TWINELINE

2017 FALL/WINTER EDITION VOL.39/NO.2

All Washed Up

Ohio Sea Grant works to stop marine debris

NOAA
The Ohio State University
Sea Grant
Ohio Sea Grant College Program

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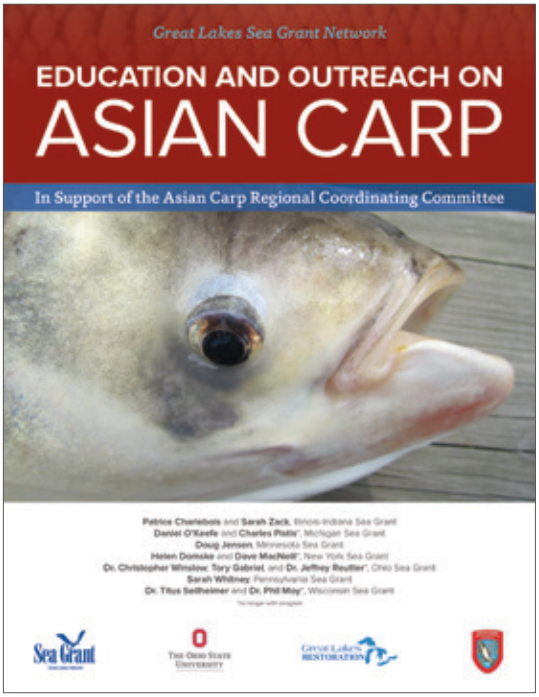
2017 FALL/WINTER EDITION

New Comprehensive Report on Asian Carp

The Great Lakes Sea Grant Network recently released *Education and Outreach on Asian Carp*, a 50+ page comprehensive and coordinated report on Asian carp in the region. The report includes listings of already prepared education and outreach materials from the Mississippi and Great Lakes basins that managers and other groups can use to educate stakeholders on the invasive fish. A survey of state and federal agency experts summarizes current research on Asian carp and identifies information still needed to most effectively control their spread. Additionally, a list of state speakers allows local interest groups to reach out to experts near them to educate members directly.

The report's development was funded by the Great Lakes Restoration Initiative (GLRI) through the Asian Carp Regional Coordinating Committee in partnership with the Great Lakes Sea Grant Network.



For a downloadable copy of the report, visit ***go.osu.edu/asiancarp***.

Twine Line (ISSN 1064-6418) is published four times a year by the Ohio Sea Grant College Program at The Ohio State University, 1314 Kinnear Rd., Columbus, OH 43212-1156. Subscription price is $10.00 per year (four issues). The opinions expressed are those of the authors only. Please contact the office to obtain permission before reprinting articles or graphics. Ohio Sea Grant is a statewide program that supports greater knowledge and stewardship of Lake Erie and the Great Lakes. It is part of the NOAA Sea Grant College Program (NOAA grant NA16RG2252, project M/P-2), which includes 33 state programs. Support of Ohio Sea Grant is provided by National Sea Grant, the State of Ohio, The Ohio State University, Ohio State University Extension, and participating universities, agencies, and businesses.

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the PLASTIC PROBLEM

Puzzling out Marine Debris Prevention

By Lisa Aurand Rice, Ohio Sea Grant Communications

Your pop and water bottles. The straw in your drink. The bags at the end of the checkout line. Plastic is everywhere. It's a common and convenient part of our everyday lives. But the very properties that make plastics useful — durability and versatility — also make them a concern.

▲ Students in Stone Lab's 2017 Water & Wildlife Training for Educators class participate in a beach clean-up at East Harbor State Park

"Plastics never disappear. They just get smaller and smaller until we can no longer see them," said Ohio Sea Grant Extension Educator Jill Bartolotta.

"It's still just as harmful, or even more harmful, for wildlife and humans because when it gets to those small pieces, that's when we start ingesting it through food, air or water. We know these microplastics and nanoplastics are in animals — in fish and in birds, and probably in people. We just don't know all the ways it affects our bodies yet."

Plastics and other human-made materials that end up in the water or on the edge of a body of water are classified as marine debris.

"Marine debris could be plastic, metal, paper, textile, fishing gear — anything from microplastics to abandoned and derelict vessels. It's found across the globe," said Sarah Lowe, Great Lakes regional coordinator for NOAA's Marine Debris Program. "The name can cause a little bit of confusion, but it is good to recognize that it is a global problem, not just an ocean issue. It is found in the Great Lakes as well."

THE PLASTIC PROBLEM: PUZZLING OUT MARINE DEBRIS PREVENTION

▲ Students from Stow-Munroe Falls High School collect about 10 pounds of trash along a half-mile stretch of beach in Fairport Harbor in September 2017.

▶ Cigarettes and other smoking related materials, such as plastic cigar tips, are the most common items found on Ohio beaches.

Ohio Sea Grant is bringing the problem of marine debris in Lake Erie to the forefront of the public's mind through research, education and outreach efforts, focusing on the reasons why debris gets into the lake and how to prevent it in the first place.

It's impossible to calculate the total amount of marine debris in the environment. Alliance for the Great Lakes reported 46.3 tons of marine debris collected in Great Lakes states during beach clean-ups in 2015, and more than a third of that was collected in Ohio and Pennsylvania, which only border Lake Erie. About one-third of the total population of the Great Lakes basin lives within the Lake Erie watershed. That means there's a lot of debris that finds its way into the lake, some of which washes up on shore. A startling 93 percent of debris on Lake Erie beaches is plastic.

One simple way to help: pick up that trash. Beach clean-ups serve the two-fold purpose of removing debris and making a big impression on those who pick it up.

In September, Bartolotta accompanied over 100 students from Stow-Munroe Falls High School in Stow, Ohio, as they collected about 10 pounds of trash during a 15 minute clean up along a half-mile stretch of beach in Fairport Harbor. The top item by far was small pieces of plastic — 750 pieces — followed by 195 cigarette butts and 100 plastic cigar tips. Other common types of trash were bottle caps and straws; all of these show up frequently on beaches worldwide, Bartolotta said.

What's just as important as the amount of debris removed is the lasting impact the experience left on those who participated. A post-event survey showed that roughly two-thirds of the students said they changed their everyday actions to reduce marine debris in the environment.

"It hits home a little more when you're actually out there on this little stretch of sand picking up tiny pieces of Styrofoam," Bartolotta said.

Ohio Sea Grant extension educators are trained to lead beach clean-ups and do so when requested, but simply picking up the trash doesn't address the heart of the problem, she said. "It's incredibly time consuming. You clean a beach one day and it's filthy again the next day. We're trying to take a step back and say, 'How do we stop using these products in the first place?'"

Fortunately, Ohio Sea Grant isn't alone in this mission. At the request of the City of Cleveland Mayor's Office of Sustainability, Bartolotta and Ohio Sea Grant Extension Educator Scott Hardy helped lead a study identifying barriers to reducing consumption of single-use plastic water bottles, grocery bags and cigar tips. Sea Grant released a report on the study in March 2017, available at *go.osu.edu/marinedebrisreport*.

"Ohio Sea Grant's goal is for the citizens of the Ohio Lake Erie watershed to become engaged, participatory stakeholders in reducing marine debris in our lake."

— SARAH ORLANDO

"We were really trying to figure out why people use single-use plastics so much when we've had reusable alternatives for so long," Bartolotta said. "For example, reusable bags have been out forever, and it seems like every time you go to an event, you get one. But we see so many people who don't use those bags when they go to the grocery store."

Bartolotta and Hardy found that the top reason people don't use those bags is simple; they forget. "They don't want to go home or back to the car to get them, and single-use plastic or paper bags are readily available," Bartolotta said. "They're there and free. It's just more convenient to get that bag in the store."

Cuyahoga County Council is considering an ordinance that would impose a 10-cent fee on carryout bags (paper or plastic) beginning July 1, the proceeds of which would pay for environmental remediation within the county and for purchase or reimbursement of reusable bags.

Bartolotta said that the results of the research she and Hardy conducted showed public support for a fee of that nature, with 36% supporting both a ban on plastic bags and a fee and another 23% supporting a fee only.

Whether or not the bag fee passes, Bartolotta and Hardy are planning a follow-up project, working with grocery stores in Cuyahoga to test messages reminding shoppers to bring reusable bags and see which strategies are most effective.

A similar program may target tourists at Put-In-Bay, Bartolotta and Ohio Sea Grant Education and Outreach Coordinator Sue Bixler hope. Visitors would see or hear messages about marine debris during transportation to and from the island and at popular attractions, including a "skip the straw" campaign at local restaurants. Then Bartolotta and Bixler would assess whether those messages affect people's behavior long-term.

Some of those messages may be ones created through another Ohio Sea Grant effort: the Ohio Marine Debris Challenge. The video PSA contest was launched in 2016 in cooperation with NOAA Marine Debris and U.S. Representative Marcy Kaptur's office. The first year, only students in Kaptur's 9th Congressional District could participate, but it has since been expanded to include all students in grades 9-12 in the Lake Erie region of Ohio.

"The kids are very excited and very positive," said Bixler, who coordinates the contest for Ohio Sea Grant. "It's hands-on. They're actually out in the field making the video and there's a social science and outreach aspect as they share it with other people."

The students work individually or in groups of up to 10 to create a public service announcement video up to 1 minute long explaining what marine debris is its impacts on the environment and what people can do to prevent marine debris and be part of the solution. This year's deadline for submissions is March 16, 2018. First, second and third place winners receive a single day entry to Cedar Point's Physics, Math and Science Week in May 2018, and first place winners receive a day field trip to Stone Laboratory. More details are available at ***go.osu.edu/marinedebrisPSA***.

Ohio Clean Marinas and Clean Boaters Program Manager Sarah Orlando has the same aim of stopping debris at its source.

"Marine debris is a critical educational component of that program because boaters already have a vested interest in the health of the water," Orlando said.

Outreach materials and programming for Ohio Clean Marina and Clean Boaters Programs focus on preparation – bringing trash bags and reusable water bottles along on boating trips. She also provides ample opportunities for recycling by offering monofilament fishing line recycling receptacles and recycling of plastic shrink-wrap used to protect boats during the winter.

In 2016, more than 4,000 pounds of boat shrink-wrap was recycled from Ohio marinas through Ohio Sea Grant's shrink-wrap recycling program. It's getting harder to find buyers for used shrink wrap, so Orlando is making sure to spread the word that shrink wrap can be used for more than one season if cut carefully or repurposed as a tarp.

In total Ohio Sea Grant programming, outreach events and displays helped educate more than 185,000 people on the impacts and prevention of marine debris. Humans are the source of the problem, and we have to be the solution.

"Ohio Sea Grant's goal is for the citizens of the Ohio Lake Erie watershed to become engaged, participatory stakeholders in reducing marine debris in our lake," Orlando said.

"We don't just want to declare that it's an issue. We want to offer solutions for that issue, whether that's through fishing line recycling containers or through research into understanding human behavior and how we can enable behavior change. Ultimately, the end goal is to reduce marine debris in Lake Erie." **TL**

▲ NOAA Marine Debris Great Lakes Regional Coordinator Sarah Lowe leads a beach clean-up at East Harbor State Park as part of Stone Laboratory's 2017 Water and Wildlife Training for Educators class.

Jill Jentes Banicki, Ohio Sea Grant Communications

new sea grant research ›

THESE PROJECTS ARE TWO OF SEVEN OHIO SEA GRANT NEWLY FUNDED TWO-YEAR PROJECTS THAT START IN FEBRUARY 2018.

Deciphering Drugs and Personal Care Products in Drinking Water

Research looks into ways to quantify PPCPs and rapidly test their presence

For more about this Ohio Sea Grant-funded project, contact Dr. Mou at **xmou@kent.edu**.

Pharmaceutical and personal care products (PPCPs) continue to be an emerging concern for not only life in aquatic ecosystems, but for the safety of our drinking water as more PPCPs travel into our water ways. One of the key concerns: We often don't know how much is in the water or how effective current water and wastewater treatment procedures are for removing common chemicals like ibuprofen and insect repellent DEET.

But newly Sea Grant-funded research by Kent State University's Dr. Xiaozhen Mou is looking at a way to measure the most common PPCPs in Ohio waters and see to what extent treatment plants are removing them.

"Right now PPCP monitoring isn't mandatory by federal or state regulations, so we don't know exactly how many or how much PPCPs are going into our waterways," said Mou. "This research project will quantify PPCP compounds and evaluate how effective different treatment processes are to eliminating them."

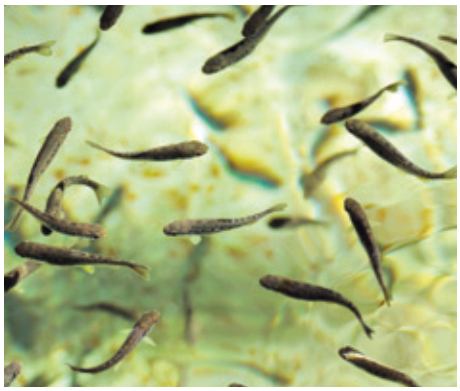
Mou, along with Dr. Laura Leff of Kent State, plans to collect water samples from five drinking water treatment plants and one wastewater treatment plant in Northeast Ohio. Together they will look for 13 of the most common PPCPs — from acetaminophen and antibiotic sulfamethoxazole to caffeine and estrone — and determine the chemicals' levels from water coming into each treatment plant and compare those levels to water samples leaving the treatment plants.

"We want to see how efficient existing processes like biological filtration in drinking water plants are to removing PPCPs and then how much PPCP contamination actually goes into natural environments by way of treated wastewater," said Mou.

With those numbers in hand, Mou's next step will be to test if an innovative approach using antibiotics-resisting genes within bacteria could potentially predict antibiotic levels in drinking water samples.

If successful, they would create a more sensitive and cheaper way to detect antibiotics in water samples.

"Our hope is this project will fill a knowledge gap that we currently have by quantifying the most prevalent PPCPs, evaluating the efficiency of current treatment processes and hopefully use a genetic tool to develop fast and potentially inexpensive way to measure PPCP levels," concluded Mou.



Tracking and Taming a Deadly Fish Disease in Aquaculture

Research to develop rapid, low-cost tests for key fish disease in aquaculture industry

As aquaculture strives to be a fast growing source of food production in Ohio, so increases the need to find ways to fight fish diseases that could impair its growth.

New Sea Grant research by Dr. Vipaporn Phuntumart of Bowling Green State University is looking at a way to apply a molecular technique to detect *Saprolegnia spp.*, a cold-loving, prevalent fungal-like fish disease that has been known to kill up to 10 percent within fish farms.

The pathogen that causes *Saprolegniasis* is a deadly one that kills both fish and their eggs and is sparked by colder weather. "When a cold-front comes in, the immune system of fish becomes compromised so it isn't as effective; this allows the pathogen to thrive and colonize the fish quickly," said Phuntumart. With colder temperatures and more frequent snows, areas in Ohio where many aquaculture farms are located are more susceptible to incidences of *Saprolegnia*-induced winter kills.

Using a technique that has up until now only been used on soil-borne plant pathogens, Phuntumart plans to test water infested with *Saprolegnia* and see if she can detect and quantify the waterborne pathogen.

The end result could be a new, innovative technique that would determine pathogen levels within 5-10 minutes right at the fish farm and would allow the farmer to test with inexpensive equipment.

"We want something that the aquaculture industry can apply instantly as a protocol," emphasized Phuntumart. "An immediate, simple $2 test that will identify the disease."

Determining how much of the pathogen the water contains, however, is only one objective of Phuntumart's project; finding an environmentally-friendly way to eliminate the deadly pathogen from the water is the other.

Phuntumart is planning to see if peracetic acid (PAA), an organic chemical widely used as a disinfectant, can treat *Saprolegnia*-infested water. If found effective as a *Saprolegnia* control, this environmentally friendly chemical would safely break down into vinegar, oxygen and water.

"Our goal for this project is that a fish farmer can run a simple test the moment he sees a cold-front coming in," said Phuntumart. "And within 10 minutes, if the *Saprolegnia* pathogen level is up in the water, the farmer can quickly treat the water with PAA and the fish population will be protected." **TL**

For more about this Ohio Sea Grant-funded project, contact Dr. Phuntumart at **vphuntu@bgsu.edu**.

Ohio Sea Grant Funds Seven New Projects in 2018

The two-year projects are led by researchers at universities across northern Ohio and along the Lake Erie coast. The selected projects focus on various aspects of harmful algal blooms, fisheries, pharmaceutical residues and tourism, in an effort to continue to help solve critical issues affecting the state's environment and economy.

THE FOLLOWING RESEARCH PROJECTS WILL BE SUPPORTED IN 2018-2020:

- Glyphosate Runoff Dynamics in Tributaries Draining into Lake Erie
  Laura Johnson, Heidelberg University
- Beyond the Medicine Cabinet: Public Perceptions of the Risks of Pharmaceuticals and Personal Care Products to Aquatic Systems and Related Disposal Behaviors
  Victoria Campbell-Arvai, University of Michigan
- Seeing the Bait on the Hook: Assessing the Impact of Harmful Algal Blooms on the Recreational Walleye Fishery in Lake Erie
  Suzanne Gray, The Ohio State University
- Stock Structure and Contribution of West and East Basin Walleye to Recreational and Commercial Fisheries in Lake Erie
  Stuart Ludsin, The Ohio State University
- Occurrence of Pharmaceuticals and Personal Care Products (PPCPs) in Source and Finished Waters for Public Supply in Northeast Ohio
  Xiaozhen Mou, Kent State University
- Development of an Efficient Approach to Quantify and Control a Fish Disease Caused by *Saprolengia spp.*
  Vipaporn Phuntumart, Bowling Green State University
- Valuing Lake Erie Beaches and the Impact of Impairments on Beach Users
  Brent Sohngen, The Ohio State University

>> For more information about Ohio Sea Grant research and funding opportunities visit ***ohioseagrant.osu.edu/research***.

iEvolving *science education*

by Joy Snow, Ohio Sea Grant

Partners Bring Hands-On Learning to Northwest Ohio Schools through Cutting-Edge Curriculum

It's one thing to learn about the environment in class through books and pictures and quite another to experience it by conducting actual scientific research. Thanks to a hands-on STEM program designed to engage kids in science, technology, engineering and math, students in Perkins and Sandusky schools are getting that chance.

The program — called iEvolve, for Inquiry and Engagement to Invigorate and Optimize Learning for Everyone — employs a citizen-science approach that teaches students to use professional methods to conduct reliable research that educates them, helps their communities, and serves scientists and students across the globe.

Dr. Bob Midden of Bowling Green State University, associate vice provost for experiential and innovative learning and an associate professor of chemistry, conceived the project after developing a science course for first-year undergraduates with non-science majors. Midden wanted to determine whether private water wells had been contaminated by abandoned oil wells in the area, so he created a simple device to test the well water and took his students to investigate. What he discovered went well beyond the test results.

"Students responded much better than those in other general education science courses," Midden said. "They liked that they were learning while doing something that provided a benefit to others."

Midden began wondering how a similar program might help students at the K-12 level. Ohio state science standards require students to demonstrate competency in planning and conducting scientific investigations, so he reached out to science organizations in the area and to two nearby school districts that were receptive to the idea.

The result was a five-year partnership, funded by the National Science Foundation and beginning in 2013, to work with children in grades three through eight in Perkins Local Schools and Sandusky City Schools. Led by BGSU, the partners include Ohio State University's Ohio Sea Grant and Stone Lab, Erie County Soil and Water Conservation District, Lourdes University, Metroparks of the Toledo Area, University of Toledo and the Toledo Zoo.

Facing Page Left to Right: Students at Meadowlawn Intermediate School in Perkins experiment with circuit configurations to learn how electricity powers devices. A student at Meadowlawn Intermediate School in Perkins holds up a battery and the motor it powers during an experiment on electricity. Students at Ontario Elementary in Sandusky experiment with differently shaped foil boats to learn about buoyancy.

The goal was to see if conducting quality research as part of the curriculum could affect student engagement and learning in science and other subjects. Students conduct experiments both in and outside the classroom and share their results with their peers and community.

"We don't want this to be separate from everyday learning," said Dr. Kristen Fussell, Ohio Sea Grant assistant director of administration and research and one of the iEvolve educators. "It's not just science learning, but how do they bring that into their whole school day?"

As citizen scientists, students in iEvolve educate themselves and their communities. They present their research at themed parent nights at schools and at public displays at local Metropark events, supermarkets and city commission meetings. By identifying environmental concerns right in their backyard, students take an important step in addressing them, and in doing so, they demonstrate the impact that a small but dedicated group of scientific minds can make.

The results can be surprisingly quick and effective. After studying the role that bees, butterflies and other pollinators play in the environment and learning how a decline in monarch butterfly populations can signal an even larger environmental concern, students in Sandusky took action. They planted a dedicated pollinator garden and handed out seeds for milkweed and other nectar plants to members of the community.

As a result, Sandusky was named the first official Monarch City in Ohio by Monarch City USA, a nationwide organization that encourages cities to undertake such plantings to restore monarch populations. Later the same year, the students' efforts had a domino effect in nearby Port Clinton when a citizen, upon learning of Sandusky's status as a Monarch City, suggested the idea to her local government, which unanimously passed a motion pledging support.

But the students' research does more than advance their education and help their local communities. Participating schools upload their findings to a data collection program sponsored by NASA — Global Learning and Observations to Benefit the Environment (GLOBE) — which is used by scientists and students from more than 100 countries for analysis and research. The site also provides grade-appropriate research activities for students in more than 30,000 schools.

Ohio Sea Grant's Emily Burbacher (far right) helps a group of Perkins 7th graders search for macroinvertebrates in Sawmill Creek.

Participating schools upload their findings to a data collection program sponsored by NASA — Global Learning and Observations to Benefit the Environment (GLOBE) — which is used by scientists and students from more than 100 countries for analysis and research.

"If you consider the value of literally millions of data points collected from around the world, if you tried to collect that data with professional scientists, it would be virtually impossible," Midden said. "There are multiple ways we benefit from this type of integration in the K-12 classroom." For example, students can validate existing data from satellites and provide onsite observations and in turn gain the satisfaction of being part of a larger scientific movement.

The iEvolve program asks students to explain not only what they know, but how they reached their conclusions. In short, it encourages critical thinking. So how does all of this affect student learning?

"There have definitely been noticeable changes with how my students react to new ideas as a result of resources we have come into contact with through the iEvolve grant," said Meghan Smith, a 7th-grade science teacher at Perkins schools. "I feel like we are asking our students to think deeper and explain their thinking more than we were doing prior to the program."

Better yet, the students love it.

Educators are still analyzing data collected from teachers and students to measure iEvolve's impact on student engagement, but signs indicate the question is not whether the program increased engagement, but by how much.

"We've fully achieved our goals during the project itself and somewhat exceeded our hopes," Midden said. "Students have uniformly responded enthusiastically for the opportunity to… [learn] science by doing science, and schools have reported finding improvements in science scores."

The question now is, what's next? Midden would like to move beyond just science. "Ideally, [we] find a school district that would like to completely revise its science, history and language arts programs and see how that affects student motivation," he said. The goal is to identify and adopt best practices to further invest students in their own education.

> "We've fully achieved our goals during the project itself and somewhat exceeded our hopes."— BOB MIDDEN

But it takes time for a district to be found and a new curriculum to be written. Meanwhile, John Gerber, a Perkins High School science teacher, is taking the lessons learned at the elementary- and middle-school levels and applying them at his high school. "I felt it was not appropriate that their exposure to… citizen-science projects abruptly end once they entered 9th grade," said Gerber, who acted as a liaison between BGSU and Perkins teachers during the iEvolve program.

Embracing the principles of iEvolve, he has proposed that his school offer advanced placement (AP) environmental science and a semester-long course on citizen-science research topics that will be determined by the students themselves. Gerber is looking forward to exploring how the increased freedom of high school affects students' research. "I'm excited about allowing students to take on a significant amount of control in identifying and designing their citizen-science research experiences."

Gerber is not the only teacher experimenting with lessons learned in iEvolve. As part of the grant, iEvolve brought in several master teachers from outside Perkins and Sandusky to provide professional development to teachers on the new science curriculum and pedagogy. "Several of these master teachers have returned to their own schools to implement citizen-science research activities and projects based on what they observed happening as part of this grant," Gerber said.

Only time will tell the full effect of iEvolve on science education in Ohio and beyond, but it's clear this is a step in the right direction. In the meantime, for the students who are involved and the communities that benefit, science will always be more than just school. **TL**

Below: Dr. Chris Winslow of Ohio Sea Grant and Stone Lab shows off crayfish from a nearby stream to educators at the 2014 iEvolve Summer Institute for professional development.

OHIO GOES TO WASHINGTON

Knauss Fellows represent Buckeye State – and learn a lot in the process

By Lisa Aurand Rice, Ohio Sea Grant Communications

Heather Fair-Wu

Jessica Sherman

When the 2017 John A. Knauss Marine Policy Fellows showed up in Washington, D.C. last January, Ohio had a bigger presence than ever before. For the first time, three fellows were chosen from among the applicants Ohio Sea Grant recommended for the fellowship, a federal program sponsored by NOAA's National Sea Grant College Program.

Amber Bellamy, Molly Semones and Kayla Miller and other Knauss Fellows from all over the country were matched with openings in federal government offices based on their areas of interest and expertise and spent the year learning the ins and outs of government. "The Knauss Fellowship is a great chance for graduate students to explore the inner workings of federal government and policy," said Ohio Sea Grant Director Dr. Chris Winslow. "These positions can be life-changing for those who are placed. The experience Knauss fellows gain and the connections they make can change the course of their careers."

Former Knauss Fellows from Ohio include Mark Monaco, director of NOAA's Center for Coastal Monitoring and Assessment, and Sarah Opfer Lowe, NOAA Marine Debris Program, Great Lakes regional coordinator.

Kayla Miller worked at U.S. Fish and Wildlife Service Ecological Services Headquarters. "I was special assistant to the deputy assistant director and I did a lot of serving as the point person for our program," Miller said. She also helped keep the 17-person leadership team organized, a feat she described as "easier said than done."

Miller was a Stone Lab Research Experience for Undergraduates (REU) student in 2013 while in the process of earning her bachelor's degree in chemistry education at Bowling Green State University. She went on to earn a master's degree in agricultural engineering from Ohio State, and she recently landed a permanent position with Ohio State University Extension and will be returning to the Buckeye state in January 2018.

"It was such a great experience to move outside of Ohio," Miller said. "Professionally, you make so many connections. I'm glad that Ohio Sea Grant gave me this opportunity. I think the Midwest is easily forgotten in D.C. and I hope was able to be a good advocate for the Great Lakes."

Amber Bellamy was placed in the NOAA Fisheries Office of Science and Technology, where she managed several publications and newsletters, and Semones worked in the NOAA Research Office of the Assistant Administrator.

"I think I definitely have a much better understanding of how science and management intersect," said Bellamy, who has a PhD in Evolution, Ecology and Organismal Biology from The Ohio State University. "I've been pleased with what I've done and the opportunities I've had."

Ohio will have two Knauss Fellows in 2018 — Heather Fair-Wu, who was placed with U.S. Geological Survey as a water mission fellow, and Jessica Sherman, who was placed with the U.S. Fish and Wildlife Service's National Wildlife Refuge System.

Applications for the 2019 Knauss Fellowship are currently open, and all application materials must be received by February 23, 2018. The one-year fellowship of $61,500 provides a stipend and living expenses of $47,000. Additional funds cover health insurance costs, moving expenses, academic degree-related and fellowship-related travel. **TL**

Ohio Sea Grant asks that all applicants contact our office prior to the application deadline. This will give us the opportunity to explain the fellowship in detail and predict the number of applicants we will get. For more information, visit ***go.osu.edu/knauss***.

Tracking OXYGEN

IN LAKE ERIE'S CENTRAL BASIN

by Christina Dierkes, Ohio Sea Grant Communications

Monitoring areas of low-oxygen water known as hypoxia

When combined with stratification – the formation of a sharp border between an upper warm layer and a cold bottom layer of water – the central basin of the lake becomes hypoxic (low in oxygen) or even anoxic (no oxygen). This can lead to fish kills and other negative impacts on the ecosystem.

Imagine going about your day, walking the neighborhood with not a care in the world, when suddenly it becomes hard to breathe. Confused and a little scared, you turn around, wondering if maybe something is wrong with the local gas lines. You note with relief that breathing is getting easier again as you move away from that particular road. When city workers check out the area a few hours later, the air is clear and nothing out of the ordinary is found. Sounds strange, right? For Lake Erie fish, a scenario like this isn't as far-fetched as it may seem.

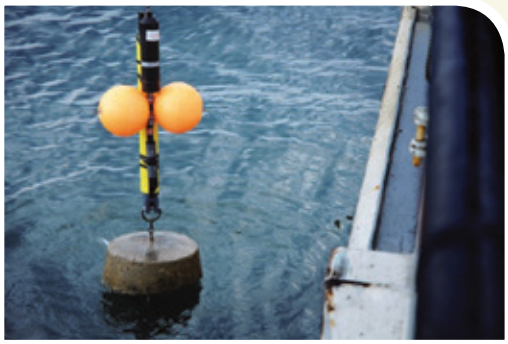
Hypoxia, an area of low-oxygen water, develops in the central basin of Lake Erie during the summer and early fall. It's caused when bacteria at the lake bottom decompose dead algae and use up oxygen in the process faster than it can be replenished from the surface or from photosynthesis. When combined with stratification — the formation of a sharp border between an upper warm layer and a cold bottom layer of water — that region of the lake becomes hypoxic (low in oxygen) or even anoxic (no oxygen). This can lead to fish kills and other negative impacts on the ecosystem.

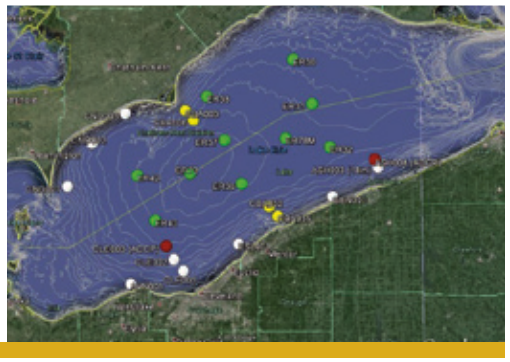
The central basin is one of three distinct parts of Lake Erie's depth profile, which also includes the shallow western basin and the much deeper eastern basin. Because the central basin's average depth is only about 18 meters, and the thermocline tends to form at around 15 meters of depth, it's the most prone to developing hypoxia that impacts life at the bottom of the lake.

Monitoring data have shown that hypoxic waters don't always remain in one place — water currents and waves can shift the edges of hypoxia into a shallow area and back out again in a matter of hours, potentially killing fish that were trapped in that area when hypoxia developed and that now can't escape that intrusion of low-oxygen water.

Researchers from the Environmental Protection Agency (EPA) monitored water movement and oxygen concentrations at the

Top: DO Trackers: Automated data loggers recorded dissolved oxygen concentrations every ten minutes for about six months, from before the onset to hypoxia in late June to the end of October, when lake water mixes again.
Bottom: (Station Locations) Loggers covered about 7800 km^2, ranging throughout most of Lake Erie's central basin.





14-16 meter depth, where it's most likely for hypoxic water to intrude into shallower areas with normal oxygen concentrations. Organisms that live there aren't adapted for those lower oxygen levels, so it's also where those intrusions can have serious negative impacts on aquatic life that can't survive these conditions for more than a few minutes.

To measure how hypoxia moves around the central basin, the EPA team, with help from the Ohio Department of Natural Resources (ODNR) and the U.S. Geological Survey (USGS), placed dissolved oxygen monitoring equipment across a 7800 km^2 area (the size of almost 1,500 football fields). The 25 dissolved oxygen "trackers" were located between Lorain and Ashtabula along the Ohio coast and between Point Pelee and just below London, Ontario on the Canadian coast, where they recorded dissolved oxygen content in the water in 10-minute intervals for about six months, from before hypoxia tends to set up in late June to after fall turnover in October, when the water in the basin mixes thoroughly again.

Putting all of the measurements together – a task requiring assistance from the University of Illinois' National Center for Supercomputing Applications due to the hundreds of thousands of data points involved — the researchers confirmed what they were expecting: the layer of hypoxic water on the bottom of the lake was sloshing around enough to move into oxygenated areas near the lake bottom for a few hours before being pushed back again.

Those changes in dissolved oxygen can have a number of impacts on Lake Erie's aquatic inhabitants. Research has shown that fish move in response to hypoxia because they avoid low-oxygen conditions, and they tend to congregate near the edges of the low-oxygen zone, trying to stay near the cooler water on the lake bottom while avoiding the hypoxic area. That means predatory fish may actually have an advantage because their prey is concentrated in shallower areas with better

MONITORING HYPOXIC WATERS

Monitoring data have shown that hypoxic waters don't always remain in one place — water currents and waves can shift the edges of hypoxia into a shallow area and back out again in a matter of hours, potentially killing fish that were trapped in that area when hypoxia developed and that now can't escape that intrusion of low-oxygen water.

light where they're easier to see and hunt, instead of being distributed randomly along the darker lake bottom.

And it's not just predators that are affected by those behaviors. Crews on commercial fishing boats have reported that having some hypoxia in the lake can lead to higher catches, as intrusions of low-oxygen water "push" those congregated fish into stationary nets. On the other hand, the August sample trawls that assess how many fish are present in Lake Erie each year may come up with skewed numbers if hypoxia pushes fish away from the regular sampling sites set up by ODNR and USGS.

Because of the shape of the central basin, hypoxia is a natural phenomenon and unlikely to ever go away completely. However, human-caused algal blooms and the decomposing algae they produce tend to make the problem worse, so recommendations for reducing blooms are also likely to help address excessive hypoxia.

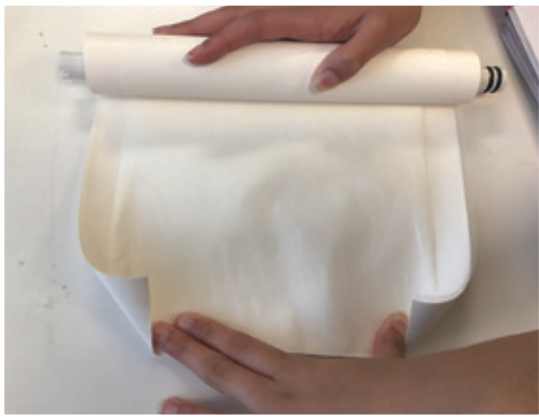
In the meantime, the team is using data from yearly hypoxia studies like this one and joining forces with NOAA's Great Lakes Environmental Research Laboratory to develop a model of hypoxia in Lake Erie that will be able to forecast intrusions of low-oxygen water before they happen. The goal is to provide municipal water treatment plants with advanced warning of a pulse of hypoxic water near their water intakes, so they can prepare their treatment plans accordingly. Low-oxygen water isn't exactly dangerous to consumers, but there are issues with its mineral content and odor that have to be addressed before the water can be sent on to consumers.

This project is led by EPA/IL-IN Sea Grant's Paris Collingsworth and is one of many within the Great Lakes Region that is part of the Cooperative Science and Monitoring Initiative (CSMI) research. CSMI coordinates annual Great Lakes monitoring and research by United States and Canadian partners to support the restoration and protection of the Great Lakes. The CSMI is led by the Great Lakes Water Quality Agreement (GLWQA) Science Annex to address the science priorities of the GLWQA Lakewide Management Annex. **TL**

An animated video of the oxygen concentrations during the study period is available at ***go.osu.edu/csmi-hypoxia***.

by Christina Dierkes,
Ohio Sea Grant Communications

HABRI UPDATES



Above: The research team tests water filters like these to see how successful the membranes are at filtering out micocystin from tap water. **Facing page:** Masters student Neelam Jagami tests the team's microcystin removal filter process in a University of Toledo lab.

Ohio's Harmful Algal Bloom Research Initiative (HABRI) is a statewide response to the threat of harmful algal blooms. The initiative arose out of the 2014 Toledo drinking water crisis, where elevated levels of the algal toxin microcystin in Lake Erie threatened drinking water for more than 500,000 people in northwest Ohio. To better position the state to prevent and manage future algal water quality issues, the chancellor of Ohio's Department of Higher Education (ODHE) worked with representatives from University of Toledo, Ohio Sea Grant and The Ohio State University to solicit critical needs and knowledge gaps from state agencies at the front lines of water quality crises. ODHE then funded applied research at ten Ohio universities to put answers in the hands of those who need them ahead of future harmful algal blooms.

Since 2015, the initiative has launched a new round of agency-directed research each year, with the first round of projects completed in spring 2017. The Ohio Department of Higher Education has funded all research, with matching funds contributed by participating universities. For the 2017 cohort, the Ohio Environmental Protection Agency (OEPA) among others will provide matching funds for some of the research and monitoring activities undertaken as part of the statewide effort.

Today 33 science teams around the state of Ohio are hard at work getting answers about harmful algal blooms that will directly help state agencies prevent and manage future HAB-related issues and will position Ohio as a leader in understanding this emerging global threat.

EARLY-WARNING SYSTEMS FOR LAKE ERIE ALGAL BLOOMS

With harmful algal blooms, advance warning is power when it comes to safe drinking water. Two new integrated monitoring networks for Lake Erie's western basin, where harmful algal blooms are most common, alert plant operators about bloom activity near water treatment plant intake zones. Two HABRI funded water quality monitoring buoys, or sondes, have been linked with 16 others in the Great Lakes Observing System (GLOS) and are augmented by weekly cruises between the Oregon and Toledo water intake points during summer. The monitoring provides real-time data about water quality — including the presence of algae and algal toxins — available online and reported in weekly emails to water utility managers and other stakeholders.

HABRI researchers at the University of Toledo and Bowling Green State University who are running these monitoring systems were able to warn water treatment facilities of approaching blooms in the western Lake Erie Basin during both the 2015 and 2016 seasons. In the 2016 event, researchers alerted the Toledo and Oregon water treatment plants about a harmful algal bloom in Maumee Bay that was located just five miles from the water intakes. The water treatment facilities were then able to adjust their internal procedures to handle the water safely.

A related HABRI project focuses upstream of Lake Erie, monitoring both nutrient amounts and their sources (fertilizer, manure, human or wild animal waste) in the rivers and streams flowing to Lake Erie. This project integrates and augments an existing array of river monitoring stations maintained by a combination of federal, state and university partners to identify possible high phosphorus-contributing locations and different sources of phosphorus runoff that may contribute to loading into Lake Erie.

The partners found that small losses of phosphorus due to current agricultural

For more about HABRI or to download its Year 2 report, go to ***go.osu.edu/habri.***

practices are prevalent throughout watersheds and are a major contributor to phosphorus runoff into the lake. This suggests that changes in those practices might make a substantial difference in reducing some of the spikes in phosphorus associated with heavy rainfall.

Combining data from GLOS with information from river sensors and existing climate models will also refine predictive tools that will give water managers more time to react to developing bloom events in the near future and ultimately lead to a better understanding of how to prevent harmful algal blooms altogether.

STOPPING ALGAL BLOOM TOXINS AT THE KITCHEN TAP

There's already a lot of activity going on in the aftermath of the 2014 harmful algal bloom (HAB) in Lake Erie, which left residents in the city of Toledo without drinking water. Water treatment plants have added additional testing for the algal toxin microcystin that caused Toledo's water shutdown, scientists are monitoring HABs as they develop, and backup intakes let larger plants avoid pulling in potentially contaminated water altogether.

A University of Toledo team led by Dr. Glenn Lipscomb is taking that activity one step further by showing that reverse osmosis (RO) membranes, an essential component of drinking water purification systems installed under kitchen sinks in many homes, can remove algal toxins from drinking water.

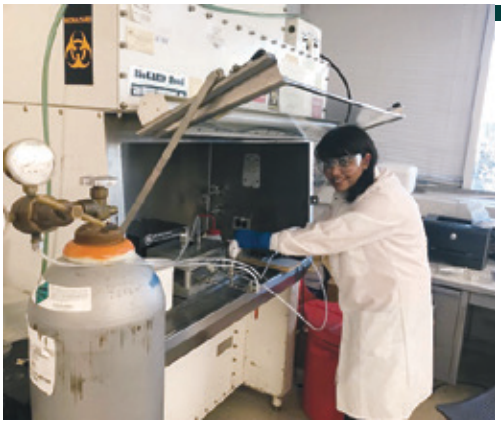
Reverse osmosis occurs when water is pushed through a semipermeable membrane with "holes" that are too small for anything but the water molecules themselves. The process removes minerals and particles that can cause undesirable flavors, but to scientists, the removal of algal toxins was an obvious additional benefit that needed to be explored further.

Partnering with NSF International (formerly the National Sanitation Foundation) and funded by Ohio Department of Higher Education, the research focuses on the reverse osmosis systems commonly sold at home improvement stores at a relatively low cost of $250-300. The goal is to develop a certification process for these home membrane systems that shows that they remove microcystin from drinking water, with the final certification protocol complete in early 2018.

One of the challenges the researchers face is the chlorine that's added to drinking water to help disinfect it: the chemical attacks the filter membrane and can reduce its longevity and its ability to filter out toxins. In response they developed "accelerated aging" protocols based on previous research that shows that higher chlorine concentrations over a short time can age filters the same as low concentrations over a longer time.

What they have found over the last year is with those "accelerated aging" protocols in place, microcystin is removed with chlorine in the water.

"Our most recent results indicate that chlorine in the water does not affect microcystin removal. Chlorine is added to our drinking water to help control microbes. The reverse osmosis units still removed microcystin to safe levels after we accelerated testing to mimic exposure to the chlorine levels present in Toledo drinking water for six months," said Lipscomb. **TL**



For more about the ODHE-funded HABRI project on early warning systems for Lake Erie algal blooms, contact University of Toledo's Dr. Tom Bridgeman at ***Thomas.Bridgeman@utoledo.edu*** or Bowling Green State University's Dr. Mike McKay at ***rmmckay@bgsu.edu***.

For more about the ODHE-funded HABRI project on drinking water, contact Dr. Glenn Lipscomb at ***Glenn.Lipscomb@utoledo.edu***.

NEW ODHE FUNDING IN 2017

Investigating the Environmental Drivers of Saxitoxin Production in Recreational and Drinking Source Waters
Timothy Davis,
Bowling Green State University

GaN ImmunoFET Biosensors for Multiplexing Detection of Cyanotoxins in Water
Wu Lu, The Ohio State University

Critical Model Improvements for Simulating Promising Conservation Actions for Tile-Drained Fields in the Maumee River Watershed
Margaret Kalcic, The Ohio State University

ImmunoFET Sensors for Detection of Microcystins in Human Biological Samples
Wu Lu, The Ohio State University

Environmental Fate and Persistence of Microcystin in Land Applied Drinking Water Treatment Residuals
Nicholas Basta, The Ohio State University

Physiological, Growth and Survival Response of Age-0 Yellow Perch and Walleye to Toxic Cyanobacteria
Stuart Ludsin, The Ohio State University

Quantifying Viral Activity Associated with Microcystin-Producing Cyanobacteria to Inform Water Treatment Options for Ohio's Public Water Systems
Robert Michael McKay,
Bowling Green State University

Optimizing the Use of Powdered Activated Carbon for Saxitoxin Removal
John Lenhart, The Ohio State University

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

HAB Associated Health Effects and Airborne Microcystin Levels Among Recreational Lake Users
April Ames, University of Toledo

Expanding the Heidelberg Tributary Loading Program to Assess Future Changes in Nutrient Runoff in the Western Lake Erie Basin
Laura Johnson, Heidelberg University

Summer Courses 2018

STONELAB

Introductory Courses *(2 credits)*

Sunday-Saturday, open to advanced high school students and current college students.

June 10-16

ENR 2360	Ecology and Conservation of Birds
EARTHSC 1107	Field-Based Introduction to Oceanography
EEOB 1930	Introduction to Biological Studies – Aquatic Biology
KNSHP 1140.05	Lake Erie Sport Fishing

July 22-28

EEOB 1930	Introduction to Biological Studies – Aquatic Biology
EEOB 1920	Introduction to Biological Studies – Birds

July 29-August 4

EEOB 1930	Introduction to Biological Studies – Aquatic Biology
EEOB 1910	Introduction to Biological Studies – Local Plants
ENTMLGY 1260	Introductory Insect Field Biology

Upper Level Courses

Open to college students who are studying biological sciences, education and natural resources as well as science teachers.

FIVE-WEEK COURSES – 4 CREDITS

Monday, Wednesday and Friday OR Tuesday, Thursday and Saturday

June 17-21

EEOB 5420	Aquatic Ecosystems – Ecology of Inland Waters (TRS)
EEOB 3420	Behavioral Ecology (MWF)
EEOB 3410	Ecology (TRS)
EEOB 3310	Evolution (MWF)
EEOB 5940	Field Zoology (TRS)
EEOB 5920	Field Biology of Aquatic and Wetland Plants (MWF)
EEOB 5930	Ichthyology (MWF)

ONE-WEEK COURSES – 2 CREDITS

Sunday-Saturday

May 20-26

EEOB 5910	Field Herpetology

June 22-28

EEOB 4950	Field Ecology
ENR 3280	Water Quality Management

July 29-August 4

EEOB 5210	Spider Biology

OTHER COURSES – 1 DAY / 0.5 CREDIT

EEOB 5970	Larval Fish Identification

Tuition Assistance and Jobs

All students taking for-credit courses are eligible for scholarship funds. The average award for high school students in 2017 was $433, while undergraduate students were awarded an average of $910. Students enrolled in five-week courses can also apply for part-time jobs at Stone Lab to cover the cost of room and meals.

Course credits are based on The Ohio State University semester credit system and are transferrable to most colleges.

Educator Courses *(2 credits)*

Open to both formal and informal educators and college students studying education.

July 14-20

EARTHSC 5189.05	Field Geology for Educators: Geologic Setting of Lake Erie

July 29-August 4

ENR 5690	Water and Wildlife Training for Educators

Educator Workshop

July 26-28

Enhancing Earth Science Education with Educational Technology

Non-Credit Workshops

- Algae Identification
- Dealing with Cyanobacteria, Algal Toxins and Taste & Odor Compounds
- Enhancing Earth Science Education with Educational Technology
- Fish Aging
- Fish-Sampling Techniques
- Intro to Bird ID and Banding
- Lake Erie Island Wetland Plant Field Identification and VIBI
- Lake Erie Sport Fishing
- Larval Fish ID
- Outdoor Photography
- Planning to Prevent the Spread of Aquatic Invasive Species: AIS/HACCP

REU Program

Stone Lab's five-week Research Experience for Undergraduates (REU) Scholarship Program must be paired with one of the five-week upper level courses. Students spend non-class days working with research supervisors, collecting data, analyzing discoveries and preparing a final presentation.

- Invasive Species and Forest Composition of the Lake Erie Islands (Botany)
- Visual ecology of walleye and emerald shiners (Ichthyology)
- Survival of birds inhabiting the Lake Erie Islands (Ornithology)
- Fish investigations to inform fisheries management (Fisheries Research/ Management)
- Exploration of Lake Erie nutrient loading, hypoxic events (the "dead zone") and harmful algal blooms (Limnology)

CARVING HER **OWN PATH**

By Lisa Aurand Rice

When Stone Lab introduced its Research Experience for Undergraduates (REU) in 2005, Kelsey Reider was one of the first to participate in the scholarship program.

At the time, she was a junior at Ohio State, double-majoring in zoology and marine ecology. For her project that summer, she helped Dr. Kristin Stanford execute the Lake Erie watersnake recovery plan.

"My project was to examine how vehicle traffic affected the snakes," Reider said. "I spent five weeks riding my bike around Kelleys, Middle Bass and South Bass islands, learning the ins and outs of real-world data collection. It might seem simple, but it contributed to the recovery plan for an endangered species, which felt incredible."

Now an ecologist working toward her PhD at Florida International University in Miami, Reider says she wouldn't be where she is today without that experience. Seeing working scientists doing what they love and making a difference inspired her to chase the same dream.

Her time at Stone Lab also paved the way for other opportunities, like a research experience through Kansas State University the following summer, and later, research fellowships that funded her studies in the Costa Rican rainforest and fieldwork in the Andes, where she studied frog species that live near melting glaciers.

The intensity of Stone Lab's accelerated classes helped prepare Reider for graduate school, and the herpetology class gave her an in-depth look at amphibians and reptiles that has been invaluable throughout her career.

None of that would have been possible without generous gifts from donors, Reider said.

"That Stone Lab REU scholarship is immensely valuable to students like me — a first-generation college student without the means to pay for a Stone Lab education on my own." **TL**

"That Stone Lab REU scholarship is immensely valuable to students like me — a first-generation college student without the means to pay for a Stone Lab education on my own."

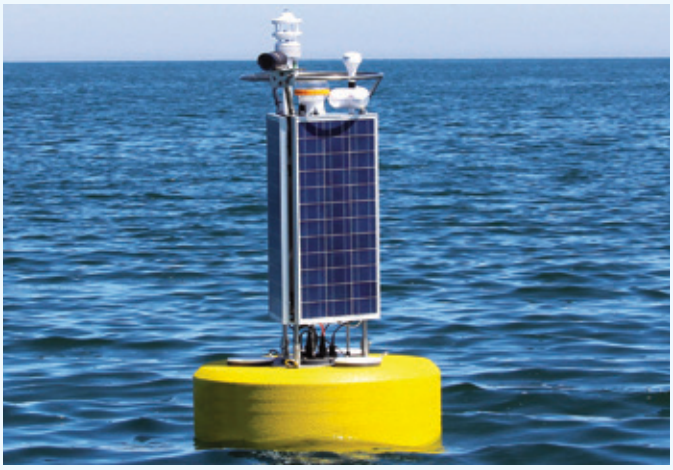
KELSEY REIDER

Support students like Kelsey Reider by donating at ***go.osu.edu/SLgift.***

by Lisa Aurand Rice, Ohio Sea Grant Communications

Buoyed Up by Donors

New Donation Helps Bring Program More Data for Algal Bloom Research



For the last three years, the arrival of spring for Ohio Sea Grant and Stone Lab has been signaled by the presence of a bright yellow buoy in the waters just off Gibraltar Island near Put-in-Bay.

Thanks to a generous donation, Ohio Sea Grant researchers will deploy a second buoy to monitor Lake Erie water quality in a new location. Ohio Sea Grant Research Coordinator Dr. Justin Chaffin plans to station a new buoy just north of Huron, Ohio.

This new buoy will play a key role in a recently funded Harmful Algal Bloom Research Initiative (HABRI) study to assess environmental factors that contribute to the development of saxitoxin, a neurotoxin produced by some algae and cyanobacteria. Chaffin and his assistants will collect and analyze water samples from the Sandusky sub-basin, where the new buoy will reside.

"Knowing when a bloom is out there based on the buoy data will make our sample collection much more efficient for those experiments," Chaffin said.

Fondriest Environmental, an environmental monitoring technology company based in Fairborn, Ohio, donated the first buoy in 2013 and the second in December 2017.

"We want to ensure they have the tools they need," said Steve Fondriest, president of Fondriest Environmental. "If the buoys can provide education and offer research scientists the ability to collect more data on the lake, that would be great."

Both buoys measure total algae biomass, blue green algae biomass, dissolved oxygen, water temperature, pH, and water clarity. One key difference that Chaffin is excited about is that the new buoy has an exposed electrical system, making it easier to service if there are any glitches.

"We're thankful for Fondriest's donation to Stone Lab. Over the last four years the data we've gathered from the buoy they previously donated has brought incalculable value to our program both as an educational tool for college students and school groups and as the piece of research equipment it was designed to be," said Ohio Sea Grant Director Dr. Chris Winslow.

"This new buoy will increase our ability to assess the health of Lake Erie and inform future decisions about nutrient loading and harmful algal blooms."

Once Stone Lab deploys the buoys in the lake this spring, they will broadcast live data to the Ohio Sea Grant website at ***go.osu.edu/buoy*** and to the Great Lakes Observing System. **TL**

Above: Fondriest Environmental first donated a buoy, left, to Ohio Sea Grant in 2013. The company recently donated another buoy, similar to the one at right.

Conference Brings Scientists and Agencies Together to Share HABs Research

The 2017 Understanding Algal Blooms: State of the Science Conference, held September 14 in Toledo, Ohio, brought together scientists and agency officials from across the state to share information on harmful algal blooms (HABs) and discuss solutions to an ongoing problem for Lake Erie communities.

Toledo Mayor Paula Hicks-Hudson addressed the assembled scientists and resource managers, thanking them for their continued work to avoid another water shutdown like the city experienced in 2014. Research initiatives such as the Ohio Department of Higher Education's Harmful Algal Bloom Research Initiative connect university scientists with water treatment plant managers and environmental agency officials to help align research projects with the demonstrated needs of communities that draw their drinking water from Lake Erie.

Graduate students from universities across the state presented 27 research posters on a range of algal bloom topics, from detecting the blooms via satellite imagery to the potential presence of microcystin toxin in crops and soil irrigated with lake water during a harmful algal bloom. The poster presentations gave students a chance to share their projects with other researchers as well as members of the public who wanted to learn more about the impacts of harmful algal blooms on their surroundings.

The conference was organized by Ohio Sea Grant, OSU Extension and the U.S. Department of Agriculture's Agricultural Research Service, and offered Ohio Environmental Protection Agency professional development contact hours to registered attendees.

>> The next HABs conference is tentatively scheduled for ***September 13, 2018.***

Stone Laboratory's Winter Program Welcomes the Public for Evening of Scientific Celebration

Another year brings another exciting Stone Lab Winter Program. This year the free event is taking place at the Longaberger Alumni House on February 19 at 7 p.m. with programming running until 9:30 p.m. Join researchers, students, and faculty in getting a glimpse at the accomplishments of Ohio State University's research facility.

Attendees will hear short presentations from Dr. Chris Winslow, director of Ohio Sea Grant and Stone Lab; Dr. Thomas Hall, president of Friends of Stone Lab (FOSL); Dr. Janet Weisenberger, senior associate vice president for research; Dr. Jeff Sharp, director of the School of Environment and Natural Resources; Dr. Randy Moses, senior associate vice president for research, and Andrew Oppliger, an Ohio State student and participant in Stone Lab's Research Experience for Undergraduates (REU).

This year's keynote speaker will be the Director of the Wilma H. Shiermeier Olentangy River Wetland Research Park and Ohio State professor, Dr. Mažeika Sullivan. Sullivan joined Ohio State in 2008 and has been director of the 52-acre Wetland Research Park since 2014. His research is primarily focused on the conservation and ecology of aquatic and river/stream-based ecosystems, and he does much of his research with the Stream and River Ecology (STRIVE) Lab.

The Winter Program is an opportunity for members of the Ohio State community and for the public as a whole to help support research at Stone Laboratory through purchasing Stone Lab merchandise and by participation in a short silent auction. Last year's Winter Program raised over $1,500 for Stone Lab programs and scholarships. Attendees will also learn about Stone Lab's summer courses and field trip programs.

The evening is open to the public and completely free. Refreshments will be provided by FOSL.

2018 Dates to Remember

February 19
Winter Program

April 20-22
Spring Work Weekend

July 12
HABs Forecast

August 25
Donor Dinner

September 8
Stone Lab Open House

The Wilma H. Shiermeier Olentangy River Wetland Research Park as seen from above

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Ohio Sea Grant and Stone Laboratory
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Ian Hawkins was a student at The Ohio State University in 2002 when he attended summer science classes at Stone Lab, Ohio State's island campus on Lake Erie.

Today he works as a veterinary pathologist in southern Georgia, diagnosing infectious diseases in domestic animals like cattle and pigs, as well as wildlife such as fish.

"I have very fond memories of my time at Stone Lab," Hawkins said, "and having an understanding about the biology and natural environment of animals, which I learned through my coursework and time at Stone Lab, helps me in determining the cause or origin of a disease across a variety of species."

You can help make priceless memories for future generations of Stone Lab students by making a donation to support scholarships or the upkeep and modernization of lab facilities.

More information on how to give is available at ***go.osu.edu/SLgift***