

TWINELINE

2018 WINTER/SPRING EDITION VOL.40/NO.1

Tourism in Ohio

Ohio Sea Grant encourages
state tourism through
environmental efforts



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2018 WINTER/SPRING EDITION



High Demand Leads To New Gibraltar Island Tour

This summer, visitors to South Bass Island will have an additional chance to visit Stone Lab every week. Due to high demand, staff have added an afternoon option to the popular Gibraltar Island tour, which introduced more than 500 visitors in 2017 to the lab's research and local history. "For almost every tour last year, we were turning people away," said Dr. Kristin Stanford,



Stone Lab's education and outreach coordinator. The new time slot should help streamline transportation and check-in and give the visits a more relaxed feeling overall, Stanford added.

For details on Gibraltar Island tours and other Stone Lab tour options, turn to **page 19** of this issue.

ON COVER: IMAGE COURTESY OF ASHTABULA COUNTY CONVENTION AND VISITORS BUREAU

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How Ohio Sea Grant Helps Ohio
Celebrate, Preserve and Share Its Allure

OHIO

exploring the Heart of America

by Joy Snow, Ohio Sea Grant



Photo courtesy Lake Erie Shores & Islands

“Tourism in Ohio is largely underappreciated. Most people never notice how travel benefits them.”

— MELINDA HUNTLEY

Tourism is remarkably complex. Like an iceberg, most people will only see a small part of the big picture, but tourism's influence is far-reaching in Ohio. It affects and is affected by many different factors, from the economy to the environment, and is intertwined with life in the Buckeye State. That's why Ohio Sea Grant has such a large stake in the success of tourism. In providing travel experiences like tours and events or supporting communities in finding the best ways to attract more visitors, Ohio Sea Grant is there to help show off what makes this state so special.

OHIO TRAVEL IS BIG BUSINESS

“Tourism in Ohio is largely underappreciated,” said Melinda Huntley, executive director of the Ohio Travel Association. “Most people never notice how travel benefits them.” When tourism in an area succeeds, it has a tendency to uplift the surrounding community too. Visitors to any area often spend money at many businesses, not just the hotel or event they traveled to attend. This spending can have a big impact on the economies of communities.

The eight counties bordering Lake Erie (Lucas, Ottawa, Sandusky, Erie, Lorain, Cuyahoga, Lake and Ashtabula) account for approximately one-third of Ohio's total travel economy. In many of these coastal places, it can be easy to see how tourism impacts communities because the effect

is direct. Businesses like Sandusky's Cedar Point or events like Port Clinton's Walleye Festival contribute to many jobs in lodging, transportation and food service. But the flow of the travel dollar beyond the businesses travelers encounter isn't always as obvious.

In 2016, 212 million visitors spent \$34 billion directly at Ohio hotels, attractions, shops and other travel-related businesses. That spending spurred an additional \$9 billion as travel-related Ohio businesses purchased goods and supplies, like ingredients for a restaurant or mechanical parts for a ferry, from neighboring businesses to meet consumer demand. All this spending adds up, and according to the Ohio Department of Taxation, the travel industry accounts for nearly 11% of all sales tax collected by the state.

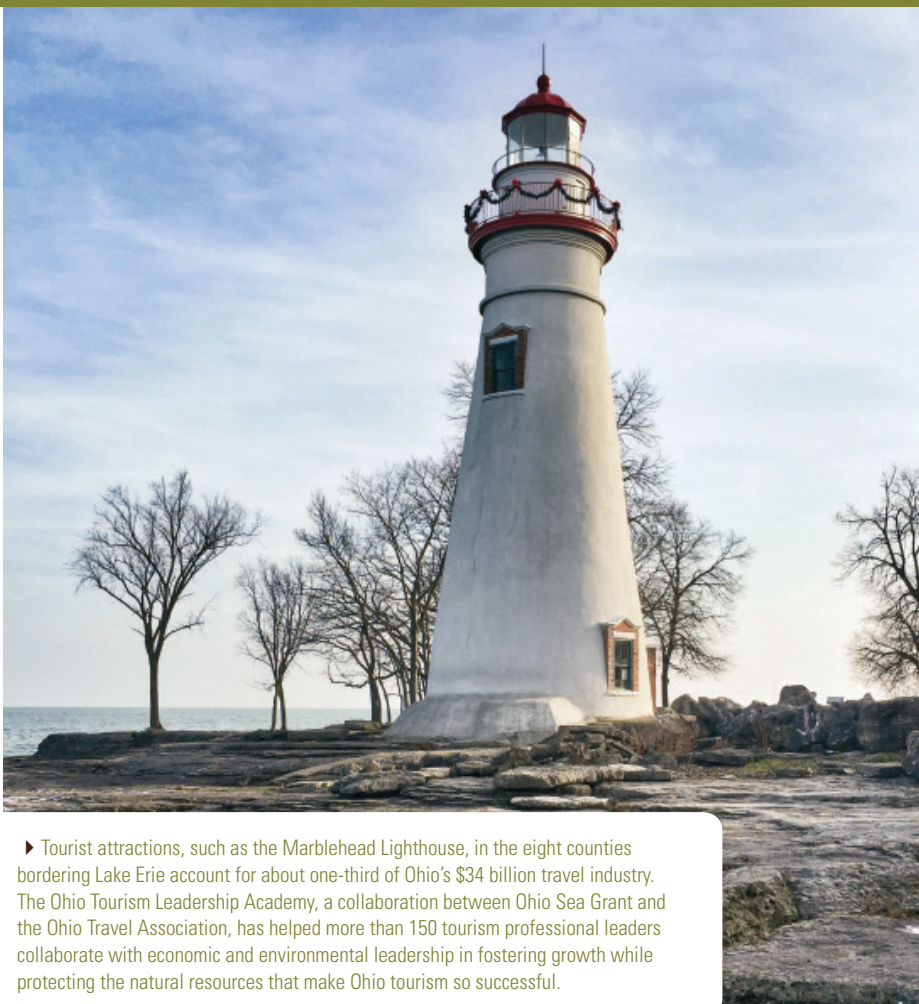


CREATING RICHER (AND MORE EDUCATIONAL) EXPERIENCES

Ohio Sea Grant is on the forefront of the effort to improve environmental education in the travel industry. Education and travel go hand-in-hand: a great way to educate people is through the creation of memorable experiences that speak to a traveler's heart, and the goal of tourism is exactly that. "You may have a perception of that place, but you don't have a connection, nor do you know what that place has to offer until someone shows you," said Huntley. Ohio Sea Grant works with industry leaders and local communities to help them provide the most memorable, educational and engaging experience possible with the goal of leaving visitors with a positive impression of the state and an understanding of its natural beauty.

Welcoming travelers is a great opportunity to change people's perceptions and educate them on the environment and how humans affect it. "Many environmental groups focus on the negative, and there is a time and place for that, but we have to balance it with the positive," said Huntley. Traveler motivation studies show that people want to learn about the places they visit, and they learn best when they're engaged. Through tour guides, posters, pavilions at festivals and many other methods, museums and popular travel destinations can educate guests on any number of subjects, like harmful algal blooms and invasive grass carp in Lake Erie, and provide travelers with a richer experience at the same time.

The best education practices do more than just educate visitors though; they work with the locations to create traveler experiences that also benefit the environment through action and education.



► Tourist attractions, such as the Marblehead Lighthouse, in the eight counties bordering Lake Erie account for about one-third of Ohio's \$34 billion travel industry. The Ohio Tourism Leadership Academy, a collaboration between Ohio Sea Grant and the Ohio Travel Association, has helped more than 150 tourism professional leaders collaborate with economic and environmental leadership in fostering growth while protecting the natural resources that make Ohio tourism so successful.

Photo: Morgan Paul

A great example of such a program is the Ohio Clean Marinas and Clean Boater programs. "The Clean Marinas Program is the classic example of a program that supports a healthy environment and a healthy economy," said Huntley. Started in 2005 through a partnership between the Ohio Department of Natural Resources (ODNR), Lake Erie Marine Trades Association and Ohio Sea Grant, the Clean Marinas Program encourages better environmental practices at marinas by offering a certification that the marina can then use to promote their business. They also have the opportunity to participate in the boat shrink-wrap recycling program, which has recycled more than 2 million pounds of shrink-wrap since 2006. That shrink-wrap has been used to make guard-rail blocks to keep Ohio roads safer. Boaters, in turn, can pledge to be a Clean Boater, and they are educated on things

they can do to help preserve the health of Lake Erie.

The Ohio Clean Marinas Program has been monumentally successful on Lake Erie. So successful, in fact, that in 2015 marina owners asked for help in developing a similar program for inland waters and lakes. This expanded the Clean Marinas Program statewide, helping to ensure the health of Ohio waterways for generations to come. Currently, more than 45 marinas are certified as Ohio Clean Marinas, and 35 more are working toward certification. The program is effective because it benefits those who have a stake in the health of the lake. Boaters seek out the healthiest waters, and Clean Marinas offers solid standards for health. The marinas, too, benefit by attracting more boaters to the healthy waters they steward, and, of course, everyone benefits from having a healthier

► The Ohio Clean Marinas Program helps more than 80 marinas across the state protect the waters their customers use for recreation. A healthy environment attracts more boating business, and the program helps marina owners take advantage of that business in a sustainable manner.



lake and a healthier environment.

Another great example of Ohio Sea Grant working with business owners to benefit the environment and their businesses is the organization's partnership with Ohio charter captains. This year, Ohio Sea Grant will host its 37th annual Ohio Charter Captains conference, sponsored by OSU Extension, the ODNR Division of Wildlife, and the Lake Erie Charter Boat Association. The event educates Ohio fishing charter boat captains on rules and regulations that apply to them as well as environmental concerns and outlooks for the coming year that affect their businesses. Two-thirds of the captains taking part report higher profits as a result of what they learned at the conference.

Many of those same captains help Stone Laboratory conduct the research that informs analysis of Lake Erie's water quality. Following the large harmful algal bloom (HAB) of 2011, a group of charter captains approached the Ohio Environmental Protection Agency (EPA) to ask how they could contribute to the health of the lake. In 2013, Stone Laboratory took over the program, and now works with the captains to collect water samples from all over Lake Erie's western basin. The captains take weekly water samples during their fishing trips on the lake, which Stone Lab staff then analyze. The results inform Stone Lab research efforts and the information on water quality is provided to the captains so they can accurately inform clients about water quality conditions. "If we're

training captains to collect samples, and we also give them accurate information about HABs, they can help us spread that information," said Dr. Justin Chaffin, Stone Laboratory research coordinator. The captains' data have already been used in studies conducted by the National Oceanic and Atmospheric Administration and The University of Toledo, and other projects are in the works.

CREATING VISITOR EXPERIENCES TO DRIVE TRAVEL

Ohio Sea Grant also manages visitor experiences that create demand for travel themselves. The Aquatic Visitors Center (AVC) on South Bass Island, run by Ohio Sea Grant in partnership with the ODNR Division of Wildlife, educates over 20,000 guests annually on the ecology and history of the lake.

Stone Laboratory and the South Bass Island Lighthouse offer periodic science and history tours during the summer months, when more than 800,000 guests visit South Bass Island and Put-in-Bay. "Those tours also give us the best opportunity to teach visitors why the health of Lake Erie is so important and directly linked to their travel experience," said Ohio Sea Grant

and Stone Lab director Dr. Chris Winslow.

The AVC, Stone Lab and the South Bass Island Lighthouse draw travelers to Lake Erie and the islands, where they spend money at hotels, on ferries or at any number of locally owned businesses. Once visitors are at the lake, they can see the beauty of Lake Erie firsthand and understand better why it's so important to the region. Ohio Sea Grant attractions provide a reason to travel to Lake Erie, but they are far from the only place travelers will visit.

LINKING SITES AND STORIES TO DRAW TRAVELERS

Ohio Sea Grant also helps communities and regions develop new tourism products that celebrate their greatest assets. From facilitating or participating in community planning, to working directly with resource managers, Ohio Sea Grant's team helps to identify, develop and promote new ways to explore Lake Erie's coast.

Its work in the burgeoning birding market along Lake Erie is a classic example. From funding an economic impact study to developing the Lake Erie Birding Trail, Ohio Sea Grant has played an important role in identifying the need and coordinating new



► The Aquatic Visitors Center on South Bass Island, run by Ohio Sea Grant and Stone Lab, educates more than 20,000 people a year on Lake Erie science and history and loans out fishing gear to young visitors. Many kids get their first introduction to fishing from this free program.



COVER STORY

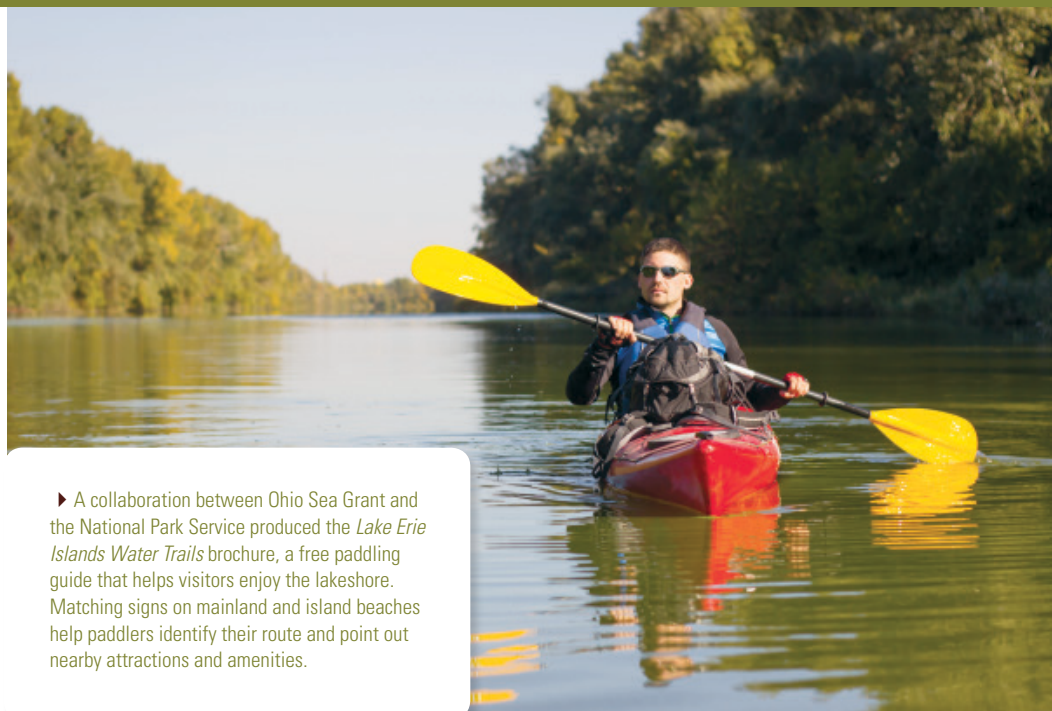
ways for travelers to experience one of North America's greatest birding destinations. Working with ODNR, as well as dozens of site managers along the coast, the Lake Erie Birding Trail is a signed trail of 80-plus birding sites. A website provides information about species, as well as other traveler needs, such as where to go to get more information. A 232-page guidebook supplements the website and has helped thousands of birders since it was published in 2014.

Creating a birding trail not only helps minimize the environmental impact additional visitors may have on a single resource site, but creates a richer experience for potential travelers. This goal is at the forefront of several other projects, including the *Lake Erie Shipwrecks and Maritime Tales* brochure and a *Lake Erie Lighthouses and Maritime Museums* publication. Both of these products tell a deeper story by connecting sites along the coast, while at the same time encouraging travelers to stay longer and spend more in local communities.

Ohio Sea Grant also led designation of a 262-mile route along Lake Erie as a national scenic byway, connecting beaches and popular travel spots with a route offering some of the most beautiful views of Lake Erie and strengthening tourism for communities along the lake.

STRENGTHENING LEADERSHIP IN OHIO'S TRAVEL INDUSTRY

True change, however, also requires a change in culture. In addition to working on projects in the field, Ohio Sea Grant focuses on making sure those in the travel industry have the skills and information they need to create a bright future. The Ohio Tourism Leadership Academy, which is run by the Ohio Travel Association and was developed with help from Ohio Sea Grant, is designed to connect emerging industry leaders with statewide decision makers



► A collaboration between Ohio Sea Grant and the National Park Service produced the *Lake Erie Islands Water Trails* brochure, a free paddling guide that helps visitors enjoy the lakeshore. Matching signs on mainland and island beaches help paddlers identify their route and point out nearby attractions and amenities.

to discuss the ways travel affects the state and how they as individuals can have a meaningful impact. The six-month program is designed to give participants the networks and know-how to best succeed in their field. More than 150 professionals from throughout the state and representing all sectors of the travel industry have graduated from the Academy, and many have run for public office, taken on leadership roles at their place of business or are in decision making board seats at the local, state and national level.

PROTECTING OHIO'S GREATEST ASSETS

Lake Erie is undoubtedly Ohio's greatest asset when it comes to tourism, and Ohio Sea Grant's work is centered on protecting and preserving the lake and other Ohio waterways so they prosper for generations to come. Lake Erie is a living organism and Ohio Sea Grant-funded research explores how humans can better care for it while benefiting from its presence. Ohio Sea Grant's Stone Laboratory conducts research on water quality and the ecological health of the lake, searching for answers to current threats like harmful algal blooms and ways to understand and counter future challenges like climate change. The

organization also funds university research on both the lake and other environmental issues in Ohio, further benefiting Ohio and its economy.

Ohio Sea Grant often partners with other organizations like ODNR and The Nature Conservancy on projects that also serve Lake Erie, such as wetlands restoration in northwest Ohio, led by ODNR, which reduces nutrient loading in the lake and provides safe habitats for young fish before they venture into Lake Erie. Other projects like Ohio Sea Grant's work with The Nature Conservancy to develop better conservation assessment models help the lake indirectly by providing scientists and policy makers with the tools they need to make better decisions regarding our environment.

In the end, Ohio Sea Grant's goal for supporting state tourism is clear. When visitors come to Ohio, they leave with fond memories of the state. They have a desire to protect the natural beauty they saw and preserve it for others to enjoy. They should see Ohio as the beautiful state that it is, and understand why that beauty exists and how they can take part in protecting it. They should want, more than anything, to come back again.

A CHARCOAL SCRUB FOR DRINKING Water

by Christina Dierkes, Ohio Sea Grant Communications

Most of us don't think much about water.

It's just the twist of a handle away when we want to take a shower or make that first pot of coffee in the morning. But behind the scenes at the local water plant, water treatment professionals are hard at work to make sure that water is safe to use, and especially safe to drink.



They use all kinds of technologies to do their work, but one of their most common tools is activated carbon (sometimes called activated charcoal). When it's mixed into the water, it adsorbs organic contamination and compounds that create taste or smell problems in tap water supplies. In drinking water drawn from Lake Erie, one of its jobs is to remove toxins created by harmful algal blooms, such as microcystins and saxitoxins.

The difficult part for treatment plant staff is knowing exactly how much activated carbon to use, because its effectiveness depends on many different factors, from toxin levels and the type of activated carbon they have on hand to whether the raw water has plants or lots of sediment in it. So they prefer to be safe, possibly using more activated carbon than necessary and raising treatment costs by hundreds of dollars each day for as long as an algal bloom is present near their water intake.

Dr. John Lenhart, an associate professor in the Department of Civil, Environmental and Geodetic Engineering at The Ohio State University, and his research team are now working on guidelines that address some of these issues, using both powdered and granular activated carbon made from wood, coconut shells, bituminous coal and a coal blend. Powdered products are used on an as-needed basis, while granular activated carbon is built into the overall treatment process when a particular plant tends to have chronic issues to address.

The research is funded by the Ohio Department of Higher Education's Harmful Algal Bloom Research Initiative (HABRI), a statewide response to the threat of harmful algal blooms that arose out of the 2014 Toledo drinking water crisis, where elevated

levels of algal toxins in Lake Erie shut down water supplies for half a million people in northwest Ohio. Lenhart recently received funding for a third project focusing on saxitoxin removal (completing in 2020), adding to the team's work on microcystin toxins (completed in 2016) and granular vs. powdered activated carbon products (completing in mid-2018).

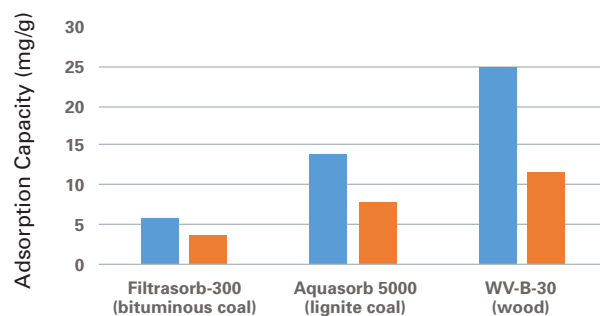
Highlights from the previous projects suggest that wood-based powdered activated charcoal is the best choice for removing microcystins, especially because it interacts with the toxin and any organic matter in the water more quickly than coal-based activated carbon. Coconut-based powdered activated carbon, a common choice in water pitcher filters, was a poor option for removing microcystin. Granular activated carbon followed similar trends during initial laboratory tests.

The scientists also saw that natural organic matter like decomposing plant material can decrease the amount of toxin removed (see graph). They are currently running experiments at a larger scale, in columns similar to those used in treatment plants.

"Our partners include water treatment plants in Wilmington and Barberton that face issues related to harmful algal blooms and saxitoxins, and that will directly benefit from the results of this research," said Lenhart. "Our continued goal is safe drinking water for communities and money savings for water plants that will be able to apply activated carbon in a more targeted fashion."

Test solutions modeled after Ohio water

■ No Competing Organic Matter
■ 5mg/L Competing Organic Matter



GRANULAR ACTIVATED CARBON

► **Chart:** How much microcystin toxin granular activated carbon can adsorb depends on what the carbon is made from, and whether the water is clear (blue bars) or contains organic matter like decomposing plants (orange bars). Results from test solutions that model the water typically going through an Ohio treatment plant show that organic matter reduces the amount of adsorbed microcystin and needs to be addressed during water treatment. Adsorption capacity is defined as milligrams (mg) of microcystin removed per gram (g) of activated carbon added.



01

scouts' *L*onor



STONE LAB PARTNERS WITH
GIRL SCOUTS FOR WEEK-LONG
EDUCATIONAL ADVENTURE

by Lisa Aurand Rice
Ohio Sea Grant Communications



02



03



04

Peru, Cambodia, Greece and... Put-in-Bay, Ohio? It may not sound exotic to those who hail from nearby, but eight Girl Scouts from all over the United States were excited to sign up for a week at Stone Lab's Gibraltar Island, a new trip available in the Girl Scouts Destinations program. Girl Scouts Destinations gives girls in grades 6 to 12 the chance to travel and have unique opportunities and experiences related to their personal interests, said Emily Fein, who is chief operating officer and director of girl experience for Girl Scouts of North East Ohio.

A few years ago, when Fein was challenged by her supervisors to host a Destinations trip, Stone Laboratory immediately came to mind. "I thought it would be a great fit. There are programs there for youth and college students, and The Ohio State University is such a fabulous research institution," Fein said. "It all just came together for us."

She worked with Ohio Sea Grant Program Administrator Erin Monaco and Education and Outreach Specialist Sue Bixler to create a schedule that was a blend of Stone Lab's college-credit course, Introduction to Biology – Aquatic Biology, and fun activities such as

kayaking and fishing. Monaco and Bixler were the group's Stone Lab guides for the week in July 2017, accompanied by two Girl Scout leader chaperones.

Though the girls ranged in age from 14 to 18, they quickly bonded with each other over their shared interest in science and enthusiasm about the activities. Monaco and Bixler led the students on a science cruise (similar to the ones taken by students who come to Stone Lab on field trips), to inland streams and rivers on the Ohio mainland to look for macroinvertebrates, and to Kelleys Island to see the glacial grooves and hunt for fossils.

One girl was so enthralled with the geology segment of the trip that she seemed to have found her calling. "They weren't sure she would make it on the plane because she had so many rocks to take home," Fein joked.

The girls also had to prepare and present a short talk on a water-related issue in their hometown and propose a solution to help solve the problem – one of the requirements that helped them earn the Ambassador Water badge over the course of the week.

Carmen Reddick, 18, a Girl Scout from the Portland, Oregon area, applied for the trip because she plans to major in marine biology.



05

► **Below:** Westlake Girl Scout Nina Wilkinson earned a Gold Award for a marine debris project in 2017. Ohio Sea Grant Extension Educator Sarah Orlando served as her project advisor. Read more about Nina at go.osu.edu/gold.



06

"All the girls really wanted to be there. I think for many of them, it really helped solidify their current paths as far as their interests."

— EMILY FEIN

Groups interested in planning a similar trip to Stone Lab should contact Kristin Stanford at stanford.147@osu.edu.

She had previously attended a Girl Scouts Destinations trip to Costa Rica and Panama helping endangered sea turtle populations and thought Stone Lab's location on Lake Erie and emphasis on freshwater biology would help round out her college applications.

"Lake Erie is so beautiful," said Carmen, who had never visited the Great Lakes before. "Every time I looked out on it, I would say 'the ocean, I mean, the lake.' It was so big, it boggled my mind."

But the scenery was just an unexpected bonus for Carmen, who was thrilled to wade in streams looking for macroinvertebrates, handle the friendly Stone Lab outreach snakes and go fishing for the very first time. One of the most

impactful segments of the trip for her was a visit with Sarah Lowe, Great Lakes regional coordinator for NOAA Marine Debris.

Lowe met with the students at the Aquatic Visitors Center, where they viewed the marine debris display and talked about how plastics degrade and get smaller, but never truly decompose. Then the students helped with a beach clean-up at nearby South Bass Island State Park, where Carmen and a friend waded into Lake Erie to retrieve some debris.

It made a lasting impression, Carmen said. She now plans to pursue her Gold Award – the highest award available to Girl Scouts – by enacting a plan to install recycling bins along the promenade at the

beach near her hometown in Oregon.

"I came back reinvigorated," Carmen said. "The plan is to raise awareness so people pick up those (pieces of litter) and put them in the recycling bin. It will hopefully work to clean up our beaches. I'm in the very preliminary steps, but I'm feeling really passionate about it."

Fein said Stone Lab – with Monaco, Bixler and Stone Lab Education and Outreach Coordinator Dr. Kristin Stanford – was an inspiration to the girls. "They saw people that were like them and women who were involved in science beyond their high school experience," she said. "All the girls really wanted to be there. They were all really interested in the content. I think for many of them, it really helped solidify their current paths as far as their interests."

The week was so successful that the Girl Scouts Destinations program will return to Stone Lab again in 2019, and Fein said girls have already begun applying for that trip.

For her part, Monaco said she relished the chance to share the unique beauty and resources the lab has to offer with a group of students who were wholly unfamiliar with the Great Lakes.

"It was also life-changing for me," she said. "It energized me and reminded me, 'This is why I'm doing this – to pass this information on to the next generation.'"

01 Eight girls from all over the U.S. came to Stone Lab in July 2017 as part of the Girl Scouts Destinations program. **02** Sarah Lowe (right), Great Lakes regional coordinator for NOAA's Marine Debris Program, showed the scouts the marine debris display inside the Aquatic Visitors Center and led them in a beach clean-up at South Bass Island State Park. **03** The week-long trip included quite a few new experiences for the girls, including handling snakes and fishing for the very first time. **04** The girls got a chance to participate in a science cruise, catching fish and identifying them in the lab. **05** A trip to Kelleys Island to see the glacial grooves was a highlight of the week for many of the girls. **06** Ohio Sea Grant Program Administrator Erin Monaco, who led the trip along with Education and Outreach Specialist Sue Bixler, said the week renewed her passion for teaching science.

LIKE A ROCK



Dr. Larry Krissek gives his Stone Lab students a solid foundation

by Lisa Aurand Rice,
Ohio Sea Grant Communications

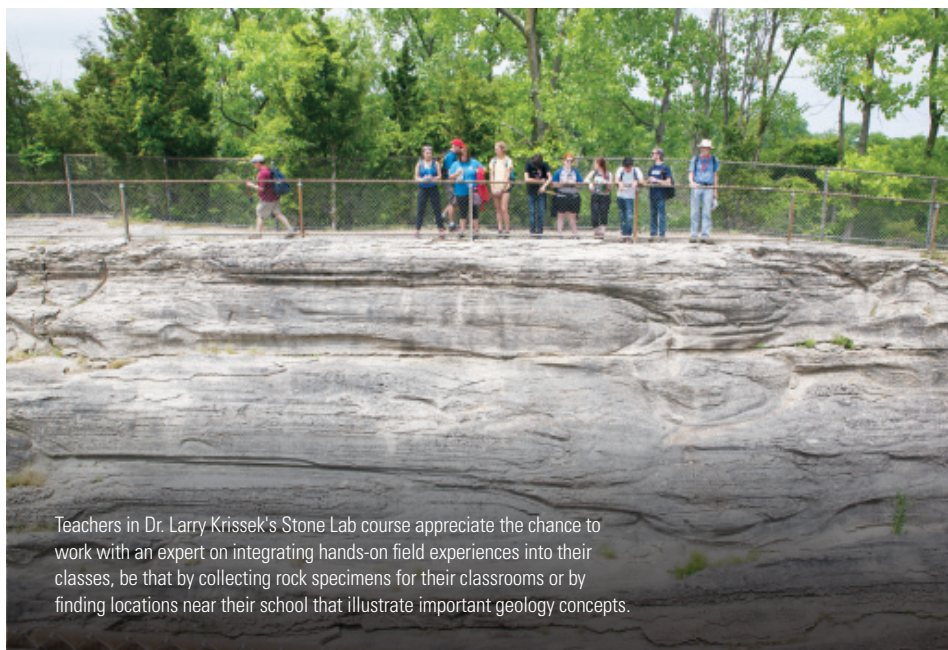
On a warm June day on Kelleys Island, sand spills into students' shoes as they make their way along the beach. They have to move fast to keep up with their professor, Dr. Larry Krissek. This is day three of Field-Based Introduction to Oceanography, and Krissek, an expert in sedimentary, marine and polar geology, doesn't waste a single minute. In just one week, his students will earn two college credits. He has a lot of ground to cover, both figuratively and literally. • The class hikes until they reach an old quarry, where they spend an hour or two searching for fossils of crinoids, horn coral and brachiopods, examine them with powerful magnifying glasses and use their rock hammers to knock some loose to keep.



Krissek, who recently retired from his full-time post as a geology professor at The Ohio State University, believes moments like these are essential for students. Learning about rocks and water in a classroom isn't the same as learning while digging in a quarry or feeling the waves in a boat on Lake Erie. That's how Krissek himself learned as an undergraduate student at the University of Washington, taking water and sediment samples on a research vessel off the coast of Seattle.

His interest in the ocean, which started when he was a boy in landlocked Kansas City, carried him through graduate work at Oregon State University and his professorship at Ohio State. He's been teaching the Stone Lab oceanography course since 1992. The introductory-level class is open to advanced high school students (typically sophomores, juniors and seniors) as well as college undergraduates.

Krissek estimates that more than half of them sign up because of their interest in marine mammals – “warm-blooded, fuzzy, squeaky things,” he says wryly. He considers it his responsibility to introduce these aspiring



Teachers in Dr. Larry Krissek's Stone Lab course appreciate the chance to work with an expert on integrating hands-on field experiences into their classes, be that by collecting rock specimens for their classrooms or by finding locations near their school that illustrate important geology concepts.

Right: Dr. Larry Krissek (left) doesn't just give his Stone Lab students a solid foundation in the sciences. He encourages curiosity and investigative thinking that will serve them well throughout their entire lives.

marine biologists to the broad range of ocean sciences, including geology and chemistry.

Krissek tries to schedule time in the field every day. The Kelleys Island trip usually takes place midweek and includes a visit to the island's famous glacial grooves. Friday typically finds them on a mainland beach, talking about shore protection and erosion.

"I think (the class) is very eye-opening to them," Krissek said. "I don't track the students, but I would say I have one or two students every other year that actually end up pursuing something in either ocean sciences or geological sciences."

For example, Stephanie Sherman, who took the class in high school, is now a senior research associate in geological sciences at Ohio State's Byrd Polar and Climate Research Center.

Krissek hopes the average student will remember to do two things after taking his class: make observations and ask questions. "I sound like an old crank, but put down your phone and pay attention to the world around you because that's where the data is coming from," he said. "Make the observations and then ask the questions."

It's not quite the same demographic, but his other Stone Lab course, Geologic Setting of Lake Erie, has a similar goal. The class, which is aimed at educators, is a weeklong trip along the lakeshore, examining the geologic features and discussing the processes that created them and the industries that arose from them.

"The vast majority of the teachers taking this course are middle or high school science teachers who are teaching biology," Krissek said. "We take those same skills that they use in their biology work and observe and ask



"It's like being a detective. There are always mysteries to be solved, and it gives me the chance to travel to interesting places." — DR. LARRY KRISSEK

questions on the geology side rather than on the biology side."

"The learning about geology begins the minute the car is put in drive," said Ohio Sea Grant Education and Outreach Specialist Angie Greene, who took the course a few years ago. "There's a reason (Krissek) starts in Columbus. When he's driving, he's pointing out natural geological features as well as businesses that use those features, like gravel pits."

First, the class heads to Stone Laboratory on Gibraltar Island for a few days on the Lake Erie Islands. Other stops include Old Woman Creek National Estuarine Research Reserve; Cuyahoga Valley National Park; beaches in Lake and Ashtabula Counties; and Niagara Falls and the Niagara Gorge.

For Greene, a longtime middle school science teacher in addition to her role at Sea Grant, seeing those features up close was an awe-inspiring experience.

"You can read about it in a book and you can look at it on a bedrock map, but until you are climbing up shale and you see how loose and brittle it is – you really just have to live that before you can have an understanding of it," she said. "To be able to do that with an expert with you the entire time, who shows you what's there, using evidence, and what caused it to happen is pretty valuable."

Greene has since developed the Stone Lab workshop Enhancing Earth Science Education with Educational Technology, a two-day experience for teachers based out of the Kelleys Island Field Station that shows them how to use the application Nearpod to create earth science content and assessments.

"I was able to take something that I learned (from Krissek) and bring more teachers and show them the interesting parts of Ohio at the time of the glaciers, while marrying that with teaching them a really cool educational technology platform," Greene said.

Krissek tries to help each educator incorporate field experience into their teaching – whether that means collecting rock specimens for them to take back to their classroom or finding locations near their schools that illustrate a point about Ohio geology. It all comes back to fieldwork, making observations and asking questions – what has captured Krissek's interest in the subject for so long.

"It's like being a detective. There are always mysteries to be solved, and it gives me the chance to travel to interesting places," he said.



For details on Krissek's classes and Greene's workshop, visit stonelab.osu.edu.



80 YEARS

of tiny Lake Erie Critters >>>

by Christina Dierkes,
Ohio Sea Grant Communications



It's easy to get excited about new science: new discoveries, cool things that have never been seen before, a new solution to an old problem. But sometimes, it's worth taking a step back to look at what's been done before, and how history can inform future research.



ECOSYSTEM MONITORING

The U.S. Geological Survey (USGS) has been collecting information on western Lake Erie benthos – the mollusks, snails and worms that live in sediments on the lake bottom – since the 1930s.

Many of these organisms are considered indicators of an ecosystem's health, so determining changes and trends over time can help management agencies like the Environmental Protection Agency (EPA) evaluate and track the effectiveness of strategies to protect that health.

With data from 1930, 1961, 1982, 1993, 2010 and 2014, USGS researchers like Don Schloesser have a lot to work with, but progression in identification techniques and microscopy means that first the information has to be adjusted to make numbers directly comparable. That means, for example, that if early data only gets as specific as the genus of a mollusk, instead of identifying it down to a specific species, scientists adjust later data accordingly, even if it's more detailed, to conform to a lowest common denominator.

While the final numbers are still being compiled and standardized as part of the 2014 Cooperative Science and Monitoring Initiative (CSMI) focus on Lake Erie, some general trends in benthos populations have already emerged.

Researchers measure benthos by the number of organisms found in a square meter of sediment, and from 1930 to 1982, those numbers increased dramatically, from 2,000 to almost 146,000 on average. That increase was likely due to the abundance of nutrients found in Lake Erie at the time – those nutrients feed algae, which in turn feed the worms that make up the majority of Great Lakes benthos and tend to indicate poor lake health.

From 1982 to 2003, benthos populations dropped by more than 80 percent, mainly due to pollution reduction efforts that removed nutrients from the environment, as well as increased water clarity caused by zebra and quagga mussels that invaded the lake in the mid-1980s. But by 2014, those numbers had climbed back up, creating a zig zag pattern that closely follows trends in nutrient runoff and algal blooms in the lake and potentially indicates a recurring trend toward excess nutrients.

To arrive at those population estimates, researchers took sediment samples at a number of established sampling sites across the western basin to make sure results were directly comparable to previous years' sampling trips.

“ Mayfly populations in Lake Erie closely follow water quality conditions. Since 1997, populations have increased dramatically, a testament to environmental protection efforts in the region.”

They use a ponar grab sampler, which looks a lot like a smaller version of the clamshell grab on an excavator, to pull up sediment from the lake bottom. They then rinse that sample through a fine mesh screen to remove fine silt and clay. Whatever stays on the screen is preserved and taken back to the lab, where it will be further separated into the various benthic sub-groups – mollusks, worms, midges and other benthos – in which the scientists are interested.

Some of that separation can be done by hand, using tweezers and strong lighting. What's left over is put under a microscope to pick out the smallest organisms. Once everything is separated and preserved in individual vials, those vials are sent off to experts who can identify the collection of mussels or worms more specifically. It's a long and arduous process, but it provides valuable information to those monitoring and working to preserve the health of the Great Lakes for future generations.

One particular type of benthic organism, the mayfly, has been used as a key indicator of environmental health by agencies like the Ohio EPA to assess how Lake Erie and the other Great Lakes are faring over time. Mayflies require very clean water to breed and begin their life cycle in lake sediments, where they live until the adult mayflies hatch into the swarms many visitors to Lake Erie are familiar with. In western Lake Erie, mayfly populations dropped to essentially zero between 1959 and 1961, and remained extremely low until 1993, when scientists found about twelve mayfly larvae per square meter of sediment. Most recently, those numbers have increased dramatically, to 300-400 mayflies per square meter, a testament to environmental protection efforts and improving water quality.

What Is CSMI?

The Cooperative Science and Monitoring Initiative is a collaboration between Canadian and U.S. agencies, research institutions and local partners to provide lake managers – those charged with keeping the Great Lakes clean and healthy for their residents – with the information necessary to make well-informed, research-based management decisions on each of the lakes.

CSMI has been managed by the U.S. Environmental Protection Agency (EPA) and Environment and Climate Change Canada (ECCC) since it started in 2002, and was included as part of the Science Annex in the 2012 Great Lakes Water Quality Agreement. The initiative works on a five-year cycle of priority setting, planning, the field year, analysis and reporting. The phases are staggered across the lakes, so during a given year each phase happens on one of the lakes.

The CSMI team cooperates with the GLWQA Lake Partnerships, groups of agencies and organizations that facilitate information sharing, set priorities and assist in coordinating binational environmental protection and restoration activities that advance the development and implementation of Lakewide Action and Management Plans. The partnerships identify the CSMI priorities for each lake to generate needed science and monitoring information to help assess the health of the lake ecosystem and to guide management actions.



Small Town Fish Festival



lures in

A BIG CROWD

Sea Grant Study Finds Local Walleye Festival Worth \$4 Million

Lake Erie supports coastal communities in a variety of ways. Whether for fishing or transit, the lake is a vital resource for many towns on Ohio's northern coast. Port Clinton is no exception, but the way they utilize the lake's resources is certainly exceptional.

This May, the coastal town will hold its 38th annual Walleye Festival, an event which has earned Port Clinton the title "Walleye Capital of the World." The four-day event draws large crowds, but until recently no one was sure what exactly the benefit was to Port Clinton.

"There was debate on whether or not the festival was worth the cost," said Nicole Defreitas, sales and marketing director for Jet Express, who ran a pilot study in 2013 to find the estimated economic impact of the festival to Port Clinton. The city wanted to know if the cost of the festival was a good use of public funds and if they were getting a good return on their investment. The findings were overwhelmingly positive, with the study showing an impact of more than \$1 million on the city of Port Clinton.

She then teamed up with Dr. Bob Lee of Bowling Green State University, who specializes in tourism and leisure studies, to expand the study to the county level and perform an in-depth analysis of the economic benefits to Ottawa County and identify the driving factors for attendance. Defreitas and Lee hoped to use the study to identify ways other coastal towns could leverage Lake Erie's resources for their own events. Funded by Ohio Sea Grant, the pair set out in 2016 to learn what was, and is, Port Clinton's key to success.

Defreitas and Lee conducted a survey to estimate visitor spending and learn participants' reasons for attending the festival. The survey asked for demographic details, such as age, household income and home ZIP code. It also asked participants how they learned about the festival and why they attended from a selection of provided reasons. Finally, the survey asked participants how much money they spent in a range of categories.

Ohio Sea Grant funds research to support local economic development and helps small Lake Erie communities learn from each other's successes.



With all the information in hand, Defreitas and Lee analyzed their data and were more than pleased with their findings. The crowd counts showed upwards of 20,000 attendees, and the total economic impact to Ottawa County was 67 jobs, \$1.8 million added in labor income and a total economic output of \$3.8 million annually. “The numbers were much higher than expected,” said Defreitas. “You get used to the festival, but you don’t really realize the impact it has.”

Port Clinton officials were ecstatic at Defreitas and Lee’s results, as they not only showed that the festival was “worth the cost,” but that it had a huge impact on the community and surrounding area in terms of increased revenue and job creation.

Even just knowing the attendance numbers helps going forward. “It’s useful for finding sponsors,” said Defreitas. “It’s also helpful for marketing the festival.”

Another benefit of the study was participants’ input to improve the festival. Suggestions ranged from requests for more parking and shaded areas to display boards educating attendees on the history of the festival or on people’s impact on the lake, a sentiment which Defreitas echoed. “If the lure of the walleye festival catches their attention, let’s use it as an opportunity to educate,” she said. Defreitas and Lee summarized the suggestions and provided them to Main Street Port Clinton, the organization that plans the event, which

intends to incorporate those suggestions when preparing for future walleye festivals.

Defreitas and Lee’s research on the Walleye Festival also shows why similar events can benefit other regions. In the study, the top two scoring reasons for attending the festival were “to spend time with family/friends” and “to get away from daily routine” (“for the Walleye Festival” was tied for third with “for the food and beverage”), suggesting an event’s subject matters less than its simple existence. Either way, there’s no doubt that Port Clinton’s Walleye Festival is a resounding success.

Looking to the future, Lee said he would like to come up with a model for other towns to use to create their own festivals or events. “Port Clinton has been very successful in developing a model. We’re interested in how other small coastal towns can borrow this model,” Lee said. He hopes that he can provide a resource that helps these small towns diversify and rejuvenate their economies by bringing visitors to their communities who then spend money at local businesses, boosting revenue and creating jobs.

Every town has something unique, and Lee hopes that his research can help people show off what makes their town special. From a local museum to agriculture tourism, he believes that every town can leverage its distinct personality and share it with the world in a way that’s both fun and benefits the community.

For more information about this project, contact Lee at bdlee@bgsu.edu.

WHAT’S THE TRUE VALUE OF LAKE ERIE BEACHES?

by Joy Snow, Ohio Sea Grant



Visitors enjoy a Lake Erie beach. Tourism is a major contributor to the Lake Erie economy, so the impact of harmful algal blooms on guests is a concern for many coastal communities.

Any Lake Erie local could tell you that beaches are an important part of the economy for communities near the lake, but exactly how important are they? Dr. Brent Sohngen of The Ohio State University is looking to crunch the numbers with help from Ohio Sea Grant.

Sohngen, a professor of environmental and resource economics in the Department of Agricultural, Environmental and Development Economics, was awarded a grant to estimate the total number of visitors to beaches on Lake Erie’s coast and the economic value they bring to the region. He plans to do this through beachgoer counts and surveys asking visitors about their trip. The surveys will include details such as home ZIP code and money spent so that Sohngen can calculate how much economic value these beaches generate – and how much of it comes from outside the local community.

He intends to use that information to estimate the economic hit these regions take when beaches are closed due to poor water quality – such as during the large harmful algal blooms (HABs) of 2011 and 2014. “This research should help us fill an important hole in our understanding of the value of public access to the Lake Erie coastline, as well as the impacts of HABs and other water quality problems on visitation and the economy,” Sohngen said. He will provide his results to policy makers and the local communities so they can better make informed decisions concerning Lake Erie and its beaches.

The project will begin this June and final results should be ready in early 2020. For more information about the study, contact Sohngen at sohngen.1@osu.edu.



by Lisa Aurand Rice,
Ohio Sea Grant Communications

QUESTIONING QUICKSILVER QUANTITIES

Stone Lab partners with Ohio EPA to monitor mercury levels

Mercury – the toxic element once common in household thermometers – is in the air we breathe, the ground beneath our feet and the rain that falls from the sky.

For most people, the only time we worry about mercury nowadays is when we eat fish. And for a good reason, says Mark Olson, atmospheric mercury network site liaison for the National Atmospheric Deposition Program (NADP).

“The problem is that methylmercury attaches to an organism’s muscle tissue,” Olson said, explaining that it accumulates, which means the farther up the food chain a fish is, the more mercury it typically contains. “If you’re eating those fish faster than you can get rid of the mercury from your system, your levels go up.”

That’s a problem because high levels of mercury can cause neurological and organ damage, among other medical issues. It does occur naturally in the environment, but human activity – such as burning coal and other fossil fuels – is a major source of mercury emissions, Olson said.

The NADP has been tracking and studying the environmental effects of atmospheric mercury at sites all over the U.S. since 1995. In 2011, Stone Laboratory’s Peach Point Research Laboratory on South Bass Island became one of those sites with the installation of a monitoring station made by Tekran Instruments Corporation and funded by the Ohio Environmental Protection Agency (EPA). Stone Lab is one of only two NADP sites in Ohio; the other is located at the southern end of the state in Athens at Ohio University.

The Tekran measures mercury in three different phases – gaseous, particulate and oxidized – said Ohio Sea Grant Research Coordinator Dr. Justin Chaffin, who manages the program for Stone Lab. The instrument takes a reading every 5 minutes and transmits the data to the Ohio EPA and NADP.

Since the installation of the Tekran, Stone Lab has added several other types of mercury-monitoring equipment and protocols to the data collection program. Rainwater and snowfall collect in a half-gallon bottle which is sent away each week for mercury analysis. Four to eight times a year, Stone Lab staff deploys a special sampler that collects and concentrates mercury from the air for a monthly period and sends it away for isotope analysis. Leaf litter was collected and analyzed fall of 2017 and is again planned for 2018. And a meteorological

“These long-term data sets will set us on the right path of reducing human exposure to mercury.”

— DR. JUSTIN CHAFFIN

tower next to the Research Laboratory tracks wind speed and direction, which pairs with data from the Tekran.

“So we can track the source (of the mercury),” Chaffin explains. “If we’re getting a west wind, maybe it’s coming from Detroit, for example.”

NADP data is used to create maps showing total mercury deposition, so individuals can see how much mercury pollution there is in their area. It’s also used by modelers who incorporate environmental and human variables to predict future mercury levels, and by scientists, who are examining potential links between atmospheric mercury and mercury levels in fish populations, Olson said.

“These long-term data sets will set us on the right path of reducing human exposure to mercury,” Chaffin said. “We want to minimize it for people through the animals we eat and the crops we grow.”

The project will continue for as long as there is funding, said Phil Downey, environmental specialist for the Air Monitoring Section of the Ohio EPA. The current grant lasts through June 2019.

Restoring wetlands, piece by piece

Long ago, most of northwest Ohio consisted of the Great Black Swamp, a 1,500 square mile swamp stretching from Port Clinton to Fort Wayne, Indiana. Now, much of that area is farmlands, but there are efforts to restore some of the region to its original state. One such spot is a complex of wetlands along the Toussaint River, just south of the Ottawa wildlife refuge.

The project, part of a larger restoration effort in the area led by The Nature Conservancy (TNC), began in 2016 with the goal of connecting the wetlands to the nearby Toussaint River and opening the area to nutrient exchange and fish habitat. Partners included Ohio Sea Grant, Ducks Unlimited, Black Swamp Bird Observatory, the Ohio Department of Natural Resources and the National Oceanic and Atmospheric Administration.

Ohio Sea Grant did preliminary work to assess the area so that it could be compared to post-restoration conditions. This helps agencies determine if the actions they took had the desired effects, such as bringing fish back to an area or helping filter nutrients out of the river before it enters Lake Erie. Extension Program Manager Tory Gabriel's team surveyed pre-restoration fish populations.

Gabriel used two sizes of trap nets to capture a variety of fish and get a precise estimate of the population, but that's far easier said than done. One goal of the larger project is to improve accessibility to the wetlands, but Gabriel and his team didn't have the luxury of waiting until improvements were made. The team often had to deal with downed trees blocking access for

their trucks, requiring them to carry heavy buckets of water and fish to and from the work area, and simply moving across the slick, gloopy wetlands was difficult.

The wetlands restoration project is currently finishing phase 1, which removes interior dikes, connects the area to the Toussaint and constructs a new water control structure, transforming the landscape from a series of isolated wetlands into a single large wetland connected to the river. The water control structure is especially important as it will allow water quality managers to change the water level as needed and will provide a tool to help control invasive European Reed (*Phragmites*).

Phase 2 establishes exterior dikes to protect the marsh and surrounding area from erosion. Once that's done, Gabriel expects to come back to determine how the restoration affects fish populations, just as he did with previous parts of the larger TNC project.

Restoring the wetlands is an important step to improving the health of Lake Erie. Wetlands slow down the flow of water from the river, which means some sediments and nutrients will settle in the marsh rather than the lake. Reducing the amount of nutrients flowing into the lake will help prevent excessive algae growth and is essential to curbing harmful algal blooms and hypoxia (when water near the lake bottom runs out of dissolved oxygen).

Restored areas will also serve as a refuge for bird and fish populations. Little fish need



Snapping turtles sometimes got caught in the nets, forcing researchers to wrestle the uncooperative reptiles free before they could check a net's contents.

a safe habitat so they can grow, and wetlands provide an excellent refuge from predators. "The hope is for increased species diversity," which contributes to a healthier ecosystem overall, said Gabriel.

Many of the paths into the marsh are also being cleared and reformed, which should alleviate many of the current difficulties for traversing the wetlands. That's especially great news for birdwatchers, as birding is already popular in the region – the Black Swamp Bird Festival takes place there each May and features tours through nearby birding sites.

It will still be a while before the restoration is fully completed. Once it is, TNC would like to further expand their restoration efforts, continuing their mission of preserving the natural ecology of northwest Ohio, and when the next project starts, Ohio Sea Grant will be there with nets and buckets, ready to get dirty.

Ohio Sea Grant is assisting The Nature Conservancy in the restoration of 231 acres of wetlands that will help keep Lake Erie healthy and provide habitat for fish and birds.

By Lisa Aurand Rice
Ohio Sea Grant Communications

From the Lab to THE ER

Biology major Aaron
Wibberley takes his interest in
science to the medical field

When Aaron Wibberley goes running in Chicago where he's a fourth-year medical student at Northwestern University, he likes to look out at Lake Michigan. The view of the water reminds him of the summer he spent at Stone Lab in 2007.

"It was by far the best summer while I was an undergrad," said Wibberley, who spent eight weeks at Stone Laboratory taking classes and conducting research as part of his biology degree from The Ohio State University. "It feels like it was yesterday."

Wibberley had always been interested in science, especially aquatic and marine animals. Growing up in Powell, Ohio, he was able to get seasonal jobs at the Columbus Zoo and Aquarium while he was in high school and earned his scuba diving certification at age 16.

In winter 2007 when he was a sophomore, he met Stone Lab Manager Matt Thomas and Education and Outreach Coordinator Kristin Stanford at an event on the Ohio State Columbus campus. Wibberley and Thomas quickly connected, talking about diving and how they might develop a research project that was suited to Wibberley's interests.

Wibberley was accepted to the Research Experience for Undergraduates (REU) Scholarship Program, which paid for his tuition, room and meals during his time at Stone Lab. He worked with Thomas on his project, which examined whether Lake Erie watersnake foraging behavior was related to the makeup of the lake bottom (benthic environment).

"It was a lot of fun," Wibberley said. "I got to do a lot of scuba diving and spent a lot of time in the boat observing snake behavior."

On the days he wasn't following around watersnakes, Wibberley was enrolled in ecology and limnology courses, both of which served him well a few years after he graduated, when he landed a job in Ohio State's Aquatic Ecology Lab (AEL) working on a project studying Lake Erie walleye. But science was only one of Wibberley's passions.



"One thing I saw Stone Lab do really well was communicate with the public about science. It helped me glean communication skills that I can use in healthcare."

AARON WIBBERLEY

"When I graduated from Ohio State, I worked for a church on campus doing student ministry," before joining AEL, he said. "I loved the people side of things."

Seeking a way to combine the two led him to consider medical school, and he's now interviewing at hospitals, hoping to be placed as an emergency medicine resident in the next few months. Though medicine may not seem to have a direct connection with his Stone Lab experience, Wibberley said his time there had a lasting impact on him.

"One thing I saw Stone Lab do really well was communicate with the public about science," he said. "It helped me glean communication skills that I can use in healthcare, talking about patient myths or misunderstandings of medical conditions."

The other takeaway is more obvious: the importance of research. As part of his med school curriculum, Wibberley has been conducting research on the detection of aortic dissection – a tear in the large blood vessel connecting to the heart. Diagnosing the condition and providing immediate treatment can be the difference between life and death.

"Stone Lab really helped instill the value of research in my life," Wibberley said.

Tour Dates Set For the 2018 Season

Stone Laboratory on Gibraltar Island, the South Bass Island Lighthouse and Aquatic Visitors Center in Put-in-Bay bring hands-on science and education to everyone who visits.

› GIBRALTAR ISLAND AND COOKE CASTLE

Explore the island, including Perry's Lookout, the glacial grooves and the outside of Cooke Castle before learning all about Stone Lab research. Two-hour guided tours are held every Wednesday (June 20-August 8) from 10 a.m.-12 p.m. and 1-3 p.m. for \$10 per person (\$5 for kids ages 6-12), plus water taxi fare. Information about getting to Gibraltar Island is available at go.osu.edu/gibtours.

› SOUTH BASS ISLAND LIGHTHOUSE

Visit the historic lighthouse, which was first lit in 1897, and climb the tower to take in the view. Free tours are held on the second Saturday of the month (June 9, July 14, August 11, September 8 and October 13) from 11 a.m.-5 p.m. The lighthouse grounds are open daily from dawn to dusk. Private group tours (April through November) can be scheduled at go.osu.edu/lighthouse.



› AQUATIC VISITORS CENTER

Explore Lake Erie's rich history and experience science up close at this educational center including aquaria with live fish. The AVC is open Wednesday through Saturday (June 20-August 25) from 10 a.m.-5 p.m. Visits are free, but guided group tours can be scheduled for \$4 per person at go.osu.edu/avc.





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“Talk about life-changing experiences!” ➤



That's **Ashley Kulhanek**, talking about her time at Stone Lab. She decided to take an entomology class there as a sophomore sociology major, and became so interested in bugs that she ended up going to graduate school to study them.

Today, she combines her science knowledge with her interest in



people as an agriculture & natural resources extension educator for OSU Extension in Medina County, teaching adults and kids about managing pests, protecting bees and other pollinators, controlling invasive species like the emerald ash borer, and keeping produce safe to eat from farm to table.

You can help students like Ashley find their true passion by supporting Stone Lab scholarships at ohioseagrant.osu.edu/giving.