

TWINE LINE

Ohio Sea Grant + Stone Laboratory

Developing Clean Ideas

*State initiative brings Ohio
researchers and agencies
together to solve the harmful
algal bloom problem*

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LAB NOTES

*Ohio Sea Grant
by the Numbers*



> *Ohio Sea Grant staff are
working with partners in
three Areas of Concern*

to restore healthy Ohio rivers and
help harbor communities thrive

FROM 1982 TO 2016,
OHIO SEA GRANT HAS FUNDED

82 RESEARCHERS
AT 14 UNIVERSITIES

studying harmful algal blooms,
their causes and prevention

Since 2015,
the Ohio
Department
of Education
has allocated



**\$7.5
MILLION**

to solving the
harmful algal
bloom problem in
Lake Erie



MATCHING FUNDS

from participating
universities doubled
the impact of the ODHE
investment to more than

\$15 MILLION
in research funding



The Ohio
Environmental
Protection
Agency added

\$500,000

IN FUNDING
FOR 2018
PROJECTS



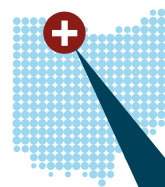
10 UNIVERSITIES
ACROSS OHIO



54 RESEARCH
TEAMS

are working on the harmful
algal bloom problem

HABRI rose out of the 2014
Toledo drinking water crisis



Elevated levels of the algal
toxin microcystin in Lake Erie
threatened drinking water for

500,000
PEOPLE IN NORTHWEST OHIO

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Results from an ongoing partnership between 10 Ohio universities continue to benefit the state and its residents.

STORY BY
**CHRISTINA
DIERKES**



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ABOUT TWINE LINE

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> A current list of Ohio Sea Grant staff and Extension Agents can be found online at ohioseagrant.osu.edu.

Stone Lab Store Opens Online

Want to show your Stone Lab pride year-round, but didn't have a chance to get your favorites on the island? We're now selling a selection of Stone Lab merchandise online! Check back often for new selections, and don't forget to send us a picture via social media. Proceeds fund scholarships for future students.

SHOP ONLINE

ohioseagrant.osu.edu/giving/merch



There's an App for That

Smartphone technology connects researchers with citizen scientists

By Christina Dierkes



C

an fish see the bait on the hook?" For Lake Erie charter captains, who make a living off sportfish finding their way to their clients' lures, it's an important question to answer, and Ohio Sea Grant researchers are on the case.

Dr. Suzanne Gray at The Ohio State University is studying how suspended sediments or algae in the water affect walleye and their preferred prey, the emerald shiner. Because walleye are visual hunters, murky waters could impact their ability to find both shiners, their primary prey, and fishing lures.

In a previous study funded by Ohio Sea Grant, the researchers found that algal blooms affect the fishes' vision much more than muddy water. "We found that both walleye and emerald shiner had about 40 percent reduced visual sensitivity under algal compared to sedimentary turbidity," explained Gray, meaning that the fish could see better when the water was brownish compared to when it was greenish. "We were kind of surprised by that."

To help take those findings into the field, the research team connected with the Lake Erie Charter Boat Association to find charter captains who would be willing to participate in the study. Doctoral candidate Chelsey Nieman created a phone app for the captains





The team has received about 200 photos so far from 19 captains submitting photos during the 2017 and 2018 fishing seasons.



that allowed them to submit photos of water conditions and any walleye they caught on charter trips directly to the researchers. With 19 captains submitting photos during the 2017 and 2018 fishing seasons, the team has received about 200 photos so far.

"The thing we realized is that the captains want to help, but their bottom line is what matters," said Gray. "So on days when they're out and the fishing is amazing, they don't really have the time to stop and take pictures. But they actually really like it on days that are slow fishing because it gives them something to show their clients."

Gray and Nieman presented their project at three of the annual Charter Captain Conferences that Ohio Sea Grant Extension lead Tory Gabriel organizes in the spring, just before fishing season starts.

► TESTING THE WATERS

Dr. Suzanne Gray studies how suspended sediments and algal blooms affect vision in sportfish and their prey. Students in Stone Lab's REU program play a hands-on part in those experiments.

The presentations were not only a good way to recruit captains for the citizen science part of the research, but also gave the captains who signed up a framework for passing the information on to their clients.

The partnership with Lake Erie charter captains will continue into the next round of Ohio Sea Grant funding, awarded earlier in 2018. But Gray and her team will also expand another aspect of their hands-on field research: controlled angling experiments.

"These experiments are where we take what we've learned about the vision of the fish in the lab, and we go out and angle for walleye using different lure colors under different conditions," said Gray. "So we want to go out after a storm when it's really turbid, or in late July when there's an algal bloom, and test out these different lure colors to look for that real-world application of what we're learning about the fishes' vision in the lab."

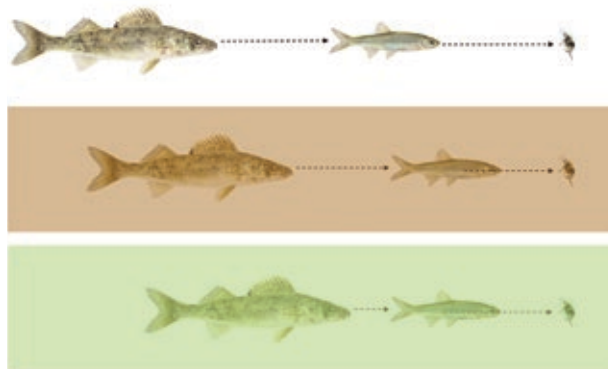
In addition to doing their own angling, the researchers will also use data from the Ohio Department of Natural Resources Division of Wildlife's annual creel survey, which has been collecting information about when and where people are angling and what they're catching since the early 1980s. Connections with the agency were made through project collaborators Dr. Jeremy Bruskotter and Eugene Braig, who have worked with Division of Wildlife personnel on past research.

"What we're hoping is that we can take what we've learned about the vision of walleye and their prey, along with the measurements of the color and clarity of the water, and link that lab-based data with this field data based on human use to try to understand how the algal blooms are affecting the success of the fishery from both the fish and the angler perspectives," Gray explained.

And considering that sport-fishing contributes close to \$1.8 billion to Ohio's economy, those are important perspectives to have. ●



STUDYING VISUAL ACUITY OF THE WALLEYE



Cloudy water comes in different forms – such as sediment (middle) and algal blooms (bottom). This can affect the way that fish see, making lures appear differently. Researchers at Stone Lab use tanks to acclimate fish to different water conditions, then present the fish with a choice between different lure colors and test which they prefer.



► RACE TO THE LURE

Doctoral candidate Chelsey Nieman conducts experiments at Stone Lab's Aquatic Visitors Center to see how far away fish can be from a lure before they no longer see it.



LEARN MORE ABOUT THIS RESEARCH

For more information about this research, or to participate in the citizen science project, contact Dr. Gray at gray.1030@osu.edu

At the Forefront of Lake Erie Science

The past, present and future home of water quality education

By Christina Dierkes



Ohio Sea Grant and Stone Lab have been at the forefront of water quality science and protection from the very beginning, when poor water conditions in the 1960s directly led to the program's founding in 1978. Between cleaning up Areas of Concern at rivers all along the Ohio shoreline, building new habitat for sportfish and managing a Clean Marinas Program

that helps boaters enjoy the water sustainably, keeping Lake Erie healthy has been a guiding force for Ohio Sea Grant for the past 40 years.

Today, water quality continues to be a top concern for Stone Lab staff and visiting researchers. A state-of-the-art Algal and Water Quality Lab houses water testing for nearby treatment plants, supports research into the lake's harmful algal bloom problem and offers student research assistants a chance to get hands-on experience in the lab.

Summer courses at Stone Lab also play a big role in its commitment to water quality. From introductory courses like Intro to Aquatic Biology to upper-level classes like Water Quality Management, high school and college students can learn about how Lake Erie is essential to quality of life in Ohio, and how they might best play a part in keeping the lake healthy.

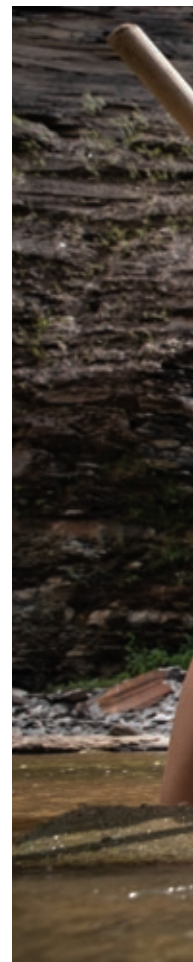
"Most students in aquatic biology are in high school or early college students, so the course gives them an introduction to aquatic science through lecture and hands-on, on-the-water activities," said Stone Lab's research coordinator Dr. Justin Chaffin, who teaches one of the Aquatic Biology sections. "By the end of the week-long course, the students know if they want to continue on the aquatic path or need to rethink their education plan."

For those that decide on a career in aquatic sciences, the options to return to Stone Lab are extensive. From upper-level classes to a Research Experience for Undergraduates (REU) Scholarship Program, and even some opportunities to get work experience in research and outreach, students at the lab learn hands-on field skills every time they come to Gibraltar Island.

But the chances for learning don't end when school is over. Professional development workshops for agency staff and water treatment plant operators combine Stone Lab's water quality research with its education focus to help aquatic professionals gain new skills that advance their careers or help them keep their jobs.

From 2011 to 2016, 227 agency and industry personnel participated in training to identify harmful algal blooms and treat their toxins. According to workshop instructor Heather Raymond, HAB coordinator and lead hydrogeologist for the Ohio Environmental Protection Agency, students appreciate the applied nature of the course material, as well as being able to get first-hand experience with sampling equipment during the research cruises that are built into the workshops.

Casey Lyon, who works for the Oregon Health Authority's Drinking Water Services, traveled across three time zones to take a Stone Lab workshop on harmful algal blooms. "This workshop is a great opportunity to learn directly from renowned cyanobacteria experts," Lyon said. "The instructors have a tremendous wealth of cyanobacteria knowledge and provide a valuable



› SCIENCE UP CLOSE

Stone Lab classes are field-based, giving students a first-hand look at the ecosystems they're studying.



perspective about protecting public health from these cyanotoxins.”

An attendee at a 2014 workshop also worked with Chaffin and staff at the water quality lab to correctly identify a harmful algal bloom in the reservoir at the City of Norwalk’s water treatment plant, averting what could have been a serious problem for the city’s water supply.

It’s because of stories like this that Stone Lab will continue to offer these courses and workshops, which play a vital part in educating generations of Lake Erie scientists and resource managers about how to keep the lake, their communities and the entire region safe and healthy for the future. ●

LEARN MORE

Information on all Stone Lab courses is available at stonelab.osu.edu. Applications are open for summer 2019 classes and workshops, with deadlines starting in early February.



Photo: Jo McCully

› CAREER PREPARATION

Research assistants and workshop students learn skills and techniques that are directly applicable to a career in environmental science and make connections with agency personnel and scientists who can become valuable references in the future.

EXPLORE

Courses at Stone Lab
Summer 2019



INTRO TO BIOLOGICAL STUDIES—AQUATIC BIOLOGY

JULY 29
TO
AUG 4

Students learn about the ins and outs of freshwater ecosystems in this one-week introductory course that lays the foundation for understanding more advanced water quality topics. Lectures, lab work and daily field trips on Lake Erie and to mainland rivers and streams reinforce lecture topics and connect theoretical learning to hands-on, real-world experiences.



WATER QUALITY MANAGEMENT

JUNE 10
TO
JUNE 16

This one-week upper-level course explores the physical, chemical and biological aspects of water quality. Starting with the basic natural processes that drive the functioning lakes and rivers, students then learn about how human impacts can alter water quality. They also cover critical water quality issues in North America and the world, their impacts on human health and ways to address these problems.



ALGAE IDENTIFICATION WORKSHOP

AUG 5
TO
AUG 6

Professional development workshops like this one (often offered with EPA contact hours) teach collection, identification and control techniques for algae found in Ohio waters. The two-day workshop also includes an overview of the basic ecology of algae, while Dealing with Cyanobacteria, Algal Toxins and Taste & Odor Compounds (August 7-8) focuses specifically on algal toxins and drinking water management.



A River Runs Through It

Restoring rivers,
supporting local economies

By Christina Dierkes



› MOVING IN THE RIGHT DIRECTION

Restoring an Area of Concern is a long process, but Ohio Sea Grant staff are committed to providing their expertise for as long as it's needed.

It's a beautiful day in Ashtabula Harbor, just a few miles from the Ohio-Pennsylvania border. A few recreational boats from the marina upstream pass by benches on the boardwalk along the river, and farther north, commercial freighters are loaded with coal for export to Canada and overseas.

But the Ashtabula River didn't always present such an idyllic image. It was declared an Area of Concern (AOC) under the 1987 Great Lakes Water Quality Agreement, after unregulated industry on the riverbanks had led to beneficial use impairments (BUIs) like restrictions on eating fish caught from the river, loss of wildlife habitat and overall environmental degradation and pollution.

For nearly 30 years, the Ashtabula River Partnership has worked on the \$85 million cleanup project to restore the river and maintain economic prosperity. Now-retired Ohio Sea Grant Extension Program Leader Frank Lichtkoppler was a part of the effort from the beginning, and got to celebrate the removal of three BUIs in 2014 just before his retirement. According to Ohio Sea Grant Extension agent Jill Bartolotta, who took over Lichtkoppler's spot on the advisory committee, the team expects the final delisting to happen by 2019.

"It wouldn't have happened without this really long-term commitment by the Ashtabula River Partnership, and there were very few people who were with it the whole time," said former Ohio Sea Grant director Dr. Jeff Reutter. "Frank was one of those key people, often serving as the secretary for the group, the facilitator for the

In 2008, a [major dredging project](#) removed contaminated sediments from Ashtabula Harbor, making it one of the cleanest, deepest harbors in Lake Erie.





group, the person that organized it and called it together, always trying to deflect recognition, but often serving as the glue to hold it together and keep it moving.”

In 2008, a major dredging project removed 635,000 cubic yards of contaminated sediments – more than 190 Olympic-sized swimming pools’ worth – from Ashtabula harbor, making it one of the cleanest, deepest harbors in Lake Erie. Along with fish habitat restoration upriver, the dredging project represented a major step toward removal of the last three beneficial use impairments and the area’s removal from the list of Areas of Concern.

“A lot of people worked very long and very hard to see the dredging completed,” said Lichtkoppler. “It was all the Ashtabula River Partnership members working together that made this happen, and Ohio Sea Grant was one of the founding partners of the Ashtabula River Partnership.” Having the deep draft available allowed for increased shipping opportunities, and a cleaner river helps provide new opportunities for local marinas and businesses.

One of the strengths Ohio Sea Grant Extension agents bring to the table is the ability to gather information – both scientific facts and public opinion – and present it to public officials in a way that allows them to make informed decisions

about public policy based on potential economic and environmental impact.

Extension agent Dr. Scott Hardy continues that tradition farther west, as part of the Cuyahoga River Area of Concern Advisory Committee, which started as the Cuyahoga River Community Planning Organization in 1989. Hardy chairs the public outreach subcommittee, which helps to ensure that businesses and Cleveland residents along the Cuyahoga River are aware of the benefits a healthy river can bring to their communities.

The committee, which also includes representatives from Cleveland Metroparks, the Northeast Ohio Regional Sewer District, the Cuyahoga River Restoration Group, the Cleveland Water Alliance, and the City of Cleveland, recently had cause to celebrate when two of the beneficial use impairments were officially removed in late 2017.

“There were ten total beneficial use impairments when the river was first designated as an AOC, and of those ten, we’ve just in the past few months had two delisted,” Hardy said. “Those two are degradation of aesthetics and restrictions on recreation and public access, and they were officially removed from the list in late 2017. We’re also hoping to get restrictions on fish consumption removed in the next few months.”

The goal of the AOC program, regardless of the river it is applied

2,099

**ACRES OF
COASTAL HABITAT**

have been protected, enhanced
or restored as a result of
Ohio Sea Grant activities.



For nearly 30 years,
the Ashtabula River
Partnership has
worked on the

\$85 MILLION

CLEANUP PROJECT



**CUYAHOGA RIVER
AREA OF CONCERN
ADVISORY COMMITTEE**

- › Ohio State University Extension
- › Cleveland Metroparks
- › Northeast Ohio Regional Sewer District
- › Cuyahoga River Restoration Group
- › Cleveland Water Alliance
- › City of Cleveland



➤ SUSTAINABLE DEVELOPMENT

Restoration activities at Ashtabula Harbor focused on creating a healthy balance between local industries and the environment. Signs along a riverwalk tell the story of the 30-year effort.

“There’s been **huge investments** in improving access and recreation along the Cuyahoga River. All of these developments have **really impacted our ability** to remove those two BUIs.”

DR. SCOTT HARDY

to, is a healthy balance between an ecologically sound river and a thriving working waterfront. Guidance under the Clean Water Act, which focuses on making all American waters fishable and swimmable, establishes which beneficial use impairments prevent that healthy balance from being achieved. An AOC advisory committee made up of representatives from nonprofit and resource management organizations, city officials and other relevant experts makes management recommendations, follows up with agencies or individuals to make sure recommendations are implemented, and potentially organizes follow-up studies to determine that the desired effect has been achieved. Once that’s the case, they work with state and federal Environmental Protection Agency representatives to remove that BUI.

In the case of the Cuyahoga, the committee has already accomplished a lot with the removal of the first two BUIs. A survey of residents along the river indicated that people see much less pollution and debris than they did 30 years ago, showing the progress that had been made and leading to the removal of the “degradation of aesthetics” BUI.

They also made some of the more barren stretches of the shipping channel, which tends to be fortified with concrete or steel bulkheads, more fish-friendly. “What we’ve done is try to create fish habitat along those stretches both by cutting holes in the bulkhead so fish could swim through, lay their eggs and swim back out,” said Hardy. “But we’re also trying to incorporate some structure along the bulkheads where fish have protection and small fish have the ability to grow up healthy.”

An event in early May helped show off the upgrades made to the riverfront in pursuit of removing the “restrictions on recreation and public access” BUI. “There’s been huge investments in improving access and recreation along the river,” said Hardy. Some examples include Merwin’s Wharf, a Metroparks-owned pub and

restaurant, the Foundry, a non-profit organization that offers rowing and sailing lessons to inner-city kids, and extensive development in The Flats, a mixed-use entertainment district in downtown Cleveland that includes opportunities for public access to the river. “All of these developments have really impacted our ability to remove those two BUIs,” Hardy added.

The event also gave the committee a chance for community outreach, to show more people that the river is starting to thrive again, and to drum up additional support from local and state officials and organizations for the continued work that will be needed to remove the remaining eight impairments. The ultimate goal is to have the river completely delisted as an Area of Concern by the end of 2025.

On the western side of the state, Ohio Sea Grant and Stone Lab director Dr. Christopher Winslow is working on another AOC, the Maumee River. The BUIs in that watershed are mostly related to fish and macroinvertebrate populations, and addressing agricultural runoff in the Maumee’s tributaries is likely to have a large positive effect on the river.

As part of a BUI workshop, Winslow, along with other subcommittee participants from the U.S. Geological Survey, The University of Toledo, Lucas County Soil and Water Conservation District and an environmental consultant, helped choose locations for construction and restoration projects that would be most effective in addressing BUIs. The committee considered everything from previously collected sediment and nutrient runoff data to whether private landowners were willing to participate in the proposed projects.

“Those potential projects were just submitted to Ohio EPA so they can assess how feasible each project is, and to develop draft restoration plans,” said Winslow. “Ohio Sea Grant staff will also continue to be involved with the AOC committee to provide expertise and help to come up with additional projects that are

► DIGGING INTO THE DETAILS

Ohio Sea Grant is funding researchers who are taking a close look at Lake Erie water quality, from toxic algae to proper disposal of medications.

most likely to address the problems the Maumee River watershed is currently facing.”

That ongoing commitment characterizes all of Ohio Sea Grant’s work: making sure that agencies, elected officials and community organizations have the science-based information they need to make decisions that benefit Lake Erie, keep local ecosystems healthy and support thriving lakeshore communities. ●



OHIO SEA GRANT’S FUNDED RESEARCH

Every two years, Ohio Sea Grant funds a set of research proposals that examine aspects of Lake Erie’s health. Some recent studies include cities’ impacts on water quality and harmful algal blooms’ impacts on fish communities and angling.



1 PINPOINTING URBAN RUNOFF’S ROLE IN HARMFUL ALGAL BLOOMS

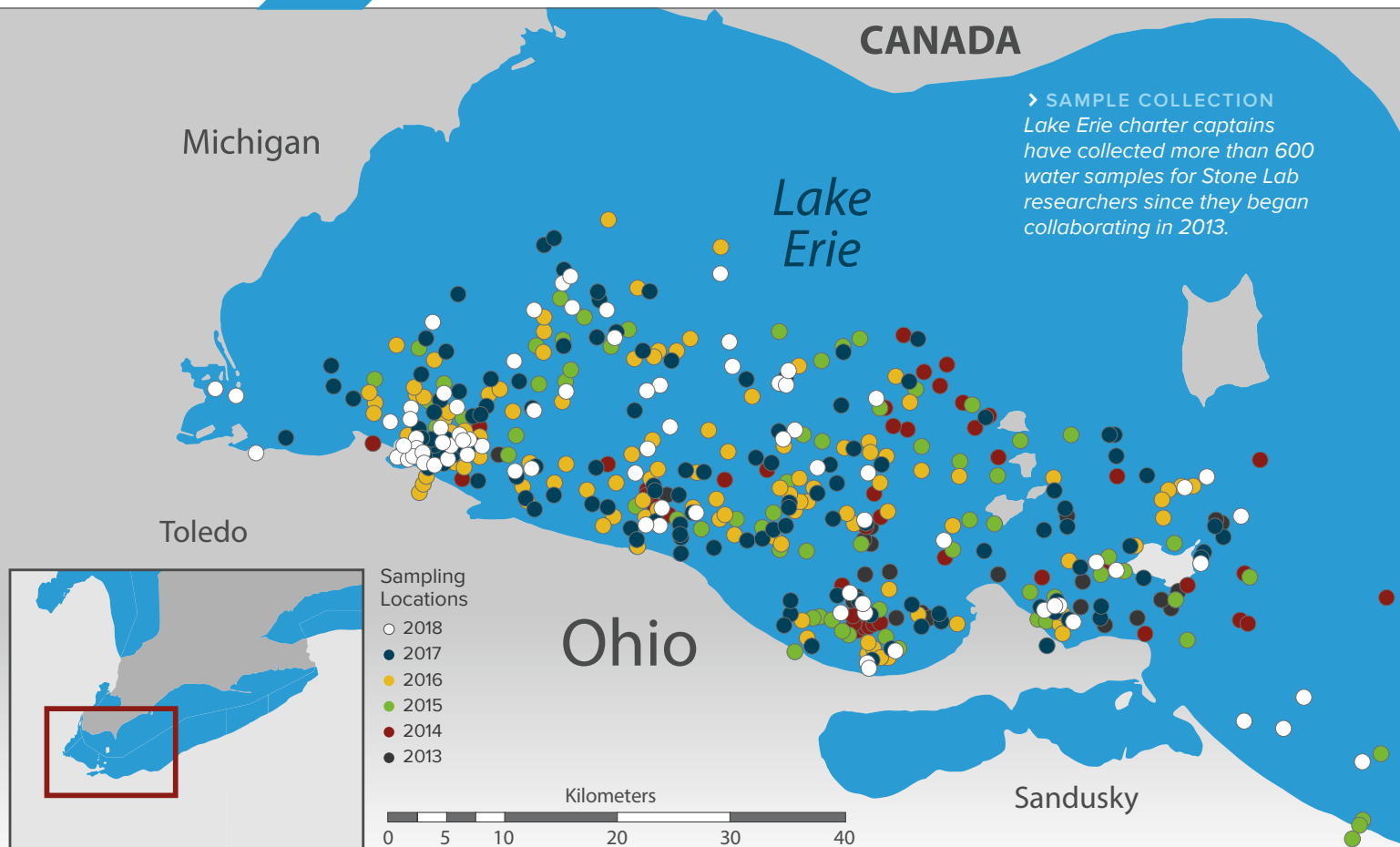
Urban runoff is one of the potential causes of Lake Erie’s harmful algal blooms, but it’s not well known how much stormwater from cities contributes. Dr. Cyndee Gruden at The University of Toledo has found that stormwater runoff in Lucas County somewhat contributes to water quality problems, and that strategic placement of management efforts like rain gardens can address the problem while also improving fish habitat.

2 GENETIC ANALYSIS POINTS OUT TOXIN-PRODUCING ALGAE

While water treatment plants and environmental agencies monitor for saxitoxin and the algal genes that produce it, there’s some concern over being able to remove it from drinking water. Dr. Tim Davis at Bowling Green State University is analyzing genetic material from environmental samples to pinpoint the exact algal strains that produce saxitoxins and cylindrospermopsins, two algal toxins of emerging concern for Ohio. The information will be used to help water treatment plants improve their water reservoir management strategies to prevent potentially toxic blooms from forming.

3 BARRIERS TO PROPER DISPOSAL OF PHARMACEUTICALS

Dr. Victoria Campbell-Arva at the University of Michigan is examining what the public thinks about the disposal of pharmaceuticals and personal care products, and how those beliefs may or may not influence behavior. The information collected will be used to identify barriers to the proper disposal of these products (such as not flushing old medications) and provide evidence-based guidance for public outreach and opportunities to dispose of these products appropriately, with the ultimate aim of keeping them out of aquatic ecosystems.



LOCAL PARTNERS, STATEWIDE IMPACTS

By Christina Dierkes

M

onitoring the health of Lake Erie is no small task, and it can't be done by just one person or group. So a few years ago, Stone Lab started working with private charter captains on the lake to help collect water samples and monitor algae, toxin and nutrient levels.

Lake Erie charter boat captains have been helping Stone Lab monitor water quality since 2013, when the lab took over the sampling program from the Ohio Environmental Protection Agency. The captains collect water samples during their regular fishing cruises, greatly expanding the number of water samples available for analysis during the harmful algal bloom season.

"In addition to collecting more than 600 samples over the past six years, the captains have educated close to 2,000 clients about Lake Erie water quality, harmful algal blooms and how they're helping us study these issues," said Dr. Justin Chaffin, Stone Lab's research coordinator. "The program gives us a more detailed look at water conditions in Lake Erie without having to schedule additional sampling trips, and it gives anglers a first-hand look at how partnerships like this can help us study and protect the lake."

The charter captains sampling program is so important to Stone Lab research that the lab's non-profit donor group, the Friends of Stone Lab, stepped in with funding when a gap between grants threatened to shut down the partnership for a year.

An Oceans and Human Health grant from the National Institutes of Health and the National Science Foundation, awarded to Bowling Green State University and Chaffin, along with collaborators from The University of Toledo, the University of Michigan, the University of Tennessee, the University of North Carolina, the State University of New York School of Environmental Science and Forestry, NOAA and Michigan Sea Grant, will keep the sampling program running for the next five years.

Stone Lab will receive \$337,000 from the \$5.2 million overall award that will expand research on harmful algal blooms that pose a threat to the health of humans and wildlife. In addition to the charter captain program, the funds will allow Stone Lab to act as a core facility for nutrient analysis for the grant collaborators. ●

> Stone Lab will receive \$337,000 from the \$5.2 million overall award that will expand research on harmful algal blooms that pose a threat to the health of humans and wildlife.



“Ready for adventure: Monarch butterflies migrate through and roost on South Bass Island on their way to Mexico.”

@STONELAB



#ThrowbackThursday to when Ohio Sea Grant was created. For 40 years we've worked to protect the environment of Lake Erie and the Great Lakes. We look forward to celebrating 40 years of Ohio Sea Grant over the next year by highlighting our most memorable accomplishments.

@OHIOSEAGRANT

“I grew up a few minutes from the Maumee River + spent a lot of time at my grandma's house near the Ottawa. In the 26 years I've been alive, it's been amazing to see the progress made because of groups like @PCSMaumee, @MaumeeAOC + many other partners!” #GLRISuccess #GreatLakes.

@DRKATFISH



“Forget gobies, we've moved up to bass!”
@stonelab”

@C_HOYNACKE



“We had three students join the CFAES Learning Communities from Columbus and ATI at @stonelab today. They dissected fish, took a science cruise on Lake Erie and learned about the varieties of amphibians and reptiles found on the islands.”

@ACELATOSU



“Spent some time at @StoneLab today with our CFAES Learning Community and had a fish heart beating to the rhythm of my heart on my wrist. What did you do on this fall Saturday?”

@EMILYWICKHAMOSU

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Keep up with current classes, research and events on social media.



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Developing **CLEAN** ➤ IDEAS ◀

BY CHRISTINA DIERKES

Harmful Algal Bloom Research Initiative continues track record of addressing Lake Erie needs

In the summer of 2014, toxin-producing algae led to the city of Toledo shutting off drinking water for half a million residents. Once the immediate crisis was over, state agencies and Ohio universities came together to address the critical gaps in knowledge about tracking and dealing with harmful algal blooms. With funding from the Ohio Department of Higher Education, the Harmful Algal Bloom Research Initiative (HABRI) was born in 2015.

“HABRI has created a dialogue between researchers and management officials to exchange information about cutting-edge science and practical needs — accelerating the process of finding solutions.”

DR. TOM BRIDGEMAN, PROFESSOR OF ECOLOGY,
THE UNIVERSITY OF TOLEDO AND DIRECTOR, LAKE ERIE CENTER



Photo: Jo McCulty

➤ BREAKING DOWN THE PROBLEM

Because HABRI researchers focus on questions they can address in two years or less, findings quickly make their way to agency personnel and managers who can apply them to their work.

HABRI is only three years old, but it has already yielded results. By focusing the 2016 funding on projects that addressed some of the explicit needs of water treatment plant operators and government agencies, the researchers were able to work with stakeholders to provide useful information in user-friendly formats. That work can range from developing instructions for lower-cost algal toxin removal to helping agencies use satellite images to connect a bloom's size and density to whether it's likely to produce toxins.

"HABRI has brought together researchers and agency personnel from across Ohio to work together on solving the harmful algal bloom problem," said Dr. Christopher Winslow, Ohio Sea Grant's director. "In addition to addressing real-world problems with concrete approaches, the structure of the initiative also provides a model for other states that could benefit from similar partnerships between academic institutions, public agencies and state government."

The second round of projects reported final results in June 2018, making the most of \$4.5 million in funding (including \$500,000 from the Ohio Environmental Protection Agency) to track algal blooms, develop new protocols to keep water treatment plant reservoirs safe and examine other ways in which Lake Erie residents may be exposed to algal toxins.

The initiative also continues to fund research projects to address harmful algal blooms and their impacts on the state. In early 2018, \$4 million were awarded to 21 research teams studying topics that range from the creation of new therapies for toxin-induced liver problems to the impacts of toxic cyanobacteria on young Lake Erie sport fish. Final results from these projects are expected in 2020.

LEARN
MORE

The complete report and an executive summary are available at go.osu.edu/habri.



HABRI Project Spotlight

ALGAL BLOOMS DON'T JUST HAPPEN IN THE WESTERN BASIN

While much of the current research on harmful algal blooms focuses on Lake Erie's western basin, Dr. Justin Chaffin at Ohio State's Stone Lab, along with partners from Defiance College and Kent State University, is also exploring what's happening in the central basin, from the Lake Erie Islands to Erie, Pennsylvania.

The researchers identified cyanobacteria – the blue-green algae that form harmful algal blooms – in the central basin, and whether they can produce toxins such as microcystins, which can negatively affect the liver. This information helps guide decision-making processes for state and federal agencies with timely information about water conditions and potential steps they need to take to keep residents safe.

Samples from the central basin, collected between 2013 and 2017, were used to identify the cyanobacteria commonly found in the water, along with water quality indicators like temperature, dissolved oxygen and phosphorus content.

In 2016 and 2017, frequent sampling during the summer focused on algal toxins in the water. "We looked for the cyanobacterial genes that are responsible for producing microcystins, saxitoxins and cylindrospermopsins, three major toxins of concern in Lake Erie," said Chaffin.

The researchers found that central basin blooms occurred earlier in the year than western basin blooms, and that June and early July central basin blooms are mostly made up of *Dolichospermum*, which can produce saxitoxins. *Microcystis*, the main cyanobacterium in western basin blooms, was found in the central basin in August and September when the western basin bloom spread eastward. ●



➤ IDENTIFYING ALGAE

Stone Lab researchers are helping agencies make informed decisions about managing algal blooms in western and central Lake Erie.



SEE MORE ABOUT HABRI AT

go.osu.edu/habrivideo



Photo: Jo McCully

> ALGAE CLOSE UP

(Above) HABRI researchers continue to study harmful algal blooms and their effects on Lake Erie water quality.

(Below) Close-up view of a spherical colony of cyanobacteria.

Funding HABRI

> RESEARCH <

Harmful Algal Bloom Research Initiative supports two more years of projects

BY CHRISTINA DIERKES

With three years of work under its belt, the Harmful Algal Bloom Research Initiative (HABRI) has yielded useful results for Ohio residents. HABRI researchers are working directly with water treatment plant operators to provide practical guidance about producing safe drinking water for cities and towns dealing with algal toxins. Other scientists are examining lesser-known potential sources of algal toxin exposure and its human health impacts. And the initiative has driven ongoing collaborations between universities and agencies, positioning Ohio to better prevent and manage future crises.

"HABRI also continues to fund research projects that address harmful algal blooms and their impacts on the state," said Dr. Kristen Fussell, assistant director for Ohio Sea Grant, which co-manages the initiative. In early 2018, \$4 million was awarded to 21 research teams studying topics that range from the creation of new therapies for toxin-induced liver problems to the impacts of toxic cyanobacteria on young Lake Erie sport fish.

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\$4 
MILLION

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21 **RESEARCH**
TEAMS

For example, Dr. R. Michael McKay at Bowling Green State University leads a project to quantify the effects that cyanophages (viruses that infect cyanobacteria) have on cyanobacterial toxin release. When viruses infect a cell, they eventually cause it to break open (a process called lysis) to spread more viruses to neighboring cells. In the case of cyanobacteria, lysis also releases toxin into the water, creating additional challenges for treatment plants that need to address a harmful algal bloom at their water intake.

The project directly addresses a concern raised by the City of Toledo water treatment plant after the 2014 “do not drink” advisory. McKay and his team recently published a paper showing that a viral infection may have worsened the problem then, and will now examine the factors that lead viruses to cause cell lysis and release cyanobacterial toxins into the water.

While many of the selected projects approach the harmful algal bloom problem from new angles, some continue previously funded HABRI research to dig deeper into the questions they’re asking. Drs. April Ames and Michael Valigosky at The University of Toledo lead one of those projects, examining the connection between potential exposure to algal toxins through recreational activities and self-reported health impacts like skin rashes or respiratory issues.

The researchers have already collected information from 327 individuals who use Lake Erie for recreation or during work to determine when, where and how different kinds of water exposure may be happening. The end goal in the next phase of the research is to connect those potential exposures to any self-reported health impacts, such as skin rashes or respiratory issues, which are common examples of health effects caused by cyanotoxins.

This information can be used to target educational outreach efforts to specific audiences most likely to be exposed to cyanotoxins during recreational activities like boating or swimming, and will be used to evaluate potential exposure and health effects in the upcoming stage of the project. ●



► TRACKING VIRUSES

Dr. McKay is examining the impact of viruses that infect cyanobacteria, causing them to break open and release toxin into the water.

OHIO DEPARTMENT OF HIGHER EDUCATION HARMFUL ALGAL BLOOM RESEARCH INITIATIVE

HABRI funded additional research projects in 2018, with results expected in 2020.



Track Blooms from the Source

These projects aim to improve use of existing technologies, as well as develop new methods to detect, prevent and mitigate harmful algal blooms and their impacts.

Lake Erie open water HAB impairment criteria
Thomas Bridgeman, The University of Toledo

Investigating the environmental drivers of saxitoxin production in recreational and drinking source waters
Timothy Davis, Bowling Green State University

Expanding the Heidelberg Tributary Loading Program to assess future changes in nutrient runoff in the western Lake Erie basin
Laura Johnson, Heidelberg University

Spatial distribution model for manure from permitted livestock facilities (CAFOs/CAFFs) in the Lake Erie western basin and Maumee watershed, Ohio
Patrick Lawrence, The University of Toledo

Critical model improvements for simulating promising conservation actions for tile-drained fields in the Maumee River watershed
Margaret Kalcic, The Ohio State University

HABSat-1 (Harmful Algae Bloom Satellite-1)
Catharine McGhan, University of Cincinnati

Evaluation of the effects of changing on-farm manure management practices on reduction of dissolved phosphorus runoff
Harold Keener, The Ohio State University

Tracking and attenuating nutrient loads from manure fertilization
Robert Midden, Bowling Green State University

Effectiveness in implementation: mapping agricultural management practices, farmer perceptions and outcomes
Saatvika Rai, The University of Toledo



Produce Safe Drinking Water

Researchers are developing new treatment methods that will give public health and water treatment professionals the tools they need to make informed decisions when water supplies are threatened by algal blooms.

Environmental fate and persistence of microcystin in land applied drinking water treatment residuals
Nicholas Basta, The Ohio State University

Testing and optimization of microcystin detoxifying water biofilters
Jason Huntley, The University of Toledo

Optimizing the use of powdered activated carbon for saxitoxin removal
John Lenhart, The Ohio State University

GaN ImmunoFET biosensors for multiplexing detection of cyanotoxins in water
Wu Lu, The Ohio State University

Quantifying viral activity associated with microcystin-producing cyanobacteria to inform water treatment options for Ohio's public water systems
R. Michael McKay, Bowling Green State University



Protect Public Health

Science teams develop techniques to better detect toxins in biological samples, study the effects of algal toxins on various types of cells, and determine the significance of the different ways that people might be exposed to algal toxins.

HAB associated health effects and airborne microcystin levels among recreational lake users
April Ames, The University of Toledo

High-throughput analysis of human toxicity and therapeutics targets of cyanotoxins across organ systems in health and disease
David Kennedy, The University of Toledo

Effects of inflammatory bowel disease on susceptibility to microcystin-LR
Steven Haller, The University of Toledo

Novel therapies for microcystin induced hepatotoxicity in pre-existing liver disease
David Kennedy, The University of Toledo

ImmunoFET sensors for detection of microcystins in human biological samples
Wu Lu, The Ohio State University

Metabolomic biomarkers of acute and chronic cyanotoxin exposure during the promotion of hepatic carcinogenesis
Thomas Knobloch, The Ohio State University

Physiological, growth and survival response of age-0 yellow perch and walleye to toxic cyanobacteria
Stuart Ludsins, The Ohio State University



Results from these newest funded projects are expected in 2020 and will be summarized in upcoming initiative reports posted at go.osu.edu/habri



Student

SPOTLIGHT >>

LEAH MARTIN '19

Zoology Major
Department of Evolution,
Ecology and Organismal Biology

Happily Marooned on an Island Lab

By Joy Snow

When a postcard for Stone Lab showed up in Leah Martin's mail one day, it seemed like a chance to get some good lab and field experience under her belt. She didn't yet realize the enormous impact it would have on how she views her studies, her future career, and science in general.

Leah signed up for a five-week ecology course and applied for a student job, leaving for the Lake Erie shore just a few days after spring semester finals. After hopscotching from a car to a boat to another car to another boat, it finally sunk in that she would be spending the next three months on an island. "It seemed unreal," Leah said, recalling her time at Stone Lab. "You're out in nature and stranded on an island, in a good way."

Being "stranded" meant she had plenty of time to get to know the biological field station assistants (BFSAs), who opened her eyes to the possibilities she had in a scientific career. Rather than spending all their time in windowless labs or at a dingy desk, the BFSAs took her in the field to survey wildlife on the islands and conduct hands-on research.

Once class started, she spent even more time outdoors, constantly taking field trips to the other islands and learning on the fly. "It changed what I expect from my classes," she said. "I want to be outside and active and have that Stone Lab experience again." Even the less glamorous moments were fun in the end. Leah remembers a field trip where two girls found leeches on their arms after wading through the water. They were obviously shocked at first, but that passed quickly. The professor calmly removed the leeches, and everyone was laughing about it by the time they returned to the lab. "Little things like that remind you that you're out in nature," Leah said.

Leah still isn't sure exactly what she wants to do after college, but, as a result of her time at Stone Lab, she knows she wants to be more active in the field. "Looking back, I don't know what my life would look like without knowing what else is out there," she said. "If you're thinking of going to Stone Lab, definitely do it!" ●

"It changed what I expect from my classes. ...I want to be outside and active and have that Stone Lab experience again."

LEAH MARTIN



go.osu.edu/leah

On the Island



VIEW VISIT
DETAILS ONLINE
ohioseagrant.osu.edu/visit



STONE LAB DEADLINES

Submit your
application online at

[stonelab.osu.edu/
applynow](http://stonelab.osu.edu/applynow)

SCHOLARSHIPS

February 1, 2019
SENR Scholarship
deadline

February 4, 2019
Research Experience
for Undergraduates
(REU) deadline

March 1, 2019
College student
scholarship deadline

High school student
scholarship deadline

May 1, 2019
Final Alaphyl
Scholarship deadline

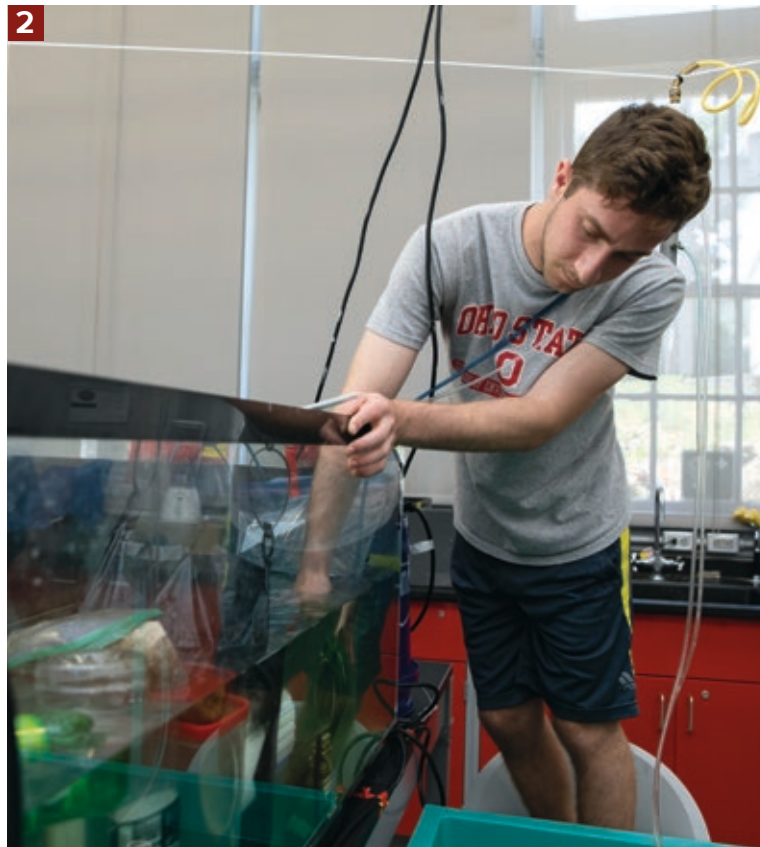
COURSE AND WORKSHOP APPLICATIONS

May 31, 2019
Other college
student, educator
and high school
student application
deadline

July 15, 2019
Current Ohio State
student deadline

EMPLOYMENT

March 1, 2019
Student employment
deadline



STONE LAB / EVENTS

1 > STONE LAB CLASSES TURN LAKE ERIE INTO YOUR CLASSROOM

Learning about science is easy when you wake up to the sound of the lake lapping on the shores of Gibraltar Island. With 20 college-credit courses and a variety of workshops, Stone Lab, Ohio State's island campus on Lake Erie, is training students from all over the United States. Will you be one of them?

Summer 2019 classes happen from mid-May to late August and range from a day or two up to six weeks in length. Applications are now open, with scholarship deadlines as early as February 1. Don't miss out!

Complete information about Stone Lab is online at stonelab.osu.edu

2 > APPLY FOR STONE LAB'S REU PROGRAM

Looking to spend your summer doing hands-on research with working scientists while taking a class on a Lake Erie island? Stone Lab's Research Experience for Undergraduates (REU) Scholarship Program is your ticket. In 2019, students will conduct research in botany, ichthyology, ornithology and limnology and present results to their peers at the end of the six-week term. REU applications are due February 4, 2019.

Check out the details and apply at go.osu.edu/reu

3 > JOIN US FOR THE CLEVELAND BOAT SHOW

Join Ohio Sea Grant and Stone Laboratory staff for fun and educational activities at the 2019 Progressive Mid-America Boat Show! Visitors can support Stone Lab's research, education, and outreach efforts by purchasing admission on January 21, Lake Erie Day. The Lake Erie Marine Trades Association (LEMTA) donates \$1 from every admission ticket purchased that day to Stone Lab student scholarships.

For more information, visit clevelandboatshow.com



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Columbus, OH 43212-1156

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Columbus, OH

@StoneLab



SUPPORT STONE LAB STUDENT SCHOLARSHIPS

Donations play a large role in making a Stone Lab education affordable for more students. And they're completely deductible, so you get a break on your taxes! Donate before the end of the year for the full benefit, support scholarships for future students, and become a Friend of Stone Lab in the process.

Friends of Stone Lab (FOSL) members receive a twice-yearly eNewsletter, an online subscription to Ohio Sea Grant's *Twine Line* magazine, and invitations to FOSL events. Donations can be designated for scholarships, research endowments, teaching positions and updates to lab facilities.



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ONLINE

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