

TWINELINE

2012 WINTER/SPRING EDITION VOL.34/NO.1



Listening in on a Fish's Life History

Ohio Sea Grant research assists fisheries managers in improving steelhead trout return rates and raising the fish's economic impact



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2012 WINTER/SPRING EDITION

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Ohio Sea Grant Welcomes Sarah Orlando



Sarah Orlando

Ohio Sea Grant Extension is pleased to announce the addition of Sarah Orlando as its new Clean Marinas Coordinator. Based at the Office of Coastal Management in Sandusky, she will oversee the state's Clean Marinas program, which encourages marina owners to use innovative solutions to protect clean water and fresh air. Orlando holds a bachelor's degree in biology from Wittenberg University and a master's of marketing research degree in marina resources management from Texas A&M. In 2008, she worked as biological field station assistant at Ohio State University's Stone Laboratory and in 2009 she worked as the lab's assistant manager.

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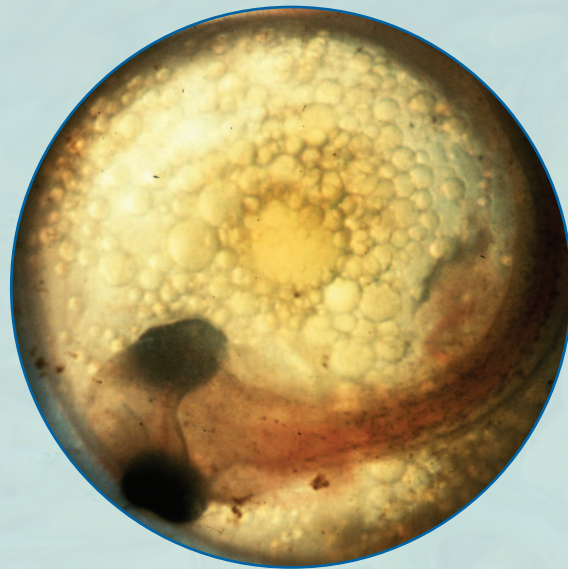
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Listening in on a Fish's Life History

Ohio Sea Grant research assists fisheries managers in improving steelhead trout return rates and raising the fish's economic impact

by Christina Dierkes, Ohio Sea Grant Communications



On a typical fall day in Ohio, anglers line the banks of rivers like the Vermilion and the Conneaut, looking for that next great catch. Their main target is steelhead trout, a salmon relative native to the Pacific Northwest that has been introduced into Ohio, Pennsylvania, Michigan, and New York rivers to extend the recreational fishing season into the fall and early winter.

Dr. John Farver and Dr. Jeffrey Miner of Bowling Green State University are studying these fish, specifically their otoliths, a small bone that acts as a balancing organ and helps with hearing. Based on chemical elements incorporated into the otolith as the fish grows, the researchers are able to determine with better than 90% accuracy (100% accuracy for Ohio-stocked fish) the state hatchery in which the fish was raised, how much time the fish spent in the river once stocked, and potentially where in the lake it spent most of its life before returning to a stream to breed.

"Fisheries managers stock about 2 million steelhead into Lake Erie each year," explains Miner, Associate Professor of Biological Sciences. "It's a very substantial fishery in Ohio, Pennsylvania, and New York that primarily occurs from October until April each year

because that's when the fish come up into the rivers to spawn. This provides an economic opportunity for the region at a time of year when other recreational activities are not at their peak."

Like their salmon cousins, most steelhead trout will return to their "home stream" to spawn, but a small percentage deviate from this pattern and move to a different stream. Because the steelhead are not native to this region, they can't reproduce successfully in most streams that flow into Lake Erie—the water gets too warm during the summer months for the offspring to survive—and state hatcheries in Ohio, Pennsylvania, Michigan, and New York stock juvenile fish into these tributaries each year, at a cost of

about \$340,000 in Ohio alone, to support the steelhead fishing needs in the region.

Estimates from 2006 place the annual value of Ohio steelhead fishery in Lake Erie tributaries at \$12 million or more, so wildlife managers want to raise fish that will return to their home stream and support the local economy instead of another state's. Being able to determine return rates then becomes an important part of developing effective management practices.

Raising and stocking of juvenile steelhead trout requires a significant amount of agency resources so groups like the Ohio Department of Natural Resources, Division of Wildlife have a major interest in determining what happens to hatchery fish after they are

released. This is where Miner and Farver's research comes into play. Based on the microchemistry—the chemical fingerprint—of the otolith, the researchers can determine the hatchery at which the fish originated, and combine that information with where it was caught to determine return rates for each hatchery stocking steelhead to Lake Erie.

"If you look at an otolith, it looks much like the cross-section of a tree, with rings that are demarcations of changes in growth," says Miner. The center part of the otolith represents the



ODNR Division of Wildlife employees release young steelhead trout into the Vermilion River. Ohio invests about \$340,000 into raising these fish each year, supporting a steelhead fishery valued at \$12 million annually.



fish's early life, and rings are added as the fish continues to grow. "It's a very reliable measure of the age of the fish, and it also contains a chronological history of where the fish has been."

Otoliths are about four to five millimeters across, located behind the steelhead's eyes, and made up in large part of calcium carbonate. Because this mineral is not routinely reabsorbed into the body, the deposited rings visible in the otolith give an accurate measure of the age of the fish. Additionally, as the fish grows, the otolith picks up other chemical elements from the water, such as strontium and barium, and incorporates them into new rings. By analyzing the patterns of these elements across an otolith, Farver and Miner, along with graduate student Chris Boehler, can connect adult steelhead to specific state hatcheries and some natural streams.

"That makes it unique for us, because we can take a big fish that's been out in Lake Erie for several years, go back to the center part of the otolith that developed when the fish was in the hatchery, and determine the chemical signature for that period of time," Miner explains. "That's what we use as our sleuthing approach to identify where that fish was, what hatchery it came from, and therefore, into what river system in which state it was stocked."

To determine otolith chemistry, the researchers use a process called laser ablation, in which the otolith is cracked in half, sanded and polished, and then examined using a laser beam 25 microns in diameter (less than half the diameter of a human hair). The laser beam vaporizes small parts of the otolith in chronological order, and the researchers can use mass spectroscopy analysis of that vapor to determine the otolith's chemical composition. They then compare those

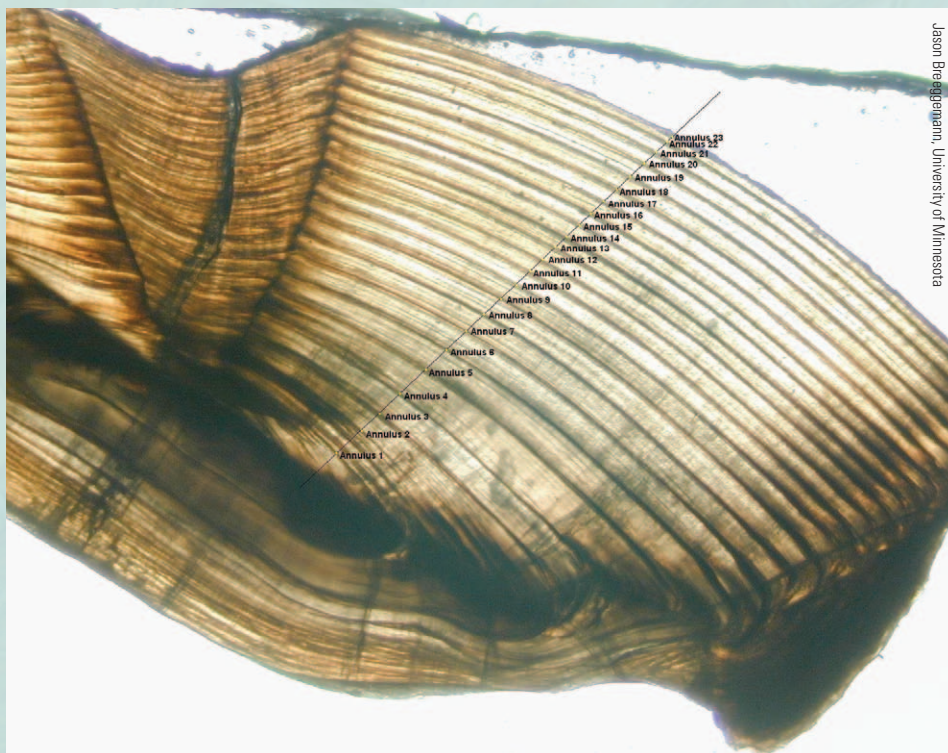
results with the chemical signatures from juvenile fish taken directly from the hatcheries to determine where a specific fish was raised before entering a Lake Erie tributary. These analyses are conducted at the University of Windsor's Great Lakes Institute for Environmental Research.

During the first part of their most recent project, the researchers traveled to the different hatcheries to determine their chemical signature, explains Farver, Associate Professor of Geology. "We've also obtained multiple year classes from each hatchery now, and we can show with close to 100% accuracy that we do get the same signature each year from each different hatchery. It means we can go out, collect any adult fish, and tell where it came from without going back to the hatchery to find out what the signature is for that year."

All of the steelhead trout raised in Ohio come from the state hatchery in Castalia,



southwest of Sandusky. This is fortunate for Miner and Farver's research because the water chemistry in the region is unique and easily identified. "One of the things about



Jason Breigemann, University of Minnesota

An otolith cross-section, showing the annual rings that mark changes in growth. The dark center represents the fish's time spent in the hatchery, and the lighter outer area marks the time it spent in the lake. Samples taken by laser ablation from different areas of the otolith show the chemical signature of the water where the fish spent each growth period. This particular fish was about 23 years old when it was caught.

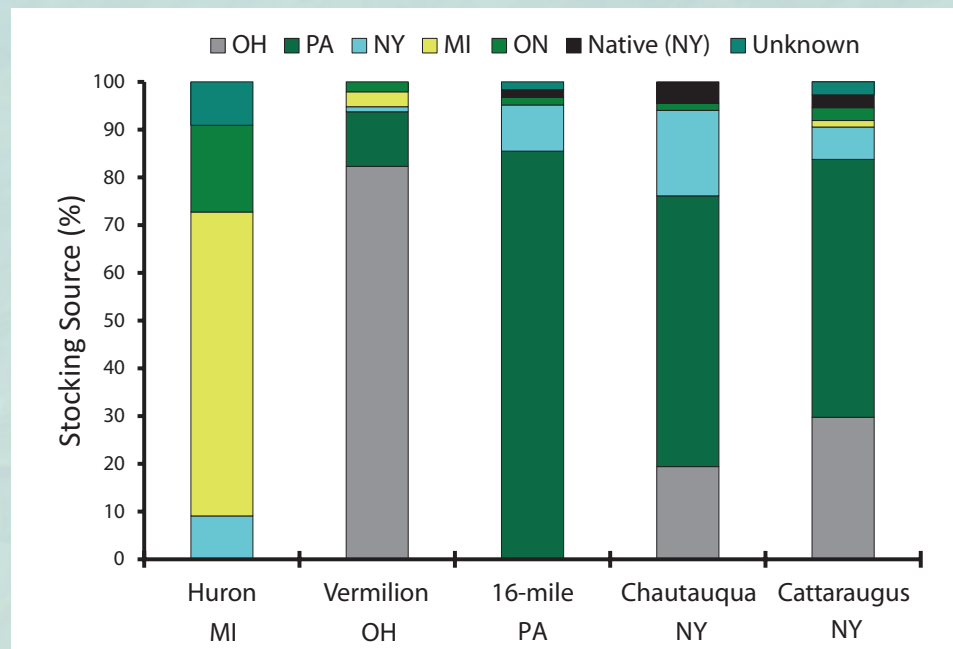


Matt MacGillivray

Castalia is that the bedrock there naturally has higher strontium concentration than the water in other hatcheries, and it's that strontium substituting for calcium in the otoliths that gives us a really strong signal," says Farver.

In addition to Ohio steelhead trout, Miner and Farver, along with graduate students, have examined fish caught from streams in Pennsylvania, Michigan, New York, and Ontario. Among their results, they found that most steelhead caught in Ohio, Michigan, and Pennsylvania also came from these states; however, New York catches were mostly fish raised in Ohio and Pennsylvania. Future research will have to determine the reasons for this discrepancy, something in which all involved state agencies are interested because fish that stray from their home streams essentially represent a loss of state funds instead of providing a return on investment at home.

"70 to 80% of the fish caught in New York are not coming from the New York hatchery or from natural reproduction, they're coming from Pennsylvania and Ohio," says Miner. "So we want to figure out what's



Samples from five Lake Erie tributaries show the expected pattern of return for Michigan, Ohio, and Pennsylvania fish, as well as the unusual pattern for both New York streams. Fisheries managers in Ohio and Pennsylvania are especially likely to have an interest in explaining this pattern, as their fish seem to be the most likely not to return to their home streams, decreasing their state's return on investment. Both native and stocked New York fish are poorly represented.

going on with these fish that we're getting such poor return to Ohio, and why we are getting so many Pennsylvania and Ohio fish in New York streams. These are some of the interesting questions we would like to pursue next. We do think it would be very helpful to both New York—because they want to figure out what's happening to their fish—and to Pennsylvania and Ohio to improve the return rates of fish to their streams."

Something both Miner and Farver emphasize when speaking about their projects is the positive collaboration with government agencies like state departments of natural resources, which have been very supportive of the research. "One of the things that's been really satisfying for me personally is the amount of help we've had from all the different state agencies," says Farver. "From fish management and hatchery personnel to the state biologists, the amount of feedback and physical help they've provided, like catching fish and collecting water, is marvelous."

The researchers hope to continue these collaborations in the future because many questions about the life history of steelhead trout in Lake Erie remain unanswered. "How do you optimally stock fish into a tributary to get the best return you can is really the most important management question," explains Miner. "Maybe you should stock your fish far upstream so that you maximize the amount of time they spend in the tributary, but maybe that way you're stocking them in a location that isn't accessible to anglers, and adults go right past those access points when they return to the stream. Biologically speaking, it's very interesting to us to know where the fish go in Lake Erie before returning. So there are quite a few management and biology questions that will be interesting to address in the future." TL

This research is currently supported by Ohio Sea Grant. For more information, contact Dr. Farver at jfarver@bgsu.edu, or Dr. Miner at jminer@bgsu.edu.

STONE LAB CONFERENCES

Bring People Together

by Matthew Forte, Ohio Sea Grant Communications

Emails, webinars, and teleconferences have all made communications across the campus and across the country easy and inexpensive, and it can all be done while sitting at a keyboard. But maybe in this day of high-tech and low-touch, it's better to travel to a unique environment to talk and share ideas in person.

Last September, Ohio State University's Ohio Sea Grant hosted two conferences at its Stone Laboratory at Put-in-Bay. Communicators from nearly 30 different departments and colleges and five regional campuses within Ohio State came for a professional development retreat. Two days later, university extension program leaders and communicators from 31 of the nation's 32 Sea Grant programs traveled to Stone Lab for their biennial national conference. For almost half of these attendees from around the country, it was their first time visiting Lake Erie.

"One of the main benefits of the retreat is that we got to experience a part of Ohio State (Stone Lab) that too few know about," says Christine O'Malley, Ohio State's College of Public Health Office of External Relations & Advancement Executive Director. "Beyond learning about the university's role in Lake Erie research and preservation, the retreat was an opportunity for peer-driven professional development at an affordable price."

Ohio Sea Grant and Stone Lab is a small program within the nation's third largest university, but it has a sizable impact, introducing 7,000 students to aquatic science during science field trips every year, and offering college classes and workshops to more than 200 people each summer. While hosting the two conferences, Stone Lab expanded its focus on education from students to



representatives from other Sea Grant programs and Ohio State communicators.

"The Ohio Sea Grant team never ceases to amaze me," says Amy Painter, National Sea Grant Communicator. "The conference was beautifully planned and executed by a small, dedicated, and well-informed staff. Each event was used as an educational opportunity so that we could learn about the program's work in research, education, and extension while also celebrating Lake Erie's natural beauty and resources."

In addition to touring Stone Lab and Gibraltar Island, participants had the chance to walk through the historic South Bass Island Lighthouse and Aquatic Visitors Center, both operated by Ohio Sea Grant. Presentations taught attendees about the importance of social media and how to use it effectively, and about marketing and branding tools.

Presentations, which included a discussion focused on defining advocacy and its impact on extension activities, provided information that

Pete Rowe, New Jersey Sea Grant Consortium Associate Director can use, he says.

"Updates from the national groups—Sea Grant and Extension offices, the advisory board, and Sea Grant Association—were the most valuable aspects of the assembly for me," he says. "It's our opportunity to ask questions and get guidance from the national office as a group and in person."

Other popular sessions at the Sea Grant Conference gave information about tracking communications efforts, repurposing content for multimedia, and the need for constructing a crisis communications plan.

Participants didn't spend all the conferences in meetings, though. Instead, in true Stone Lab form, they headed to the boat dock, boarded a Stone Lab research vessel, and motored out to a spot on the lake where they conducted fish trawls, sampled plankton, and tested water clarity—seeing firsthand the problems, like harmful algal blooms, Sea Grant is trying to solve.

"Truly, I had no idea what a fabulous resource we have on Lake Erie!" says Libby Eckhardt, Ohio State's College of Arts & Sciences Chief Communications Director. "I've been with Ohio State for nearly five years and the wonders never stop. I'm in love with Stone Lab now and can't wait for next year's retreat."

The next Ohio State communicators retreat is scheduled for September 13 – 14.

Talking with representatives from other Sea Grant programs gave Moira Harrington, Wisconsin Sea Grant Institute Communications Manager, some ideas of her own.

"Networking with peers gives a better vantage point about your own program," she says. "I also picked up a lot of immediate-use ideas. For example, New York Sea Grant did a direct-mail postcard about its social media platforms. I came right back to Wisconsin and did something similar and I am confident that this 'borrowed' good idea will pay off."

By fostering this sharing of ideas across programs, the meetings generate a lot of energy, Rowe says. "Meeting together creates a better social network with the ability to pass ideas, program activities, and stories between communicators and extension," he says. "Physically being able to get together at regional and national levels creates a rapport that you cannot get from emails and phone calls." **TL**



Photos from the conference and retreat are available at go.osu.edu/ConferencePhotos and go.osu.edu/RetreatPhotos.

View the presentations from the 2011 Sea Grant Extension Assembly and Communicators Conference at go.osu.edu/Conference and presentations from the OSU Communicators Retreat at go.osu.edu/Retreat.



Sea Grant Invites Public to "Cache in" at Aquatic Visitors Center

A visitor to South Bass Island with an interest in treasure hunting may wind up discovering the Aquatic Visitors Center (AVC), thanks to a geocache hidden near the facility. A geocache is a small waterproof container, often hidden near tourist attractions with its geographic coordinates posted on geocaching.com. People plug the coordinates into their GPS or smartphone and track down the container, which holds a finders' log and some assorted prizes—in this case fishing lures and temporary tattoos—that are free to the finders. But in addition to being high-tech hide-and-seek, geocaching is also a learning opportunity.

"People don't just do it for the sake of hiding and finding something," explains Dr. Rosanne Fortner, Ohio Sea Grant Education Coordinator. "People geocache

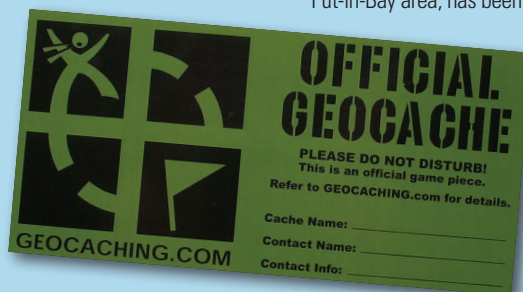
so they can learn something as they go. That's the very thing our cache does—it introduces people to the AVC."

Open from June through August, the AVC is a former state fish hatchery now operated by Ohio Sea Grant and the Ohio Department of Natural Resources Division of Wildlife. When people pull up the AVC cache's webpage, go.osu.edu/cachesite, they can read a lot of background information about the AVC's history

as a fish hatchery, as well as follow a link to the Stone Lab website. Named "Go Fish Lake Erie," the AVC cache is easy to locate (although Fortner won't reveal where it is) and since it was established in June 2011, 96 people have found it.

The AVC cache, one of 17 hidden treasures in the Put-in-Bay area, has been successful, Fortner says.

"It's a great way to bring people to an area of South Bass Island that they might not have otherwise visited, or they might not have realized it's a tourist spot." **TL**



The Benefits of Birding

Sea Grant Research Finds
Bird Watching Contributes \$30 Million to
Northern Ohio's Economy

by Matthew Forte, Ohio Sea Grant Communications

A flutter of yellow feathers against the trees catches the birder's eye. Peering through binoculars, she smiles—the bird is a rare Magnolia Warbler, not often seen in Ohio. It rests for a few minutes, then flies off as the bird watcher excitedly scribbles down the date, time, and weather conditions in her notebook.

This birder is one of 2.4 million who flock to Ohio to see birds migrate through the area. Birding is a large portion of Ohio's \$39 billion tourism industry, with birders paying for gasoline, food, and hotel stays. But until now, there hasn't been much information about exactly how much money birding brings in and what types of programs and facilities would draw even more birders.

Dr. Philip Xie of Bowling Green State University recently completed an Ohio Sea Grant-funded project showing that birding contributes \$30 million and 283 jobs to northern Ohio's economy. Understanding these impacts will help local governments, park managers, and conservation groups better support birding and market northern Ohio's birding opportunities to attract more bird enthusiasts.

"Everyone knew there were a lot of bird watchers in Ohio, but nobody knew how much money they spent or what kind of economic impact they had on communities," Xie says. "Having solid numbers will help us in two ways. Policy makers will learn about the financial impact of bird watching in terms of how much tax revenue and jobs it creates. Second, the information will be useful for strategic marketing—once we

know where these birders are from, we will know where to spend our marketing dollars better."

Surveying more than 1,100 birders at six of northern Ohio's most popular birding sites, Xie has found that most bird watchers who visit sites along the Lake Erie coast live in Ohio, but

many birders also come from neighboring states. Ottawa County's Magee Marsh, listed as "one of the top birding destinations on the continent" in the American Birding Association's *Birding* magazine, attracts birders from around the world. Bird watching at the marsh supports 195 local jobs and has an economic ripple effect to the tune of \$19 million in direct and indirect impacts within a 15-mile radius. Birders spend money that supports salaries, local products, and taxes; when local people receive that money, they turn around and spend it again. This re-spending of money has a multiplying effect for the entire region, generating \$1.48 for every dollar that birders spend in northern Ohio.

To enhance birding experiences and economic impacts of birding in Lake Erie coastal communities, Ohio Sea Grant has



Considered one of the continent's best birding locations, Magee Marsh in Ottawa County draws several thousand bird watchers from across the country during spring migration.

teamed up with the Ohio Department of Natural Resources to create the Lake Erie Ohio Birding Trail. The trail connects 84 birding sites along the 312-mile lake coast, and a newly designed website, lakeerieohiobirding.info, lists information about good but lesser-known birding sites that are located near more popular ones.

"Part of Magee Marsh's popularity comes from its quality of birding, but it's also very well known," says Melinda Huntley, Ohio Sea Grant Extension's Tourism Program Director. "The Birding Trail gives us the ability to link different sites. The Magee Marsh boardwalk is always packed in the spring, so if we can let people know about other nearby sites, we can minimize the stresses on the popular environments and level out the impacts."

Sharing Results

Birding holds a huge potential to grow northern Ohio economies, Xie says, but it will take some initial investment from local governments to market birding sites and to improve those sites by building more boardwalks and viewing platforms.

"If more birders learn about Lake Erie birding and decide to lengthen their stay in the area, the bird watching industry will have an even larger economic impact," Xie points out. People who watch birds along Lake Erie tend to be advanced active birders who will spend money on bird-watching equipment. Nearly 75% of survey respondents are willing to pay more than \$300 for a pair of birding binoculars, 60% spend more than \$100 annually on birding books, and nearly 50% would pay \$500 for a camera.

An important component of Xie's project has been to show communities and local governments the importance of birding as an industry. For example, now Xie can point to his findings, which show that Conneaut Harbor in Ashtabula County draws birders who annually contribute \$1.04 million to the local economy. In comparison, Magee Marsh attracted the most revenue of all six surveyed sites with \$19.3 million, and Mentor Marsh in Lake County brought in the least, with about \$592,000. Xie will be sharing similar information with various groups along Lake Erie about what local officials and parks can do to draw even more bird watchers.

"Communities have asked for this economic impact information so they can make wise decisions about what investments to make," Huntley points out. "Before public officials plan marketing efforts or enhance natural areas and public access opportunities, they want to see the potential economic value."

Huntley agrees that birding is an important piece of northern Ohio's tourism industry that officials shouldn't overlook. "The beauty of birding is that its primary opportunities are during the spring and fall, those months that are the shoulders of the busy summer season," she says. "We tend to focus only on the summer as being the primary tourist season, but we can extend it

to spring and fall because that's when people are coming for better birding."

In the long run, birding gives considerable returns on investments, Xie says. "It's important for legislators to understand the magnitude of their decisions and to allocate resources and implement policies to attract birders. After all, birding is big business and

now we have a lot more information about how to attract it." TL

View Xie's report at go.osu.edu/birding. For more information about this Ohio Sea Grant-funded research, contact Dr. Xie at pxie@bgsu.edu.

Ohio attracts
2.4 million
birders each year.

Bird watching at the 84 sites along
Ohio's Lake Erie coast supports
283 jobs and every **\$1** a
birder spends in the region generates
\$1.48 in the local economy.



Jim McCormick

THE ULTIMATE RECYCLING

New Ohio Sea Grant project examines economic impact of recycling Lake Erie dredge materials

by Christina Dierkes, Ohio Sea Grant Communications

An essential part of keeping a Lake Erie port operating is dredging shipping lanes to maintain adequate depth for water traffic, whether that's small fishing boats or large freighters. But what to do with the material that gets scooped up from the bottom of the lake? In many cases, it's dumped in open lake waters, or impounded in lots near the harbor. But Dr. Elizabeth Dayton, Research Scientist at Ohio State University's School of Environment & Natural Resources, believes the dredge material can be put to better use.

Dayton and her collaborator, Dr. Joseph Fiksel, Executive Director of Ohio State's Center for Resilience, are investigating the economic feasibility of using dredge material in soil blending, a process that creates custom soil materials for a variety of applications. "We'll look at developing soil blends that can be used in horticulture, landscaping, and maybe by the highway department as a beneficial reuse for dredge material," says Dayton, who has previously studied reuse of other soil materials, such as spent foundry sand used in metal casting.

The researchers are working with Ohio soil blenders in Port Huron and Independence

to create "recipes" for soil blends that would include dredge materials and be of use to gardeners, landscapers, or highway departments. The soil blenders will provide input on the required specifications for the various soil mixes, and the researchers will tailor a blend to those specifications. "We'll be looking at physical and chemical properties of the blend, things like pH, bulk density, water holding capacity, and fertility," Dayton says.

The dredge material itself tends to be mostly silt, which isn't optimal for

horticulture, or is it going to be a landscape material, or will it be used on the shoulders of highways. And then our blend would be tailored to hit those specifications."

The bulk of the project will focus on an economic analysis of the beneficial reuse of dredge materials. To optimize transportation costs and routes, Dayton and Fiksel, along with a post-doctoral researcher, will use EcoFlow™, a software tool developed by Ohio State's Center for Resilience and used to determine the lowest-cost path of materials through a transport network.

Using EcoFlow™, the team will create a model that can optimize a sustainable transport network from ports to soil blenders to end users that minimizes cost and environmental impacts. "The soil blending should be fairly routine," Dayton says. "The exciting thing is going to be finding out how beneficial reuse of dredge material can be feasible." The researchers expect to complete model development in early 2014.

The dredge material used in the study will come from Toledo Harbor, the sixth-largest port in the Great

Lakes. According to the U.S. Army Corps of Engineers, the port requires removal of 850,000 cubic yards each year—the volume



Open lake disposal of sediments may contribute to water quality problems in Lake Erie, as the sediments carry nutrients that can worsen harmful algal blooms.

gardening uses. "So we will try to get a list of specifications for what the end user would need," Dayton explains. "Is it going to be for

of 260 olympic-sized swimming pools—to maintain minimum depth in the shipping channel. To function at full capacity, almost 2 million cubic yards—614 swimming pools—would need to be removed, but managing that dredged material is difficult.

“Right now, the method of disposal is open lake dumping, for the most part,” Dayton explains. “There’s a tremendous water quality problem in the Western Basin of Lake Erie, and the additional sediment and nutrients [from open lake disposal] ultimately exacerbate that problem. To me, it’s also a waste of a resource to dig the sediment out and have it just flow back, and then you have to dig it out again.” Additional nutrients in the water encourage harmful algal blooms, and if financially feasible, beneficial reuse of dredge materials would be a welcome alternative to disposal or storage in material impoundments.

“We think beneficial reuse of byproducts is the ultimate recycling,” Dayton says.

While the Toledo area will serve as the trial run location for the project, Dayton expects the final EcoFlow™ model to have applications in other ports and harbors as well. “There’s no reason why we couldn’t expand looking at soil blenders and end users in any area,” she says. “We think of this project as being somewhat modular; if we can make it work in one area, we should be able to replicate it in another area.”

The Center for Resilience at Ohio State University is an interdisciplinary research center dedicated to improving the strength and flexibility of industries and the environments in which they operate. The Center’s Byproducts Synergy Network, of which both Dayton and Fiksel are a part, focuses on converting industrial and municipal byproducts into economically viable materials for other businesses. Along with partners in engineering, science, and business at Ohio State and other institutions, the Center has leveraged more than \$20 million in ongoing research projects. For more information, visit go.osu.edu/CFR. **TL**

For more information about this Ohio Sea Grant-funded project, contact Dr. Dayton at dayton.15@osu.edu.

OHIO SEA GRANT TO FUND 11 RESEARCH PROJECTS

Every two years, Ohio Sea Grant issues a request for proposals to scientists across Ohio conducting projects that address critical issues facing Lake Erie and the Great Lakes. In addition to beginning several new projects, Ohio Sea Grant will support a number of projects continuing from the last cycle. Below are the eleven projects Ohio Sea Grant will fund between February 2010 and January 2015.

Ethan Kubatko, Ohio State University. Feb. 2010 – Jan. 2013. Development and validation of a high-resolution nearshore model for Lake Erie.

Mark Partridge, Ohio State University. Feb. 2010 – Jan. 2013. Leveraging natural amenities for sustainable development in the Great Lakes region.

Richard Slemons, Ohio State University. Feb. 2011 – Jan. 2013. Environmental tolerance of Type A Influenza virus isolated from wild waterfowl in Ohio.

Carol Stepien, University of Toledo. Feb. 2011 – Jan. 2014. Temporal and spatial analyses of walleye and yellow perch genetic stock structure. A high-resolution database for fishery management.

Harold Walker, Ohio State University. Feb. 2011 – Jan. 2013. The role of sediment in controlling the fate and toxicity of microcystin.

Linda Weavers, Ohio State University. Feb. 2011 – Jan. 2013. Sonochemical desorption of contaminant mixtures from sediment.

Elizabeth Dayton, Ohio State University. Feb. 2012 – Jan. 2015. Beneficial reuse of dredged material in manufactured soil blending: Economic/logistical and performance considerations.

Hanping Wang, Ohio State University. Feb. 2012 – Jan. 2014. Genetic improvement of yellow perch: Creating the fourth generation of fast-growing lines and performing on-farm and on-station performance testing.

Darren Bade, Kent State University. Feb. 2013 – Jan. 2015. Should nitrogen be managed in Lake Erie? The potential role of nitrogen fixation by cyanobacteria.

Robert Greenbaum, Ohio State University. Feb. 2013 – Jan. 2014. The sensitivity of visitor stays to taxes and crime in American coastal communities.

Jay Martin, Ohio State University. Feb. 2013 – Jan. 2015. Impacts of climate change on public health in the Great Lakes due to harmful algae blooms.

GREEN MARINA PARTNERS STRENGTHEN GREAT LAKES STEWARDSHIP

by Matthew Forte, Ohio Sea Grant Communications



ODNR

The Great Lakes are extremely valuable as an ecosystem, tourist destination, and source of freshwater, and it's the goal of the Great Lakes Sea Grant programs to take care of them. One of Sea Grant's tools for this important task is the Clean Marina Program, which promotes coastal businesses and educates marina operators and boaters about being good stewards of the Great Lakes. Marina owners who are part of this voluntary program go above and beyond the legally mandated procedures to protect water quality by reducing their facilities' environmental impacts.

"The Clean Marina program provides ways to limit boating's impact on the ecosystem and customers appreciate our efforts to protect the waterways," says Mike Solberg, Operator of Huron Lagoons Marina, Inc., one of Ohio's certified Clean Marinas. "It is our duty as marina operators to protect the surrounding waters that provide for our livelihood."

Certified Clean Marinas, which adopt a checklist of best practices to reduce or prevent pollutants and hazardous substances from entering the water, can make a significant impact in protecting water quality

in the Great Lakes. Nearly 100 certified marinas in the region work to keep public waterways clean, with 42 in Michigan, 37 in Ohio, and 17 in Wisconsin.

"Marina operators have seen our efforts as a welcome avenue toward stewardship," explains Elizabeth LaPorte, Michigan Sea Grant Communications & Education Services Director and Green Marina Project Leader.

To receive certification as a Clean Marina, a facility operator must meet

required regulations along with a list of best practices that prevent pollution and reduce or eliminate the environmental impact of boating. While those lists are thorough (view Ohio's list at go.osu.edu/OHCleanMarina), marina and boatyard operators who have committed to them and become certified say the requirements aren't overly burdensome. Marinas already must abide by federal and state regulations; the Clean Marina guidelines just ask that marinas, harbors, and boatyards go a bit further.

As a way to standardize the certification criteria among all Clean Marina programs in the Great Lakes region, the EPA is funding the Green Marina Education and Outreach Project. The three-year project supports collaboration among Michigan, Ohio, and Wisconsin Sea Grant programs working to grow the Clean Marinas program in the Great Lakes region and encourage Clean Marina leaders to continue collaborating beyond the grant period by establishing a Great Lakes Network of Clean Marina programs.

"The Green Marina project allows Sea Grant programs and Clean Marina leaders to work



The Green Marina Education and Outreach Project is designed to help reduce or eliminate pollution from entering the Great Lakes through boating and marina activities.

collaboratively to protect Great Lakes water quality and help sustain Great Lakes Clean Marina efforts in the future,” LaPorte says.

Along with the Sea Grant programs, the Green Marina partners include a 24-member team comprised of state departments of natural resources and other regulatory agencies, boating industry representatives, and marina operators from across the Great Lakes states. Part of this team is currently reviewing state guidelines and will then construct the single checklist for Great Lakes Clean Marina best practices.

Having consistent best practices for marinas across the region makes a boater’s day on the lakes easier. “We want to make sure the message we give is clear in every Great Lakes state,” says Amy Samples, Michigan Sea Grant Community Outreach Coordinator. “For both boaters and marina operators, it’s good for those policies to be consistent throughout the region because we have numerous people traveling from lake to lake.”

Once there are common best practices for the Great Lakes region, the hope is that the process of training marina operators will be less expensive, more convenient, and more consistent. Rather than each state investing time and money in different training tools, Green Marina project partners are now working to enhance the existing Clean Marina online classroom, originally developed by Michigan Sea Grant, to make the training applicable for other Great Lakes states. This online training makes it easier for marina operators to work at their own pace while learning about laws, regulations, and best practices.

“In Michigan, our budget for conducting in-person workshops was eliminated in 2009. By developing the Clean Marina Classroom, marinas were still able to participate in the required training to become certified Clean Marinas,” LaPorte says. “We’re also addressing the recruitment of new marina operators to get them involved with Clean Marina programs in Michigan, Ohio, and Wisconsin.”

Once the regional best practices are in place, the partners will develop some common

recruitment materials and the online training classroom to educate more marina operators, a key step in becoming certified.

By encouraging more marina operators to seek Clean Marina certification, Sea Grant leaders enable the marina industry to take the lead on adopting best practices that benefit their business, their patrons, and the environment.

“As we increase the number of certified Clean Marinas, we are taking proactive steps to ensure that marinas are not only in compliance with marina regulations, but that they are staying one step ahead,” says Sarah Orlando, Ohio Sea Grant Clean Marina Coordinator. “If more marinas participate in the program, marinas as a whole can reduce their impact on Great Lakes air and water quality, and any new regulations may not be necessary down the road.”

Another product of the Green Marina partnership will be quarterly webinars

to inform marina operators about new regulations and pollution-prevention practices. By hosting the webinars, Ohio Sea Grant is inviting marina operators from not only the Great Lakes region, but from across the nation. The technology allows anyone to attend without paying travel costs and after the session, those presentations will be available in the future.

The first webinar, held at the International Marina and Boatyard Conference (IMBC), Clean Marina Workshop in Florida, attracted many marina managers who came to learn about the latest best management practices for protecting water resources, says Vicky Harris of Wisconsin Sea Grant. **TL**

For more information about the Green Marina Education and Outreach Project, visit miseagrant.umich.edu/greenmarina.



National and regional webinars led by Ohio Sea Grant, in collaboration with Michigan and Wisconsin Sea Grant programs, will address boat maintenance best practices to protect water quality.

How's the Lake Doing?

New research project examines the relationship between upstream land use, public policy, and Lake Erie water quality

by Christina Dierkes, Ohio Sea Grant Communications



Ohio Office of Redevelopment

If you live on the shores of Lake Erie or any other body of water, you probably think about that environment's health and how it can be improved or protected. But did you know that land management practices 50 or 100 miles away can still have an influence on the lake you see from your window? For example, land use and management near the Ohio-Indiana border, in the western reaches of the Maumee River watershed, can have an effect on the ecosystem of Maumee Bay halfway across the state.

Researchers at Ohio State University and Case Western Reserve University have received funding from the National Science Foundation for a four-year project to examine how practices in the watershed affect water quality in Lake Erie, and how people's perceptions of the lake influence those practices. They hope to develop decision-making models that would help

policy makers and watershed managers understand how guidelines and regulations are formed, and identify practices that both make sense for upstream activities and can improve the downstream ecosystem.

"Not many people have looked at different populations within a watershed and what drives some of their decisions about land use," says Dr. Jay Martin, Associate Professor of Ecological Engineering in Ohio State's Department of Food, Agricultural & Biological Engineering. "By knowing what guides people's behavior in these different settings within the watershed, we can start to make necessary changes."

The final models developed through this project will also include climate change scenarios as a possible variable. This will allow researchers to examine how public policy and environmental conditions are likely to change under different levels of

global warming, and whether desired changes in land management practices need to be approached in a different way based on probable future climates.

"Most people don't realize this, but even if we reduced our carbon emissions tomorrow, climate change is still going to occur because of the buildup of carbon in the atmosphere," explains Dr. Erik Nisbet, Assistant Professor of Communication at Ohio State. "So we know the climate is changing, but how do we as a society adapt to climate change to mitigate its impact on the ecological system? By changing human behaviors and better managing what we contribute to the problem, maybe we can help deal with or at least dampen how badly climate change may impact water quality in Lake Erie."

Nutrient and sediment runoff from agriculture and other land uses plays a big role in the health of Lake Erie, causing

harmful algal blooms, reducing water clarity, and reducing fish populations. With a changing climate, Ohio and the entire Great Lakes region is expected to get heavier rainfalls and stronger thunderstorms, which will wash more nutrients and sediments from upstream areas downstream into Lake Erie. This increased runoff is likely to cause an increase in harmful algal blooms that thrive on the phosphorus delivered to the lake from rivers.

The project begins with the development of a decision-making model for public policy makers, watershed managers, and the general public to determine how the perceived condition of Lake Erie influences land management practices, and whether there are differences of perception based on factors like a person's distance from the lake.

"We're trying to understand what issues are relevant or what issues are perceived as relevant in the watershed," Martin says. "Is it the agricultural practices that people perceive as impacting Lake Erie, is it the more urban practices like fertilizing lawns, are they worried about climate change, those kinds of things."

During focus groups, the researchers will interview different groups of people living within the Maumee Bay watershed, comparing agricultural and urban populations as well as populations close to and farther away from the lake. Findings from these groups will be combined with results from workshops with scientific experts and interviews with government officials and watershed managers, and a general population survey, led by Dr. Eric Toman, Assistant Professor in the School of Environment & Natural Resources at Ohio State.

"We're going to try to get a good feel for what is driving people's decisions, what drives how regulations are made, and what drives how actual decisions are made by people like you and me," Martin says. "And then hopefully we'll be able to develop a model that predicts 'when these sets of conditions are in place, this is how people respond to those.'"



The Maumee River watershed is the largest watershed in the Great Lakes region. It has been designated an Area of Concern by the U.S. EPA, as multiple sources of pollution affect the health of the river and Lake Erie.

The next research step will apply similar methods, but focus specifically on farmers within the watershed, their agricultural practices, and what influences their land management decisions.

"The fundamental goal here is to understand farmer behavior," says Dr. Stuart Ludsin, Assistant Professor in the Department of Evolution, Ecology & Organismal Biology at Ohio State. "And then as we begin to have that information, we can build models that can be used to predict future farmer behavior as climate and the economy change."

In agricultural settings, phosphorus (the main nutrient involved in Lake Erie's harmful algal blooms) is either added as fertilizer to rowcrops like corn, tobacco, and potatoes, or tied up with manure from livestock operations. It also tends to bind to sediment particles, so much of the phosphorus that initially enters Lake Erie through upstream runoff is contained in sediment. However, under certain conditions like changes in water temperature or pH, that bound phosphorus can detach from the sediment and become available to organisms that feed on it.

"The algae can't grow on phosphorus that's attached to sediments, but the attached



Buffer strips—areas of natural vegetation between agricultural fields and neighboring streams—can help filter nutrients and sediment from runoff before it enters the stream or river.

phosphorus can become soluble depending on water conditions," explains Martin. "It's the available phosphorus that can drive harmful algal blooms." Exact conditions under which this conversion takes place are still under research, so in the meantime, limiting the amount of phosphorus entering the lake is the best way to reduce and prevent harmful algal blooms.

Once the social interactions within the watershed are clarified, the researchers will develop land use models, based both on traditional methods that consider past developments and on new models based

on people's behaviors. They will also add hydrological models—essentially how water flows in the Maumee Bay watershed—developed by Carlo DeMarchi, Senior Research Associate in the Department of Geological Sciences at Case Western Reserve University.

“A lot of this part of the project is more foundational, but we're combining it with new knowledge from our research up to that point,” Martin explains. “Then we have a model where we can look at what's happening on the social side to guide people's behavior, and we can link it with existing models to predict the impact on western Lake Erie. That should be really relevant to answering questions about improving the water quality of western Lake Erie and maintaining the ecosystem services that a lot of people there depend on.”

Lastly, the researchers will incorporate climate change scenarios into the previously created models to estimate the effects of warmer temperatures and increased rainfall on Lake Erie, agricultural practices, and people's perceptions of the health of the lake, as well as how behaviors may change as the region's climate is affected by global changes.

“We're really trying to understand how climate change is going to impact the local system, both ecological and social,” says Nisbet. “A lot of times global climate change is presented as very abstract, as something happening to people in other regions, but in this case we're looking at the localization. We need to understand the local impacts of climate change and communicate to people what those local impacts will be, how it might actually impact their daily lives.”

Other Ohio State researchers involved in this four-year project include Dr. Robyn Wilson, Assistant Professor in the School of Environment & Natural Resources; and Dr. Elena Irwin and Dr. Brian Roe, Professors of Agricultural, Environmental & Development Economics.^{TL}

To learn more about this project, visit ohioseagrant.osu.edu/maumeebay or contact Dr. Martin at martin.1130@osu.edu.



Agricultural practices are one way in which people can affect the watershed and Lake Erie. Flooding due to increased rainfall can wash fertilizers off fields and into streams and rivers, contributing to a higher nutrient load in the lake.

Sea Grant Funds New Project on Impact of Climate Change on Lake Erie *Microcystis* and Public Health

Dr. Martin's work is expanding to include considerations of ecosystem services and public health through collaboration with Dr. Tim Buckley of Ohio State's College of Public Health. They are working on a Sea Grant-funded project to model the public health impacts of *Microcystis*, a type of blue-green algae, in light of a changing climate and new developments in land use in the Maumee River watershed.

Once complete, the models will link algal growth with river discharge (the flow of water from rivers into Lake Erie), people's exposure to *Microcystis* toxin from drinking water and fish drawn from the lake, and the associated health risks. The models will also forecast how increased rainfall predicted under climate change scenarios, along with increased nutrient runoff due to changing land use, will impact the public's exposure to microcystin, the toxin produced by this particular blue-green alga.

“The ecological condition of Lake Erie and the health of the 2.8 million Ohio residents that live along its coast are inextricably linked,” explains Buckley, Associate Professor and Chair of the college's Division of Environmental Health Sciences. “As the ecological condition of Lake Erie is fundamentally harmed by human impacts—including climate change, agriculture, and urban run-off—so is the health of our communities. This project will allow us to evaluate the nature and extent of this harm to better protect this invaluable resource and the public's health.”

Dr. Stuart Ludsin of Ohio State's Department of Evolution, Ecology & Organismal Biology and Dr. Carlo DeMarchi of Case Western Reserve University's Department of Geological Sciences are also key collaborators on this multi-disciplinary project.

STONE LABORATORY

2012 SUMMER COURSES

Introductory Courses for All Majors

Open to college and advanced high school students.

1-week courses, 2 semester hours

- **ENR 2360: Ecology and Conservation of Birds** (June 10 – 16)
- **EDUPAES 1140.05: Lake Erie Sport Fishing** (June 10 – 16)
- **EEOB 1930: Introduction to Biological Studies – Aquatic Biology** (June 10 – 16, July 22 – 28, or July 29 – August 4)
- **EARTHSC 1107: Field-Based Introduction to Oceanography** (July 22 – 28)
- **EEOB 1910: Introduction to Biological Studies – Local Plants** (July 29 – August 4)
- **ENTMLGY 1260: Introductory Insect Field Biology** (July 29 – August 4)

Upper-Level Courses

Open to college students who are studying biological sciences, education, and natural resources, as well as to science teachers. See website for courses that may be taken for graduate credit.

1-day course, .5 semester hour

- **EEOB 5970: Larval Fish Identification Workshop** (June 24)

2-day course, .5 semester hour

- **EEOB 5950: Algae Identification Workshop** (August 6 – 7)

1-week courses, 2 semester hours

- **EEOB 5910: Field Herpetology** (June 10 – 16)
- **EEOB 5210: Spider Biology** (June 10 – 16)
- **EEOB 4950: Field Ecology** (July 22 – 28)
- **ENR 5194: Climate and Sustainability** (July 29 – August 4)

5-week courses, 4 semester hours (June 17 – July 21)

- **EEOB 5930: Ichthyology**
- **EEOB 5940: Field Zoology**
- **EEOB 3410: Ecology**
- **EEOB 3310: Evolution**
- **EEOB 5420: Ecology of Inland Waters**
- **ENR 5699: Current Topics in Environment and Engineering**, 1 credit (Four Thursday evening seminars)

Course credits are based on the Ohio State University semester credit system and are transferable to most colleges and universities.

Non-Credit Workshops

Open to the public and college students as non-credit courses. Participants must be at least 18 years of age.

- **Algae Identification Workshop** (August 6 – 7)
- **Dealing With Cyanobacteria, Algal Toxins and Taste & Odor Compounds** (August 9 – 10)
- **Outdoor Photography Workshop** (August 10 – 12)
- **Lake Erie Sport Fishing Workshop** (August 10 – 12)
- **Fish-Sampling Techniques Workshop** (September 15 – 16)

Science Courses for Educators

Classes are open to classroom teachers, non-formal educators, and education majors with a junior rank or above by summer 2012.

1-week courses, 2 semester hours

- **EARTHSC 5189.05: Geologic Setting of Lake Erie** (June 16 – 22)
- **ENR 5690: Climate Change Education** (July 22 – 28)
- **EEOB 4950: Field Ecology** (July 22 – 28)
- **EARTHSC 5584: Principles of Oceanography for Educators** (July 29 – August 4)
- **ENR 5194: Climate and Sustainability** (July 29 – August 4)

REU Program

Live the life of a professional researcher this summer! In Stone Lab's Research Experience for Undergraduates Scholarship Program, students spend five weeks working alongside top scientists to learn how to conduct in-the-field research. This year students will lead the following projects:

- **Reproductive biology and early life history of fishes (Ichthyology)**
- **Survival rates of birds of the Lake Erie islands (Ornithology)**
- **Dissolved oxygen in Lake Erie; tracking the "dead zone" (Limnology)**
- **Nutrient loading (Eutrophication) and algal production (Limnology)**
- **Fisheries techniques; research and fish survey development**
- **Efficiency of developed snake deterrents (Herpetology)**
- **Biological curation; phylogeny and taxonomy**

Tuition Assistance and Jobs

All students taking for-credit courses are eligible for scholarship funds, which typically range from \$100 to \$2,500. Students enrolled in five-week courses can also apply for Stone Lab's part-time positions or find jobs at local Put-in-Bay businesses.

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

For applications, go to stonelab.osu.edu or call 614.292.8949

Friends Of Stone Laboratory

Dear friends,

Dear Friends,

Happy New Year! It is hard to believe that it is 2012 already. This year plans to be an exciting one for Stone Laboratory. We are anticipating the largest student enrollment with increasing numbers of Research Experience for Undergraduate (REU) students. Renovations and updates to the research building will enhance student experiences during workshops and courses. We are planning many education and outreach activities to improve scientific understanding in the Great Lakes region and to promote the laboratory. 2012 will be busy and better than ever!

Of course, student scholarships, laboratory improvements, and education, research, and outreach efforts would not be possible without your continued support through service, donations, and promotion. We need your help now more than ever. This year, we will strive to increase the John L. Crites Research Endowment to allow Stone Lab to provide more scholarships for REU students. For each donation at or above \$250 to the Crites Research Endowment, you will receive a pen and ink drawing that depicts your favorite Stone Laboratory building. We as FOSL Friends can support quality education opportunities for the next generation of Great Lakes scientists and stewards.

I would like to invite you to be one of the first FOSL Friends to see the renovations at the lab by attending the Spring Work Weekend in April. Your presence and service is essential to Stone Lab's outreach efforts.

Keep in touch with us throughout the year with our FOSL Friends Facebook page or by visiting the Stone Lab website for information and updates at stonelab.osu.edu. Thank you for your continued support of Stone Lab through promotion, donations, and service. I look forward to seeing you at our 2012 events!

Sincerely,

Tracey Meilander
FOSL President

broaderimpacts@yahoo.com

Changes at the Lab

The fall of 2011 saw many changes at Stone Laboratory. The retirement of John Hageman left the lab with a major void to be filled.

Fortunately, our very own Kristin Stanford, aka the Island Snake Lady, filled that vacancy. The new year also saw the transferring of Eugene Braig, Stone Lab Assistant Director, to the Ohio State School of Environment & Natural Resources. Once again, Stone Lab filled that vacancy with another familiar face, Dr. Chris Winslow. Chris has been a researcher and instructor at Stone Lab for several years, as well as an instructor at Bowling Green State University and Kutztown University of Pennsylvania. **FOSL**



Dr. Chris Winslow

Island Happenings

Stone Lab hosted a couple of local island events at the South Bass Island Lighthouse in December. The second annual Christmas Bazaar and Open House on December 6 saw 22 local vendors and artists set up tables throughout the South Bass Island Lighthouse and porches to display their wares. More than 200 people attended and



used the opportunity to supplement their Christmas shopping lists. FOSL and the Lake Erie Island Chapter of the Black Swamp Conservancy (LEIC-BSC) jointly sponsored the event. Thank you to Kelly Dress and Kristin Stanford for helping organize, decorate, and arrange for refreshments for the bazaar. The LEIC-BSC also held their annual potluck dinner at the lighthouse on December 13. Stone Lab welcomes the opportunity to work with the local community in ways that benefit everyone involved. **FOSL**

Spring Work Weekend

Join us April 20 – 22 for the Spring Work Weekend to help open Stone Lab for the summer season. There will be jobs for everyone, including brush removal and various outdoor activities, moving equipment and furniture into our newly renovated classroom building, and plenty of cleaning, organizing, and painting. Meet up with former classmates, share old stories from your time on the island, and make new memories. This event is one more opportunity to lend your support for the education and research that takes place at the lab and we usually manage to have some fun. **FOSL**

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

FOSL BOARD OF DIRECTORS

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Arleen Pineda, Program Coordinator (pineda.2@osu.edu)
Kelly Dress, Business Office Manager (dress.3@osu.edu)

Dates to Remember

April 20 – 22, 2012 Spring Work Weekend
May 5, 2012 Ohio Academy of Science State Science Day (Judges needed)
September 7 – 9, 2012 Stone Lab Open House/FOSL Members Annual Meeting

Stone Lab Renovations

There have been many major renovations taking place this fall to lab buildings on both Gibraltar and South Bass islands. Roofs were replaced and/or repaired on several of the buildings. The ichthyology and limnology labs on the first floor of the Stone Lab building are in the process of being totally renovated: new floors, ceilings, utilities, cabinets, and lab tables. The research building on South Bass also has had most of the first floor renovated. Removal of the concrete floor allowed for installation of new drainage systems, utilities, and a uniform working surface. The remodeled work spaces will be modular so that

future research needs can be accommodated easily. Repairs to the research building's roof and the broken chimney maintain the historic appearance in addition to fixing the serious safety issues posed by the chimney. Several of the trees on Gibraltar had to be taken down due to potential safety issues. Amazingly, some of the trees that appeared relatively healthy from the outside were badly decayed from within and represented a hazard in a strong wind. Lab Manager Matt Thomas spoke about the highlights of many of these projects at the Winter Program on January 24. **FOSL**





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Crop Yields

If climate change continues as predicted, corn and soybean yields in Great Lake states like Ohio and Indiana could decrease 20-30% by 2049 and 40-80% by 2090.

Ecosystems >

About Us

The OSU Climate Change Outreach Team is a partnership among multiple departments within The Ohio State University. The team's goal is to help localize the climate change issue by bringing related research and resources to residents of Ohio and the Great Lakes region.

More About Us >

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31 JAN Business and Climate Change: Are Sustainability Efforts Enough?

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Kevin Leahy, Duke Energy

15 FEB Fracking & Climate Change
Timothy Considine, University of Wyoming

13 MAR Invasive Species & Climate Change
Cindy Kolar, U.S. Geological Survey

Featured Presentations

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