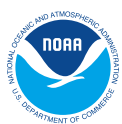


*Office of Research
Annual Report*

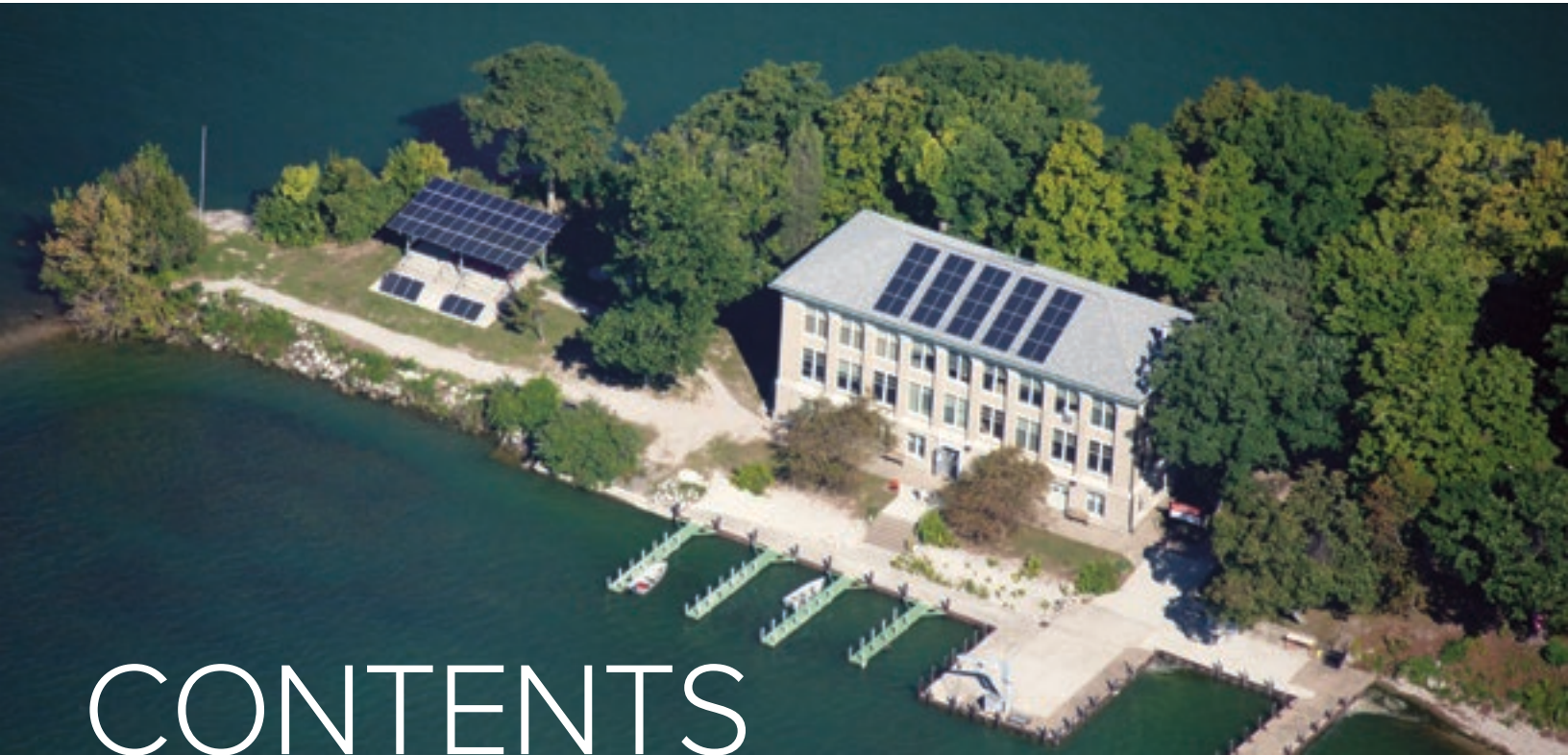
July 2017–June 2018



CENTER FOR LAKE ERIE AREA RESEARCH



INCLUDING **OHIO SEA GRANT** COLLEGE PROGRAM AND **STONE LABORATORY**



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OHIO SEA GRANT

In the Last Five Years

Sparks **\$2 Million** annually in charter captain industry profit

Restored **2,181 acres** of degraded ecosystems worth more than **\$12 Million**

\$1 Federal support = **\$3** State support

\$13 in economic benefit to local communities for every federal dollar invested

\$15.6 Million averaged annually in economic impacts

125,000 K-12, college and adult students learned about Lake Erie through Stone Lab programs

400 TEACHERS educated each year, bringing Stone Lab science into their classroom

Supports the **\$14.1 Billion Lake Erie tourism industry**
EMPLOYING 123,880 PEOPLE

227 agency and industry personnel trained to identify harmful algal blooms and treat their toxins

40,000 professionals educated and trained to help them advance their careers or keep their jobs

On average annually **76 businesses retained**
17 jobs created
387 JOBS RETAINED

161 COMMUNITIES empowered through training and tools to protect themselves from storm floods and other coastal hazards

Mobilized **9,171 HOURS** of volunteer time valued at \$210,933

175 Partners dedicated to help expand Ohio Sea Grant's impact in Ohio



Center for Lake Erie Area Research

Lake Erie has been called the most important lake in the world. It is the southernmost, shallowest, warmest, and most biologically productive of the Great Lakes, producing more fish for human consumption than the other four lakes combined. Additionally, 11 million people rely on it for their drinking water every day. Unfortunately, Lake Erie also faces a number of challenges that the Center for Lake Erie Area Research (CLEAR), which includes the Ohio Sea Grant College Program and Stone Laboratory, and its partners are working to address (e.g., harmful algal blooms, nutrient loading, invasive species, coastal economic development, coastal resilience, etc.).

Since occupying Gibraltar and South Bass Islands in the early 1920s, and in the 40 years since the National Oceanic and Atmospheric Administration (NOAA) awarded The Ohio State University as the Ohio Sea Grant College Program, CLEAR staff and partners have worked to rejuvenate Lake Erie and the regional economy. With a unique combination of research, education and outreach efforts, CLEAR has become a program of action, working with various stakeholders to solve the lake's most pressing environmental and economic issues and to answer basic biological questions about the ecological functioning of the ecosystem.

This integration of research, education, and outreach has positioned CLEAR to investigate pressing issues and share solutions with those likely to shape the lake's future. Research alone seldom solves problems, but when it is translated and delivered through innovative tools and training, new opportunities arise. Through its affiliation with both the university's Office of Research (OR) and the College of Food, Agricultural, and Environmental Sciences (CFAES), CLEAR has access to leading scientists and educators across the state and the Great Lakes region enabling the program to share research findings with decision-makers, citizens, business owners, and future leaders.



Unique Aspects of CLEAR

STONE LABORATORY: Located on Lake Erie's Gibraltar and South Bass Islands, the lab is the research, education, and outreach hub of CLEAR. Stone Lab offers >20 college courses each summer. These courses are designed for college undergraduate and graduate students, educators, and superior high school students. Since 2000, Stone Lab students have come from >90 different colleges and universities and >300 high schools. CLEAR manages 15 buildings on ~15 acres across South Bass and Gibraltar Islands; including Jay Cooke's Castle (a National Historic Landmark), the historic South Bass Island Lighthouse, and the historic Put-in-Bay Fish Hatchery, which functions as an Aquatic Visitors Center attracting over 12,000 visitors annually.

At Stone Lab, CLEAR maintains and operates its own fleet of research vessels (43' R/V Gibraltar III, 37' R/V Biolab, 27' R/V Erie Monitor, and 27' R/V GS-3), a recently renovated Research Building with state-of-the-art water quality lab, a Dining Hall, housing facilities, classrooms, and a Lecture Hall. This asset portfolio allows CLEAR to respond immediately to emerging Lake Erie issues and opportunities. CLEAR uses these facilities to annually offer special workshops and programs for the State Legislature, the Ohio Congressional Delegation, Coastal County Commissioners and Mayors, science writers, charter captains, coastal property owners, the farming community, water treatment plant operators, and students grades 5 through adult.

OHIO SEA GRANT COLLEGE PROGRAM:

In the late 1800s the United States government issued funding to states to establish a network of universities with a focus on agriculture, science, and engineering to enhance the nation's ability to produce food, develop the interior of the country, and expand our engineering and science capabilities. These universities are known as land-grant colleges. The Ohio State University is the land-grant college/host in Ohio and the program resides within CFAES.

In 1966, Congress voted to use the land-grant model to enhance utilization, development, and wise management of the country's coastal, ocean, and Great Lakes resources by forming Sea Grant Colleges. These programs are part of the National Sea Grant College Program within NOAA, U.S. Department of Commerce. As one of the 34 programs in the NOAA Sea Grant portfolio, Ohio Sea Grant utilizes a partnership of government, private sector, and academic resources

*This integration of **research, education, and outreach** has positioned CLEAR to investigate pressing issues and share solutions with those likely to shape the lake's future.*

to address environmental, economic, and educational issues through a combination of research, formal training, and informal outreach projects. Based on the program's accomplishments, impacts, and capabilities, The Ohio State University has maintained the official designation as a "Sea Grant College" since 1988.

Sea Grant is a matching funds program and requires at least \$0.50 of non-federal support/match for every federal dollar invested in the program. Matching funds for the Ohio Sea Grant College Program are currently provided by a line item in the budget of the Ohio Department of Higher Education, The Ohio State University (OR and CFAES), private businesses, individuals, and the home institutions of scientists receiving Ohio Sea Grant/NOAA funding.

Ohio Sea Grant's 40th anniversary was September 2018. Over that time the program has used NOAA funds included within a biennial omnibus budget to support >450 projects, >250 principal investigators from 32 colleges and universities, and ~500 graduate and undergraduate students. Our annual NOAA portfolio of research projects supports ~8 large grants (~\$60,000/year for up to two years) and ~8 small grants (\$10,000). Our long-standing, trusted reputation as a NOAA grant manager has resulted in CLEAR being recognized as the go-to program to manage funds for numerous granting programs for the state. Grant management at CLEAR includes (1) identifying stakeholder research priorities (i.e., needs and gaps), primarily from state and federal agencies, (2) posting calls for research proposals, (3) performing a rigorous grant review, (4) tracking grant progress and fiscal activity, and (5) communicating research results by engaging numerous stakeholders.

EXTENSION EDUCATOR IMPACT: CLEAR supports five OSU Extension educators distributed from Toledo to Conneaut and a very productive communications and IT team based in Columbus. The Extension team has specializations that meet the needs of stakeholders, including: (1) a fisheries specialist, (2) a Clean Marinas/Clean Boater Program manager, (3) a community and economic development agent, (4) a watershed management and coastal resiliency educator, and (5) an emerging contaminants and marine debris educator.



Advisory Boards and Seeking External Advice



Each Extension specialist has an external private sector advisory committee (Appendix C). Historically, we have also utilized an internal Ohio State Director's Advisory Council. Some of these committees/councils have bylaws and a regular schedule of meetings while others meet more irregularly, but at least once a year.

CLEAR has also worked hard to establish active partnerships and collaborations with the Ohio Environmental Protection Agency, Ohio Department of Natural Resources (Ohio Division of Wildlife and Office of Coastal Management), the Ohio Lake Erie Commission, Old Woman Creek National Estuarine Research Reserve, The Nature Conservancy, the Lake Erie Marine Trades Association, the International Joint Commission and many more. In addition to partners, these groups are also program stakeholders. Service on their boards and committees has given the program unique opportunities to identify and understand their priorities and to work together to address these needs. Scientists from these organizations also serve on OSG external review panels to help decide which project proposals to support.

A final way CLEAR seeks external advice is through regular evaluations and surveys conducted at outreach events and with all workshops and education programs. Because of the programs CLEAR hosts, the center has come to understand the needs and priorities of state legislators, coastal county commissioners and mayors, science writers, charter captains, water treatment plant operators, farmers and more.

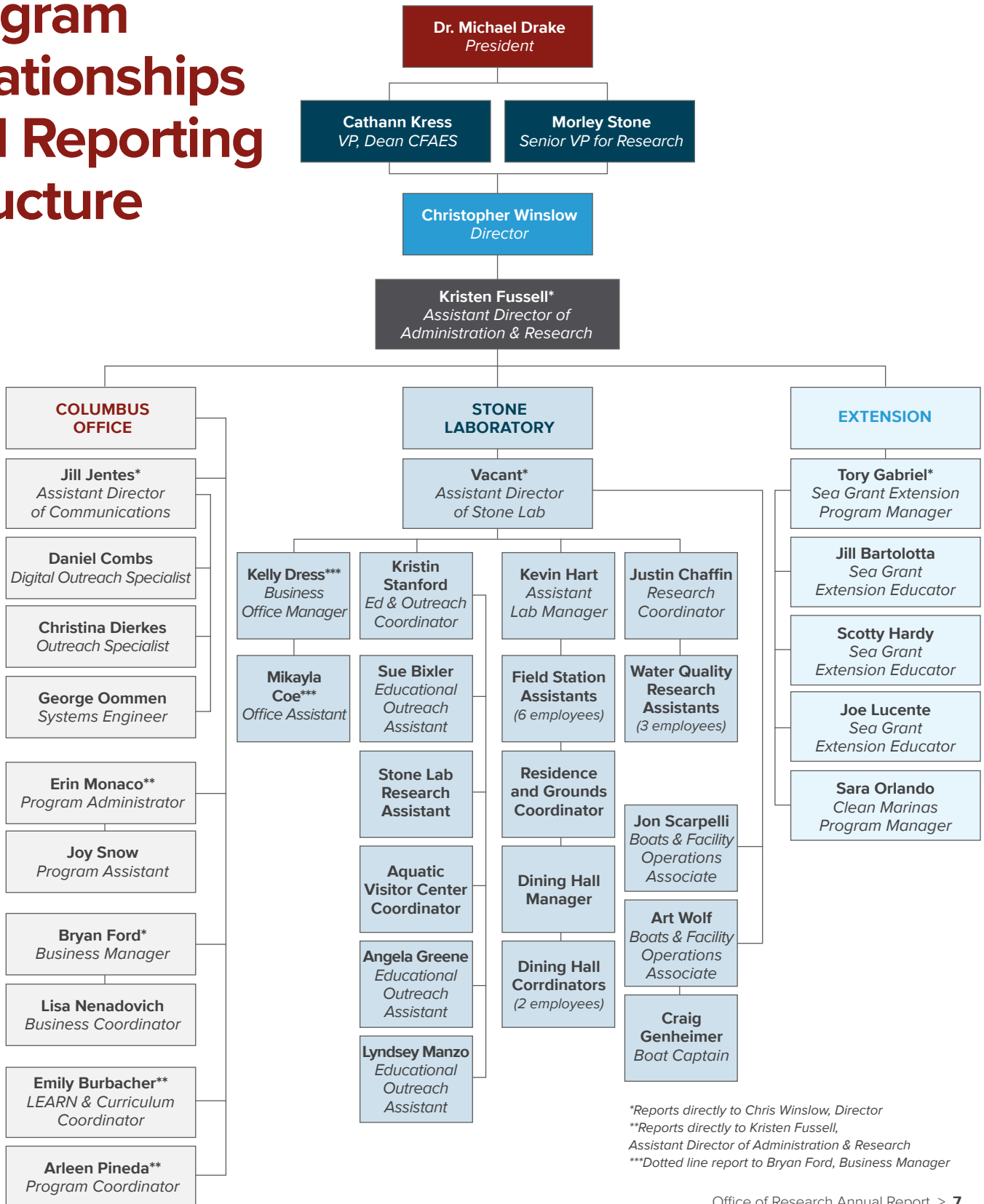
Description of Governance

Dr. Christopher J. Winslow is the director of CLEAR at The Ohio State University which includes Stone Laboratory (Lake Erie island campus and field station) and the Ohio Sea Grant College Program (NOAA- funded program). Dr. Winslow is also Executive Director of the Lake Erie Area Research Network (LEARN); an NSF-funded consortium created through a 2016 planning grant. LEARN is a network of Ohio colleges and universities whose mission is to promote collaborative inter-institutional research, education, and networking across field stations, scientific laboratories, and diverse researchers to address the challenges and opportunities facing Lake Erie. Dr. Winslow reports to two vice presidents at The Ohio State University: Dr. Morley Stone, Vice President for Research, and Dr. Cathann Kress, Vice President for Agricultural Administration and Dean of the College of Food, Agricultural, and Environmental Sciences.

*Service on our partners' boards and committees has given the program **unique opportunities to identify and understand their priorities and to work together to address these needs.***

OHIO SEA GRANT AND STONE LABORATORY

Program Relationships and Reporting Structure





Engagement and Interaction

General Description of Faculty Engagement

CENTER'S CORE FACULTY AT OHIO STATE INCLUDING BOTH DEPARTMENT AND COLLEGE AFFILIATION:

From July 2017 to June 2018 CLEAR has engaged 15 faculty members across 8 departments at Ohio State. Additionally, the center also forged 36 strong faculty ties at 13 universities across Ohio. Engagement with "core faculty" includes (1) funding multiple research projects, (2) inclusion in our grant review process, (3) teaching at Stone Lab for multiple years, and (4) membership in LEARN. Because CLEAR strives to build effective partnership outside of Ohio State, "core faculty" at other institutions are included within Appendix A. This table does not include non-faculty partners; i.e., Extension educators (e.g., Greg Labarge) and agency personnel (e.g., USGS, Ohio EPA, Ohio DNR, Ohio Department of Health, etc.).

CENTER AFFILIATED FACULTY AT OHIO STATE INCLUDING BOTH DEPARTMENT AND COLLEGE AFFILIATION:

As with core faculty, individuals at other institutions are included within Appendix A. CLEAR has engaged 10 faculty members across eight departments at Ohio State, along with 18 faculty at 10 institutions and research centers. Engagement with affiliated faculty includes (1) a funded research project and (2) teaching at Stone Lab.



Interaction with Other Research Centers

CLEAR has engaged 13 centers, institutes and discovery themes across campus during the last fiscal year. In relation to the centers listed below, that has meant one or both of the following: (1) funded researchers within these centers (2) worked with center investigators to increase the broader impacts of their research efforts. Included within this broader impact support is CLEAR's ability to communicate research findings beyond publications and presentations at local/regional/international conferences. CLEAR regularly incorporates research findings into formal lessons (aligned to state standards) and/or helps design unique courses/workshops to expose target audiences to research efforts and findings. Informally, the center also offers the option of incorporating researcher findings into numerous outreach/engagement efforts and include findings into CLEAR's website, a quarterly award-winning publication (*Twine Line*), various webinars, e-newsletters, and reports, factsheets, and displays designed for lay audiences.

Additionally, CLEAR partnered with 270 agencies, municipalities and other stakeholder organizations during the last fiscal year (Appendix B). Partners and stakeholders use the information CLEAR produces and support the work it does, and the center does the same for them. This includes service on advisory committees, assistance with fundraising, providing in-kind donations for special events and programs, assisting in developing program priorities and conducting programs, funding or co-funding projects, and much more.

CLEAR regularly incorporates research findings into formal lessons and/or helps design unique courses/workshops to expose target audiences to research efforts and findings.

RESEARCH CENTER AFFILIATIONS

Byrd Polar and Climate Research Center

Lawrence Krissek

Center for Applied Plant Sciences

Matt Davies

Comprehensive Cancer Center

Thomas Knobloch

Foods for Health Discovery Theme

Jiyoung Lee

Food and AgriCultural Transformation (InFACT)

Nicholas Basta, Jeremy Bruskotter, Jiyoung Lee, Jay Martin, Brent Sohngen

Food Innovation Center

Jiyoung Lee and Wu Lu

Infectious Disease Institute

Jiyoung Lee, have had initial discussions with Michael Oglesbee on potential future collaborations and joint funding opportunities

Ohio Agricultural Research & Development Center (OARDC)

Nicholas Basta, Jeremy Bruskotter, Matt Davies, Suzanne Gray, Brent Sohngen, Christopher Tonra, Hanping Wang, Robyn Wilson

Ohio Water Resources Center

Linda Weavers and John Lenhart

Olentangy River Wetland Research Park

Jeremy Bruskotter, Suzanne Gray, Robyn Wilson

Sustainable and Resilient Economies

Nicholas Basta, Jiyoung Lee, Jay Martin, Brent Sohngen, Linda Weavers, Robyn Wilson

The STEAM Factory

Christopher Tonra

Translational Data Analytics Institute

Jim Hood, Margaret Kalcic



Proposals Submitted, Awarded, and Projects Managed

WITH THE ENGAGEMENT AND SUPPORT OF CLEAR



Over 85% of the proposals submitted were funded (24/28) totaling \$10,564,602 in funding.

CLEAR STAFF WORK WITH GRANTS AND RESEARCH FUNDING IN A NUMBER OF WAYS:

› CLEAR staff serve as principal investigators (PIs) and actively seek external funding to create new research, education and outreach initiatives.

Proposals Submitted: CLEAR's staff PIs submitted 28 proposals during the last fiscal year for a total of \$13,767,239. Over 85% of the proposals submitted were funded (24/28) totaling \$10,564,602 in funding (Appendix D).

Awards Received: CLEAR staff (6 different principal investigators) received a total of \$6,675,405 in grant and foundation support between July 2017 and June 2018 (Appendix E). **Funded Projects:** Through research competitions, nine CLEAR staff members have 29 funded projects totaling \$2,383,003 in funding from 13 sponsors including private foundations, state agencies and institutions and federal agencies and organizations (Appendix F1).

› As a part of NOAA's National Sea Grant College Program, CLEAR conducts research competitions for large and small grants (Appendix F2). CLEAR had \$5,704,540 in NOAA Omnibus funding active between July 1, 2017 and June 30, 2018. Of that funding, \$4,035,820 is in core funding to support CLEAR's extension, management, communications and development programs. The remaining funds are large and small grant pass-through dollars funding 60 projects totaling \$1,668,720 given to 26 principal investigators at 12 institutions.

› As a result of CLEAR's ability to run research competitions to address the most pressing needs of the state, CLEAR's management of externally funded research has seen dramatic growth over the last few years and is a testament to our ability to be an unbiased scientific resource for the state and the extremely strong research management ability of Ohio State's Office of Sponsored Programs. Last fiscal year, CLEAR managed research competitions and funded projects for state and federal partners at a total of \$6,321,518 in grant dollars on behalf of 6 different state, national, and bi-national agencies resulting in an additional 59 projects awarded to 35 principal investigators at 10 institutions (Appendix F3).

Major Activities of the Center

OVERVIEW OF THE MAJOR OUTREACH, EDUCATION AND RESEARCH ACTIVITIES AND OUTCOMES OF CLEAR

For a more extensive summary of activities, refer to Appendix G

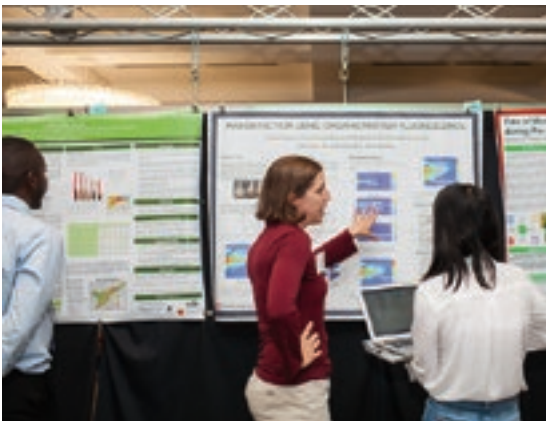
Outreach

Getting information out to the public is key to CLEAR's outreach programming. The program's five Extension educators, with offices spread across Ohio's Lake Erie counties, interact with Ohio citizens to answer their questions about Lake Erie, fishing, economic development, and marine debris through presentations, trade shows, and training workshops. In 2017 alone, 38,113 people attended public and professional presentations given by CLEAR staff. Combined with 86 new communications resources, CLEAR's outreach and engagement initiatives bring program resources to its >270 external partners (refer to Appendix C). Because research and education are only truly valuable if stakeholders receive and really use that Lake Erie information to better their livelihood and surroundings, outreach through Extension and communications initiatives are intertwined in all aspects of the program.

DELIVERING USEFUL AND UNBIASED RESEARCH INFORMATION TO THE PUBLIC:

CLEAR's stakeholders rely on the program's skill to provide science information without bias. By tapping into its extensive network of partners representing all types of environment-related organizations within Lake Erie research, education and outreach sectors—from governmental agencies to environmental non-profits to academia across the Great Lakes region—CLEAR brings together experts to deliver the most up-to-date, unbiased information to the public. Considered a go-to program for Lake Erie science, CLEAR has just in 2017 provided 688 public and professional presentations and sponsored 249 events.

NOAA HABS FORECAST: One of CLEAR's key talents is its ability to bring researchers and stakeholders together to learn from each other and to provide useful research information to their constituents. A great example of this is the NOAA Harmful Algal Bloom (HAB) Forecast, where CLEAR hosts NOAA scientists at Stone Laboratory to deliver its annual HAB prediction (how big the bloom will be and where in Lake Erie). CLEAR works with NOAA to create publications and visuals to help the general public better understand the issue and organizes HABs experts to deliver the science. Typically, researchers from ~10 government agencies and academic institutions are made available at this event to talk with industry representatives most affected by the blooms (e.g., charter captains, small businesses, tourism bureaus, farming community). In turn, the researchers learn what information these industries need to best explain HABs to their constituents so Lake Erie tourism, for example, won't be severely affected by bad information. CLEAR is the bridge that has been instrumental to getting critical information out to >20 media outlets and >300 people who attend the event's webinar.



NOAA HABS research



CLEAR ORGANIZED

249

events in 2017

STATE-OF-THE-SCIENCE CONFERENCE: CLEAR, with its CFAES Extension and USDA partners, has created an annual State of the Science Conference to bring >250 researchers, elected officials, professional resource managers and media across the region together to discuss the latest in HABs research. This one-day event is one of 249 events CLEAR organized in 2017 and has been key to getting the latest HABs research information to water treatment plants and water-related agency personnel.

SCIENCE WRITERS WORKSHOP: CLEAR hosted more than 20 science reporters at Stone Lab for an annual two-day event to learn about the latest Lake Erie research. Most topics are requested by the reporters before the event and CLEAR lines up the experts. Now in its ninth year, CLEAR has seen great results: Reporters leave the event with at least a year's worth of Lake Erie-related story ideas and CLEAR ensures that the reporters are exposed to accurate environmental information to relay to their audiences.

DECISION-MAKERS DAY: Coastal community decision-makers and government officials make important decisions every day that ultimately impact Lake Erie. Thanks to CLEAR's one-day outreach event for officials, those decision-makers can get more educated on the issues and the opportunities facing Lake Erie. In 2017, more than 50 officials got a chance to partake in hands-on activities and appreciate and understand Lake Erie's challenges and opportunities.

WORKING DIRECTLY WITH OHIO COASTAL COMMUNITIES TO HELP IDENTIFY NEEDS AND FIND SOLUTIONS:

Because each CLEAR Extension educator is part of their Lake Erie coastal community and maintains an advisory board of coastal residents, CLEAR creates its programming based on community input. In 2017, 12 Ohio communities implemented sustainable economic and environmental development practices and policies (e.g., land-use planning, working waterfronts, energy efficiency, climate change planning, smart growth measures, and green infrastructure) as a result of CLEAR's activities.

MARINE DEBRIS: Partnering with the NOAA Marine Debris Program, CLEAR and the Great Lakes Sea Grant Network (seven other Great Lakes Sea Grant Programs) have focused attention on educating coastal communities about marine debris. With marine debris making up 87% of items found at Sea Grant beach clean-ups, there was a need to educate the public to decrease their use of these single-use plastic items. In 2017, Ohio Sea Grant Extension educators partnered with the City of Cleveland Mayor's Office of Sustainability and thunder::tech to study consumer behavior around single-use plastic items. Thanks to that partnership a social media campaign was developed to educate lakeshore residents. Additionally, information gathered will inform the City of Cleveland as it assesses a potential plastic bag levy.

COASTAL STORM PLANNING: Severe storms can have devastating impacts on families, communities, property and the environment, which can be mitigated through better community planning and resilience. To help the region better prepare for severe storms, the CLEAR managed the Great Lakes Coastal Storms Grant Program, which created a \$1 million competitive grant process that Grant focused funds and resources in 15 Great Lakes coastal communities to reduce and mitigate risks from storm and weather hazards and climate change. As a result of the grants, a planning tool for adaptation and response to coastal storms for Ohio marinas, an observation forecasting and warning system for rip currents, and an evaluation of flood hazard identification tools were created.

OHIO CLEAN MARINAS PROGRAM: In 2005 CLEAR recognized that Lake Erie's marinas and boaters have a vested interest in the health of Lake Erie. As such, the program began to channel that passion to create an empowered stakeholder



Decision-Makers Day



group. Partnering with the Lake Erie Marine Trades Association and the Ohio Department of Natural Resources, CLEAR created the Ohio Clean Marinas and Clean Boater Programs in 2005, where each year boaters pledge and marinas implement a checklist of best management practices to become ‘certified’ clean boaters and marinas. With a statewide expansion in 2015, the Clean Marinas Program continues to bring more marinas into the initiative. Along with this expansion came a restructuring of the best management practices checklist to make the program more accessible to more marinas. In addition, in 2017 CLEAR and its partners created an expanded checklist of BMPs to include new practices based on best available science and enhance focus on priority areas such as nutrient runoff, habitat, and community engagement. By establishing a partnership with Mondo, Inc., a plastics recycling company, CLEAR has helped recycle nearly 2.3 million pounds of boat shrink-wrap that would have otherwise gone to landfills. Instead, this recycled material is turned into plastic guardrail blocks that help protect more than 200 miles of Ohio highways.

PROVIDING WORKFORCE TRAINING TO OHIO’S PROFESSIONALS: In addition to the >20 Stone Lab courses open to resource managers, CLEAR also helps its coastal communities through in-person training, workshops and e-learning programs. In 2017 alone, 329 resource managers used ecosystem-based approaches in the management of land, water, and living resources; 4 individuals were HACCP-certified; and 3,156 fishermen, seafood processors and aquaculture industry personnel modified their practices using knowledge gained in fisheries sustainability and seafood safety as a result of CLEAR activities.

CHARTER CAPTAINS CONFERENCE: With almost 700 captains and an estimated \$9.7 million in revenue in 2010, Ohio boasts the largest charter fishing fleet on the Great Lakes. Recognizing the importance of this industry, for more than 30 years, CLEAR has organized the annual Ohio Charter Captains Conference to support this local economy while enhancing stewardship of the lake. Topics at the one-day conference include environmental issues, marketing, business tips, marine laws, and a session on new regulations. Year-to-year, training needs are identified by surveying attendees. Partners include the Ohio Department of Natural Resources-Division of Wildlife, the Lake Erie Charter Boat Association, the U.S. Coast Guard, and U.S. Customs and Border Protection. Now in its 36th year and annually reaching 20-25% of licensed captains with 93% saying their operations improved based on knowledge gained, the Ohio Charter Captains Conference helps Lake Erie charter businesses be more successful through training in business management, regulatory requirements, and environmental issues.

GOVERNMENT LEADERSHIP ACADEMY: Good government is the goal of the Local Government Leadership Academy in Toledo. Developed by CLEAR, the program partners with OSU Community Development, the County Commissioners Association of Ohio, the Ohio Township Trustee Association, and the Toledo Area Chamber of Commerce to put together this 10-week course that helps elected officials improve their leadership and negotiation skills and relevant Ohio knowledge to become better community leaders. Nearly 400 people have participated since 2002, when the academy graduated its first class, including mayors, State Senators, and State Representatives. CLEAR has assisted many other Ohio counties in developing similar programs.



Ohio boasts the largest fishing charter fishing fleet on the Great Lakes with

\$9.7 MILLION



IN REVENUE IN 2010



The Tourism Leadership Academy has

186
GRADUATES

TOURISM LEADERSHIP ACADEMY: Tourism is a \$15 billion industry along Lake Erie, making it a top economic driver in coastal communities and roughly a third of the state's tourism economy. Travel industry leaders, along the coast and statewide, influence policy decisions and make strategic decisions to foster growth, protect resources, and lead change. Yet, industry members cited lack of confidence and access to information as a reason why they did not participate in leadership opportunities. CLEAR partnered with the Ohio Travel Association (representing >500 hotels, restaurants, attractions, museums, etc.) on a leadership program for emerging and new tourism leaders. Sessions focus on tourism's relationships and responsibilities with the arts, humanities, economic development, media, natural resources, heritage, and policy. Now with 186 graduates, the academy is shaping the future of tourism in Ohio, as 85% of graduates campaign for leadership positions within three years of graduation.

GREAT LAKES CLEAN MARINAS CONFERENCE: When the Ohio Clean Marinas Program learned in 2016 that the marina industry in Ohio needed training on such things as regulatory updates, boater education and new technology, Ohio Clean Marinas staff developed a marina conference to provide in-person marina and industry training for certified Clean Marinas and interested personnel. The first conference was held in 2017 with 75% of the 50 attendees receiving information at the event that will help them keep their business going or advance professionally.

ELEARNING PROGRAM: As stakeholders continue to require information faster and through convenient media (smartphones, tablets, etc.) there was a need for swift and cost-effective dissemination of real-time Great Lakes research and outreach information to coastal stakeholders beyond what we could accomplish with in-person conferences and training workshops. Beginning in 2009, CLEAR developed an eLearning program that allows researchers and educators to deliver education and training to environmental professionals across the Great Lakes region and around the world through various webinar programs. CLEAR provides one- and two-hour educational sessions to environmental professionals in numerous specialties. More than 79,000 people have attended or accessed these education and training webinars offered by CLEAR's eLearning program, with nearly 500 subscribing in 2017.

Education

CLEAR's major initiatives within the formal education space primarily revolve around Stone Lab's (1) formal courses and workshops, (2) spring and fall workshop program, (3) summer operation of the island's Aquatic Visitors Center, and (4) efforts to subsidize the cost of these opportunities.

STONE LAB COURSES: The goal of college courses and workshops offered at CLEAR's Stone Laboratory is to provide individuals interested in aquatic sciences access to cutting-edge curriculum and exposure to researchers conducting research projects relevant to the Great Lakes Region. CLEAR programming can address the national STEM needs of advanced high school students, undergraduate and graduate students and K-12 teachers. Additionally, CLEAR provides needed professional development for agency and municipal employees. Annually, CLEAR offers ~20 college-credit courses and workshops for college students and aquatic science professionals that provide professional development and resume-building opportunities. A recent survey sent to 1,516 students that took courses and workshops at Stone Lab since 2012 highlight the success of the program. Of the 299 individuals that responded to the survey, 79 graduated and were employed in a career related to their degree within two years of graduation (STEM job, MS or PhD programs, postdoctoral work, or professional school).



Stone Lab Courses

STONE LAB FIELD TRIP PROGRAM:

Since 1973, Stone Laboratory has provided hands-on science learning opportunities for middle and high school students across Ohio and beyond that may be unavailable to them in a traditional classroom setting. Stone Lab offers students the chance to be a scientist for a day, participating in activities such as fish trawling and seining, fish identification and dissection, plankton identification, water quality monitoring and much more to show them real-world science applications outside the classroom. Annually, the lab's hands-on outdoor field trip program provides opportunities for >80 groups of middle and high school students (>2,200). These participants gain both awareness and understanding of Lake Erie's natural, cultural, environmental and economic importance to Ohio and the U.S. through this interactive learning opportunity. CLEAR not only strives to meet the required state science standards for these groups but also works to stimulate a future interest in science and instill a lifetime stewardship ethic for the Lake Erie ecosystem.

AQUATIC VISITORS CENTER: The Lake Erie island region, specifically South Bass Island, is a flourishing summer travel hot spot within Ohio, attracting more than 10,000 daily tourists. Through a partnership with the Ohio Department of Natural Resources Division of Wildlife, CLEAR has expanded programming at the Aquatic Visitors Center (AVC) in Put-in-Bay, Ohio. The AVC provides a free hands-on fishing experience for children under 16 and free tours of the facility highlighting information on the historic fish hatchery, Lake Erie fishes and food webs, aquatic invasive species, sustainable sport fishing practices, and other issues facing Lake Erie. Annually, >12,000 visitors experience these offerings, viewing native fish, invertebrates and microscopic organisms found in Lake Erie's western basin.

CLEAR INCREASES EDUCATIONAL OPPORTUNITIES THROUGH DONATIONS, ENDOWMENTS AND FOUNDATION SUPPORT:

Research shows a declining state of STEM education in the United States and Ohio. At the same time, hands-on science experiences have the potential to increase a student's passion for careers in STEM fields. Courses and workshops offered at CLEAR's Stone Lab provide these hands-on experiences, but unfortunately, these opportunities require students to pay for room and meal in addition to tuition and workshop fees. Therefore, any mechanism that decreases this financial burden to students will increase the probability of higher



Stone Lab Field Trip Program

enrollment and ultimately exposure to hands-on STEM coursework. The Friends of Stone Laboratory (FOSL), a nonprofit group founded with the help of CLEAR in 1982, continues to fund >20 endowments to support CLEAR's research, education and outreach efforts with scholarships, equipment purchases, and much more. Annually, the program's endowment portfolio awards >70 tuition scholarships and ~8 Research Experience for Undergraduates (REU) scholarships valued at >\$70,000. Since FOSL was created, it has awarded >1,700 scholarships, fellowships and REUs to students who may not have been able to attend summer classes otherwise. From 2000-2017, CLEAR has awarded 424 scholarships to college students and teachers, and 392 to high school students totaling \$442,753. Within that same timeframe, CLEAR supported 132 REUs with a total value of \$456,815.

Since its inception in the mid-1970s, more than 100,000 students have participated in Stone Laboratory's science field trip program. However, this program comes with a cost that many school districts cannot afford and many families struggle to cover this educational expense for their child. With more than \$75,000 in total funding from both the Andrew's Foundation and the Toledo Community Foundation's First Solar Fund foundation support, CLEAR has been able to offer 19 hands-on environmental and scientific learning field trips to Stone Laboratory to 17 different underserved schools reaching over 700 Ohio students. Field trip students participated in a hands-on scientific research cruise aboard a Lake Erie research vessel, collecting environmental and biological data and doing the hands-on work of a scientist. Program participants gained both awareness and understanding of Lake Erie's natural, cultural, environmental, and economic importance to Ohio and to the United States through this unique learning opportunity. Clearly, these funds have provided opportunities for a life-changing experience to students who could not otherwise attend.



During the summer

10,000

tourists visit

AQUATIC VISITORS CENTER





Research

CLEAR works with grants and research funding in four distinct ways: (1) our staff principal investigators (PIs) actively seek external funding to create new research, education and outreach initiatives (Appendices D, E, and F1), (2) PIs and students from many institutions use our Stone Laboratory vessels and facilities for a wide-range of Lake Erie and Great Lakes research, (3) we manage our National Oceanic and Atmospheric Administration (NOAA) Sea Grant-funded research competitions as a part of the National Sea Grant College Program (Appendix F2), and (4) we manage research competitions and fund projects for other state and federal partners (Appendix F3).



After an intensive 10-year effort, the Lake Erie Watersnake became the

23RD

SPECIES REMOVED

*from the list
of federally
threatened species*

CLEAR STAFF AS PRINCIPAL INVESTIGATORS:

CLEAR has two staff scientists located at Stone Laboratory. Dr. Kristin Stanford is a herpetologist and focuses most of her research on understanding the population dynamics of the de-listed federally threatened Lake Erie Watersnake. Dr. Justin Chaffin both coordinates our research program at Stone Laboratory and is leading research in the area of harmful algal bloom (HAB) ecology and toxicity. Lake Erie Watersnake Research and Monitoring: Dr. Kristin Stanford and other CLEAR-supported research partners continue to monitor the population of the endemic Lake Erie Watersnake and conduct an intensive outreach campaign, reaching over 9,000

individuals in 2017, which educates local residents, transient boaters and tourists about the need to conserve the species. After an intensive 10-year effort, the Lake Erie Watersnake became the 23rd species removed from the list of federally threatened species in 2011. The snakes have a limited distribution and a threatened status in Ohio, making post-delisting monitoring and outreach an important component of its continued conservation. In 2017, population monitoring, which processed more than 2,000 snakes on 5 islands, focused on assessing the presence of a newly emerging threat, Snake Fungal Disease (*Ophidiomyces ophiodiicola*). 393 snakes were assessed, and findings indicated that 75.4 percent of Lake Erie Watersnakes may be harboring this fungus. Other monitoring included analysis of diet samples, showing round gobies, a very prevalent invasive species, as the dominant prey item of the Lake Erie Watersnake and stable reproduction – 56 females produced 1,327 live offspring that were tagged and released for future first-year survival estimation.

HARMFUL ALGAL BLOOM RESEARCH, MONITORING AND TOXICITY FORECAST:

Dr. Justin Chaffin's research focuses on cyanobacterial HABs in Lake Erie and the environmental factors that promote bloom growth and toxicity. One of his current research projects aims to develop a forecast for Lake Erie cyanobacterial bloom toxicity and incorporate that forecast into the NOAA Lake Erie HAB Bulletin. A toxicity forecast will help water treatment plants better prepare to remove the toxins and produce safe drinking water. This project is funded by the ECOHAB program of NOAA's National Centers for Coastal Ocean Science. Chaffin's other projects include understanding the prevalence and environmental factors that promote saxitoxin (a lesser known cyanotoxin) production by bottom-dwelling and open-water cyanobacteria, investigations of Lake Erie central basin cyanobacterial blooms, and developing criteria for water quality impairment. Both of these projects are funded by the Ohio Department of Higher Education (ODHE). Stone Laboratory serves as the nutrient analysis core facility for the National Institutes of Health and National Science Foundation-funded Lake Erie Center for Fresh Waters and Human Health, led by Bowling Green State University. Recently completed projects studied the interaction between nitrogen and light intensity in bloom toxicity, the effectiveness of data buoys to track cyanobacterial blooms, nitrogen cycling in Sandusky Bay, and internal loading of phosphorus



Lake Erie Watersnakes



Water quality research lab

in western Lake Erie. Dr. Chaffin also coordinates a citizen scientist Lake Erie water quality monitoring program in which charter boat captains collect data and water samples once a week. This program not only increases the spatial coverage of water samples taken, but also serves as an opportunity for the charter captains to educate their clients about the importance of a clean Lake Erie. Overall, CLEAR collaborates with many researchers from other universities and state and federal agencies to understand and predict harmful algal blooms in Lake Erie.

CLEAR PROJECTS AT OHIO STATE: Including Dr. Stanford and Dr. Chaffin, CLEAR works with 11 Ohio State PIs who actively seek external funding (Appendices D, E, and F1). During the last fiscal year, CLEAR staff serving as PIs have had 29 active projects for a total of \$2,383,003 covering a diverse array of topics. These projects include funding from the National Park Service through the Ohio History Connection to create new interpretive education outdoor signage at the South Bass Island Lighthouse to tell the rich history of the buildings and keepers, funding from both the Andrews Foundation and the Toledo Community Foundation's First Solar Fund to offer Stone Laboratory field trip scholarships to underserved schools in Ohio, and funding to decrease use of straws and other single-use plastics at tourist destinations along Lake Erie's shoreline, just to highlight a few.

RESEARCH AT STONE LABORATORY: CLEAR staff are not the only individuals to use Stone Lab research facilities and vessels. Facilities, equipment, and research vessels offer researchers an ideal

setting to conduct Lake Erie research, and facilities use has almost doubled after extensive renovations concluded in 2013. Since 2013, Stone Laboratory has hosted a yearly average of 33 research projects based at Stone Laboratory that were led by 29 different PIs from 21 different institutions. Additionally, since 2013, an average of 39 visiting researchers from 10 different states and four different countries have used the facilities, equipment, or research vessels at Stone Laboratory, but the project was not necessarily based at the laboratory. The projects studied harmful algal blooms, aquatic invasive species, endangered species, fisheries management, and pollutants in the atmosphere and the water.

FUNDED RESEARCH THROUGH NOAA'S SEA GRANT COLLEGE PROGRAM: CLEAR has been a grant-awarding center since its inception as a Sea Grant College Program in 1988. Since 2014, approximately 40 percent of CLEAR's core omnibus budget from NOAA has been dedicated to competitively funded research projects. Our NOAA funding currently supports 17 large grants (up to \$60,000/year for up to two years) and 13 small grants (proposals for grants of up to \$10,000). These projects cover topic areas such as nutrient dynamics, sustainable fisheries, pharmaceuticals and personal care products, tourism and coastal economic development, and aquaculture and are aligned to meet Ohio's state agency needs. Proposals for small grants from development funds can be submitted at any time. Proposals submitted for the biennial large grant cycle are reviewed by a panel consisting of expert professionals and scientists from agencies, academia, industry, and non-governmental organizations at both



During the last fiscal year, CLEAR staff serving as primary investigators have had

29

ACTIVE PROJECTS

> for over <

\$2.3

MILLION





Center for Lake Erie Area Research

the preproposal and full proposal stages. CLEAR staff leads the proposal review process, but do not rate or review the proposals. Full proposals submitted to the large grant cycle are all subject to external, written peer review and investigators can submit written responses to blinded peer reviews. A representative from the National Sea Grant Office attends the panel meeting to ensure fairness and the absence of conflicts of interest. The director of CLEAR rarely deviates from the recommendations of the panel when deciding which proposals to include in our biennial omnibus submission to the National Sea Grant College Program. CLEAR's ability to attract state-of-the-art research, hold a rigorous, unbiased and transparent research competition to address the most pressing needs of the state, and deliver high-quality outreach materials from the research conducted has led to CLEAR being a go-to entity for research competition and grants management.



As of June 2018, the Ohio Department of Education has provided over

\$7.4
MILLION

to manage efforts related to the algal toxin microcystin

HARMFUL ALGAL BLOOM RESEARCH INITIATIVE:

The Harmful Algal Bloom Research Initiative (HABRI), funded by the Ohio Department of Higher Education (ODHE), is a statewide response to the threat of harmful algal blooms and one of the external grant programs CLEAR is managing. The initiative was born out of the 2014 Toledo drinking water crisis, where elevated levels of the algal toxin microcystin in Lake Erie threatened drinking water for over 500,000 people in northwest Ohio. To better position the state to prevent and manage future algal issues, the Chancellor of Ohio's Department of Higher Education worked with CLEAR, The Ohio

State University, and the University of Toledo to manage research efforts across Ohio's universities to address critical technology needs and knowledge gaps identified by state agencies. As of June 2018, ODHE has provided Ohio Sea Grant with \$7,476,522 to manage efforts aimed at: (1) developing ways to reduce nutrient loads into Lake Erie and improve methods to detect, prevent and mitigate harmful algal blooms and their impacts; (2) assessing the health impacts of harmful algal blooms and associated toxins; (3) developing new treatment methods for contaminated drinking water; and (4) ensuring these solutions are disseminated to agencies, elected officials, urban planners, and the agricultural community. HABRI funds have resulted in (1) the rapid determination of whether blooms are toxic and where toxins are moving within Lake Erie, (2) prediction capability for the location and severity of blooms, (3) the development of new, innovative techniques for producing safe drinking water, (4) the information needed to inform the public if fish from toxin-laden water bodies are safe to consume, and (5) information that establishes connections between nutrient flows upstream and downstream of various land management practices. With consistent input from state agencies, HABRI projects have been extremely successful at providing quick and reliable answers to many of the unknowns of HABs and their toxins (go.osu.edu/habri).

CLEAR'S PROJECT MANAGEMENT FOR OTHER STATE AND FEDERAL PARTNERS:

As a result of CLEAR's ability to run successful research competitions to address the most pressing needs of the state, the program's management of externally funded research has seen dramatic growth over the last few years and is a testament to its ability to be an unbiased scientific resource for the state and the strong research management at The Ohio State University's Office of Sponsored Programs. Last fiscal year, CLEAR managed research competitions and funded projects for state and federal partners at a total of \$6,321,518 in grant dollars on behalf of 6 different state, national, and binational agencies resulting in an additional 59 projects awarded to 35 principal investigators at 10 institutions (Appendix F3).

GRANTS MANAGEMENT FOR OHIO LAKE ERIE COMMISSION AND OHIO DEPARTMENT OF NATURAL RESOURCES:

CLEAR is also managing projects for the Ohio Lake Erie Commission and the Ohio Department of Natural Resources Office of Coastal Management (ODNR – OCM) covering HABs and



Harmful algal blooms

their toxins. The Ohio Lake Erie Commission sought out CLEAR to manage their funds due to our ability to attract more proposal submissions from high-level researchers. CLEAR currently manages seven projects for the Commission: four independent projects relating to HABs and beneficial reuse of dredged materials and three projects that supplement other CLEAR- and ODHE-funded HABs research. Currently, ODNR – OCM is working on a large Sandusky Bay Initiative funded by multiple state and federal agencies to decrease the severity and duration of HABs in Sandusky Bay while also increasing the aesthetics of the region’s shoreline. Sandusky Bay currently has a harmful cyanobacterial bloom that produces microcystin toxin for the majority of spring and summer each year. CLEAR is managing two rounds of funding for the research component of this initiative, with a third round of funding arriving in the near future. For this initiative, CLEAR is tasked with the management of the grant dollars and subawards, leading project PI and stakeholder webinars and in-person meetings with funded researchers, and overall project reporting on research findings to other stakeholders involved in this large state initiative.

A GO-TO RESOURCE FOR FUNDING AGENCIES:

CLEAR is recognized as the go-to program for managing research, education and outreach efforts that address critical Lake Erie Issues. CLEAR, within the timeframe of this report, is managing \$6,321,518 in grants from six different sources (International Joint Commission, National Atmospheric and Oceanic Administration, Ohio Department of Natural Resources, Ohio Department of Higher Education, Ohio Environmental Protection Agency, Ohio Lake Erie Commission). The decision to have CLEAR manage funds is rooted in (1) the program’s active and regular engagement of state and federal agencies when soliciting research priorities from stakeholders, (2) its thorough vetting of projects submitted for funding, (3) its wide reach when disseminating research findings to decision-makers and impacted lake residents, and (4) the role of CLEAR staff play on numerous influential boards. For example, Dr. Winslow specifically sits on the International Joint Commission’s Science Advisory Board, working groups for both Annex II and Annex IV of the Great Lakes Water Quality Agreement, and is an Agency Partner for the Lake Erie Commission.

After engaging agencies to help identify research needs and gaps, CLEAR encourages involvement in the proposal review process. For example, the Advisory Board established to guide the Ohio Department of Higher Education’s Harmful Algal Bloom Research

Initiative includes the Ohio Environmental Protection Agency, Ohio Department of Natural Resources, Ohio Department of Health, Ohio Department of Agriculture, and the Ohio Lake Erie Commission. When engaged on these advisory boards, agency staff come to appreciate the effort and detail that drives funding decisions.

Having built these strong relationships with state agencies, CLEAR is now regularly asked to convene academic researchers from Ohio State and across the state to address pressing issues that agency staff may not have the expertise or data to address. For example, Dr. Winslow was recently asked to convene a team of Ohio researchers to help the Ohio EPA develop the criteria needed to designate the open waters of Lake Erie as impaired for recreational use because of harmful algal blooms. The product of this working group informed new state criteria that was ultimately submitted to the U.S. EPA. CLEAR is currently convening another task team to help the Ohio EPA determine how to beneficially use dredge material from Lake Erie.

The state legislature has also shown appreciation for CLEAR’s efforts to conduct, fund, manage, and disseminate research efforts to address Lake Erie issues. This legislative support for CLEAR is illustrated by a recent \$2.65 million capital needs investment in Stone Laboratory to address harmful algal blooms (Senate Bill 299: Clean Lake Erie 2020). This investment will allow CLEAR, specifically Stone Lab, to increase its capacity to study algal blooms and assess progress toward nutrient reductions. A portion of the funding will be used to build new lab space on the island campus (\$1,900,000) that will increase capacity to collect and process needed water samples. Not only will this address the nutrient loading and HABs issue impacting Lake Erie, but it will also support research efforts that will likely address current and future lake stressor (e.g., pharmaceuticals, plastic debris, etc.) and assess ecosystem stability (e.g., invasive species, fisheries science, lake dead zones, etc.). Another portion of SB299 will be used to purchase lab equipment to outfit the lab space (\$500,000). Finally, the remaining \$250,000 will be used to purchase and maintain real-time data buoys and sondes to be deployed in the lake. These buoys will allow researchers to gather real-time data in key locations in the lake and its tributaries to inform agencies and stakeholders of blooms and nutrient movements. Additionally, these buoys will provide data regularly requested by NOAA (Great Lakes Environmental Research Lab in Ann Arbor) to help aid in short- and long-term lake forecasting (e.g., water mixing, water levels, wind speed and direction, wave height, water temperature, etc.).



CLEAR is managing over

\$6.2
MILLION

*in grants from
6 different sources*





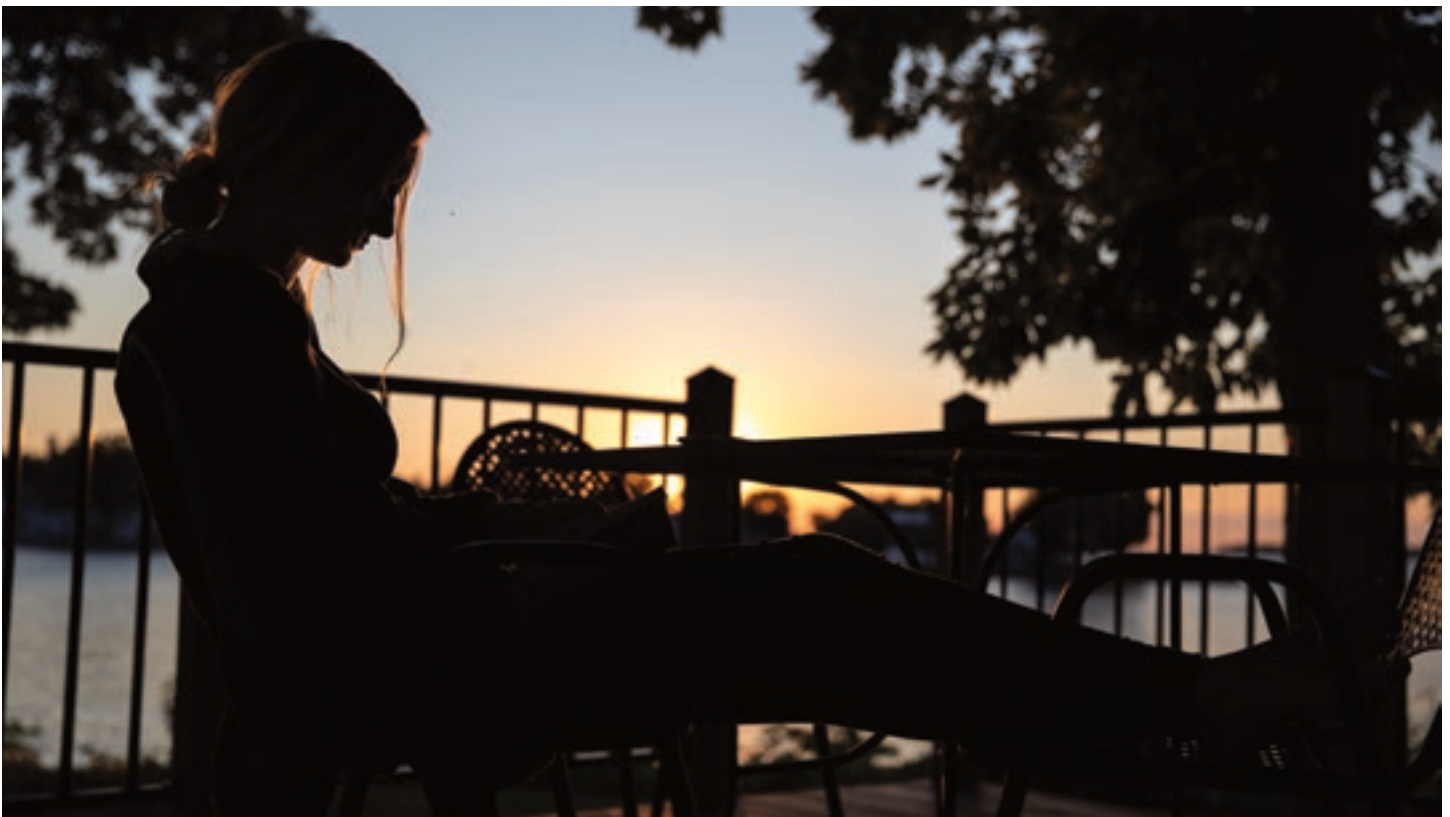
Budget Overview

CLEAR has a diverse portfolio of sources of funds that support our operations. CLEAR receives financial support from University & Extension Funds (38%), Grants & Projects (25%), Revenue (18%), Endowment & Development Income (10%), and from State of Ohio (9%). In addition, our funding sources are not entirely reflected within the financial statement (Appendix H) that is presented due to CLEAR having funds under organization numbers (40540) & (41600). This financial statement reflects organization number 40540 only.

Below is a budget narrative pertaining to each fund group with a more detail in Appendix H:

GENERAL FUNDS: Currently we receive financial support from the Office of Research within our General Funds. These funds are utilized to support our administrative staff and operations within the Columbus office. Our general funds group currently reflects a one-time deficit of \$415,309. We are currently in the process of resolving this deficit, by using a combination of our capital reserves and surplus funds we have on hand to significantly reduce or eliminate this deficit.

DESIGNATED FUNDS: These are funds we receive from lab fees we charge to students taking courses at Stone Laboratory, to cover the use of equipment, boats, etc. This is the amount of distribution we receive from each course. As we move forward, we have been informed by the Office of the Registrar that we will no longer be able to charge lab fees for the courses that are offered at Stone Lab. Therefore, this fund source will not be available moving forward.



EARNINGS: Majority of our revenue comes from services that we provide at Stone Laboratory. These services include field trips for elementary & high schools, workshops, courses, tours, conferences, and research ventures. To off-set the increasing costs of operating the island, we have, and are currently reviewing, the rates we charge for our groups and adjusting them to off-set these costs. Our last noticeable change in rates was in FY17. In addition, ~\$450,000 of financial support from the College of Food, Agricultural, & Environmental Sciences (CFAES), is transferred to these funds to support the operations of Stone Laboratory.

DEVELOPMENT & ENDOWMENT INCOME: A majority of our Development & Endowment funds fall under CFAES, which are not reflected. We currently have ~29 Development & Endowment funds, with a total principal balance of over \$1.5 million and revenue (including endowment income) for FY18 of over \$300,000. These funds are utilized to support scholarships, outreach activities, and facility needs.

GRANTS & CONTRACTS: This group of funds reflects the State of Ohio funding we receive. As the report reflects, our State Line Funding has remained flat over the course of the past three years. We are optimistic this will remain the same, or increase, as we move forward. We utilize these funds to support the outreach and educational initiatives of CLEAR.

OSP FUNDS: CLEAR staff serve as principal investigators (PIs) and actively seek external funding to create new research, education and outreach initiatives. CLEAR staff (6 different principal investigators) received a total of \$6,675,405 in grant and foundation support between July 2017 and June 2018 (Appendix E).

PLANT FUNDS: These funds include support that we have received from the Office of Research to support our facility and equipment initiatives. We hope to utilize these in reducing our current deficit listed under General Funds.

EXTENSION FUNDS: In addition, we receive ~\$350,863 in financial support from CFAES to support our Extension operations as well as to support staff that are working on Extension initiatives. These funds are not reflected on the financial statement.



*All of these funds and/or a combination of funds are utilized to **meet match requirements** from the awards we received*



Future of CLEAR

Research Growth

GROWTH OF CLEAR'S RESEARCH CAPACITY: Our program currently funds a tremendous amount of research, but has only two active researchers on staff (Drs. Justin Chaffin and Kristin Stanford). The majority of staff is made up of individuals that function as Extension educators, communicators, individuals charged with operating Stone Lab, and administrative staff. In an effort to increase CLEAR's research contributions, besides funding research and hosting researchers at Stone Lab, the center is (1) strategically engaging impactful Ohio State researchers to incorporate into the staff (e.g., support one month of summer salary) and/or (2) leveraging the island campus as a tool/resource to increase their likelihood of grant success. For example, CLEAR encourages PIs to strengthen the "broader impacts" of their grant proposals by augmenting the scientific merit of their research with the development of new curriculum to be taught at Stone Lab or to tap into an existing portfolio of outreach opportunities. The goal is to have more researchers incorporate CLEAR and the island campus into their grant proposals. Future partnerships with key Ohio State faculty will (1) provide the researcher with priority access to CLEAR facilities and equipment, (2) help the researcher become part of the center's outreach portfolio, and (3) will include the researchers in the design of curriculum to communicate the finding of their research. Currently, CLEAR aims to add researchers that can increase social science capacity, fisheries expertise, economic analysis strength, and strong curriculum development and assessment effort. Metrics: (1) number of MOUs executed, (2) increased number of grants submitted and awarded by MOU staff additions, and (3) increased number of publications by MOU staff additions.

*The goal is to have more researchers **incorporate CLEAR** and the island campus into their grant proposals.*



INCREASED GRANT SUPPORT TO ADDRESS LAKE ERIE ISSUES:

CLEAR plans to increase funded efforts to address nutrient loading and harmful algal blooms, beneficial use of dredge material, invasive species, the impact of climate change on ecosystem function and coastal resilience, presence and impacts of pharmaceutical and personal care products, sensor technology, and fisheries management. Metric: Increased funding support.

INCREASED GRANT MANAGEMENT:

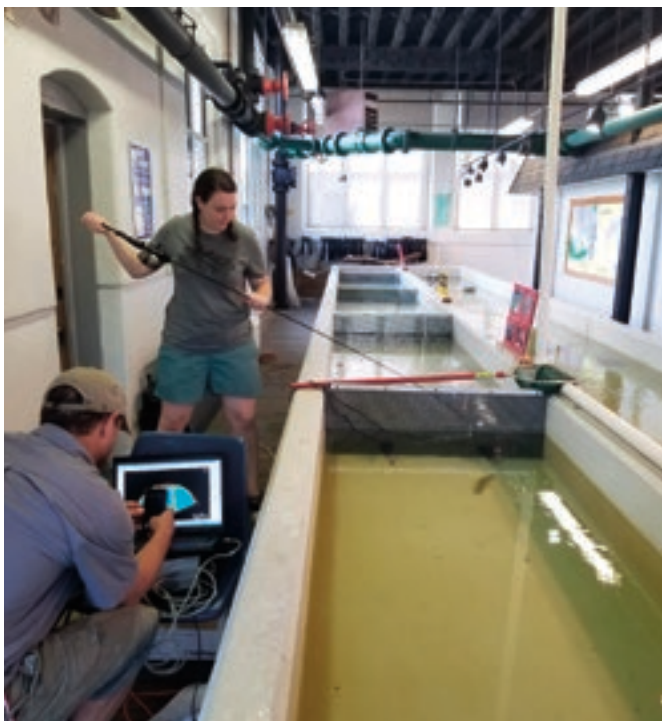
CLEAR continues to be viewed as a program that can effectively manage research dollars to address Lake Erie Issues. CLEAR's management of current funds includes identifying research priorities with state and federal agencies, running a thorough proposal review process and closely tracking project budgets. CLEAR's ability to effectively disseminate research findings, encourage PIs to engage with stakeholders, and provide researchers with venues to increase the broader impacts of their science will continue to highlight the strength of CLEAR as a grant management program. Currently the center is managing research dollars for the Ohio Lake Erie Commission, the Ohio Department of Natural Resources Office of Coastal Management, and the Ohio Department of Higher Education. Metric: Increased number of research, education, and outreach dollars managed.



Education Growth

COURSES AT STONE LABORATORY: CLEAR is currently revisiting its relationship with the School of Environment and Natural Resources (SENR) within CFAES to increase the number of Ohio State faculty teaching courses at Stone Lab and identify current main campus courses that would be strengthened if taught on the island. Last year CLEAR initiated discussions with SENR to show how CLEAR can meet the needs of SENR students and faculty. This includes designing professional development certificate programs that build marketable field-based skills. In the summer of 2019 CLEAR will be offering four new courses at Stone Lab and has made adjustments to the summer calendar to accommodate new SENR courses. SENR is promoting these courses to students and will cover the salary of faculty to teach these courses. Metrics: (1) increased enrollment, (2) improved course evaluations, (3) increased number of new faculty teaching at Stone Lab, (4) increased number of new faculty conducting research at Stone Lab, (5) increased students getting STEM-related jobs, enrolled in or graduating from a STEM graduate program.

CURRICULUM ASSESSMENT: CLEAR will work to more thoroughly evaluate the success of its field trip program designed for 5th-12th graders. This will be coupled with the development of new, innovative lessons that include pre- and post-trip exercises for teachers to use in their classes. The intent of the pre-exercise is to prepare students for their island experience. Field trip activities will also continue to meet ever-changing state science standards. Finally, CLEAR needs to make an effort to target underrepresented populations and identify foundation support to cover, or at least reduce, the cost associated with field trips. In 2017 CLEAR had success in this space, securing foundation support from both First Solar and the Andrews Foundation. Metrics: (1) increased attendance by students from underserved schools, (2) higher field trip evaluation scores, (3) increased number of field trip requests, and (4) earlier requests for field trip dates.





Outreach Growth

*CLEAR is recognized as a **key research depository** for the state. Numerous agencies, NGOs, and funding units reach out to CLEAR to **learn about ongoing research efforts** related to threats to Lake Erie and the Great Lakes.*

IDENTIFY REGIONAL CONFERENCES TO HOST AT STONE LAB: CLEAR currently has the capacity to host conferences for 60-80 participants but sees the potential to grow that capacity. Metric: increased number of events hosted annually (currently one every other year).

IDENTIFY FOUNDATION SUPPORT TO HOST NEW OUTREACH EXPERIENCES: This year CLEAR submitted its first George Gund Foundation proposal. It received high reviews, but based on budget allocations under the current federal administration the Gund Foundation decided to support efforts outside their normal scope. CLEAR intends to reapply to the Gund Foundation, First Solar, and the Andrews Foundation and to seek additional opportunities. Metrics: (1) increased number of foundation proposals submitted and (2) increased level of foundation support.

Cross Cutting Growth

ESTABLISHMENT OF AN EFFECTIVE ADVISORY BOARD:

Because the research, education, and outreach efforts of CLEAR involve Ohio State faculty, universities throughout the state, state agencies, and businesses throughout the watershed, it is the center's intent to convene two advisory boards. One board will include Ohio State staff and faculty while the second will include non-Ohio State academics, stakeholders, and agencies. This effort was initiated in 2018 but was put on hold due to a request from Dean Kress to hold off on an External Advisory Board search until after her advisory board is established. Additionally, Dean Kress will provide input on CLEAR's list of potential internal advisory board members. Metrics: (1) First meeting of both advisory boards this summer, and (2) two meetings this calendar year.

CONTINUED GROWTH OF BOARD AND COMMITTEE INVOLVEMENT:

CLEAR is recognized as a key research repository for the state. Numerous agencies, NGOs, and funding units reach out to CLEAR to identify current and likely future threats to Lake Erie and the Great Lakes and to learn about ongoing research efforts related to existing threats. Beyond CLEAR staff knowing the majority of projects underway, staff are also aware of many projects that have been proposed but not funded. This happens because CLEAR staff sit on as many advisory boards, working groups, and task teams as possible and regularly update leadership on the efforts of these groups. Metric: Maintain constant level of involvement.

GENERATE REVENUE AND PARTNERSHIPS WITH ISLAND BUSINESSES:

CLEAR has initiated conversations with island business to discuss the feasibility of using the South Bass Island Lighthouse grounds as a location to host special events (e.g., weddings, receptions, reunions, etc.). As staff assess the pros and cons of growing this portion of the program, they are planning to engage with island businesses. Historically, staff have received comments from island residents and businesses that the lighthouse grounds and its historical residence are underused. As staff investigate this possible revenue stream, they will involve island residents to show the community that Ohio State's growth generates growth for island businesses. The ultimate goal would be to use revenue from event hosting to: (1) staff the

grounds during the tourist season, (2) develop and purchase educational displays for the grounds, and (3) renovate the facility and upgrade grounds for visitors and future events (e.g., window replacement, plumbing, burying electric lines, landscaping, the addition of picnic tables, gazebos and chairs for public, etc.). Once the needed educational displays and renovations/upgrades are completed, CLEAR staff hope to use future revenue to support scholarships for students and to reduce current charges for field trip groups who visit Stone Lab to participate in hands-on science experiences (science field trips; grades 5-12). Metrics: (1) formalize partnerships with island vendors (e.g., catering, transportation), (2) advertise the event location, (3) develop guidelines for the use of grounds (e.g., what services are permitted, who is program point of contact, what are only permitted vendors (photographer, caterer, etc.), and (4) show increased rental/use of grounds.

Facilities Growth

STONE LAB MASTER PLAN: Last summer, Ohio State's Planning and Real Estate (PARE) visited Stone Lab per Dr. Winslow's request. After that visit and a full tour of all properties, PARE requested to aid CLEAR in development of a facilities master plan (MS) for Stone Lab. This offer included the contribution of IPPLG funds to support 50% of the cost of this effort (\$50k of \$100k project cost). This offer has indicated a desire of Vice President Keith Myers to invest in this facility and a strong indication that there are likely donors that he could introduce to Stone Lab. ~10 PARE staff visited Stone Lab on November 1 and 2 to gather all the information needed to fully understand the property and structures on the island campus. In February 2019, PARE and FOD will start calling leadership from CLEAR, OR, and CFAES to discuss growth of the Stone Lab campus.

AQUATIC VISITORS CENTER VISION: Dr. Winslow is currently working with the Ohio Department of Natural Resources to assess their interest in transferring ownership of the Aquatic Visitors Center (AVC) to CLEAR. Currently CLEAR leases the facility for \$1 per year. This future purchase, if approved by the university, will allow the center to pursue renovations to the upstairs of the facility for use as researcher housing and meeting space. This



Center for Lake Erie Area Research

proposed housing renovation will allow CLEAR to advertise the assets of Stone Lab (e.g., fleet of four research vessels and high-end equipment) more broadly without fear of inadequate housing to support increased use. The conference space will give CLEAR the ability to host small conferences with a capacity of 140-160.

The ground floor of the AVC is currently a free educational facility that brings history, fishing information, and hands-on activities to tourists visiting South Bass Island. CLEAR took over management of the AVC in 2009, continuing to teach the next generation about the importance of protecting Lake Erie. This space sees between 10,000 and 12,000 visitors annually. Currently the educational displays are outdated and need to be refreshed. If CLEAR is able to take possession of this asset, in addition to researcher housing, the center hopes to develop an extensive evaluation of current offerings at the AVC and survey other Ohio science education centers to determine what renovations and displays should be added in the future. Questions in this evaluation process will include: (1) who visits the AVC and what are their perceptions around their engagement, (2) what do non-visitors and visitors desire to learn at AVC and other science education centers, and (3) what themes resonate with AVC visitors and potential visitors and how could these themes be used to lead to the intended outcomes of the AVC. The evaluation will ultimately provide impactful insights into regional concerns and current knowledge levels to improve environmental and scientific educational messaging. Metrics: (1) begin dialogue to determine pros/cons associated with transfer of AVC. Contingent on this metric: (1) develop AVC business plan, and (2) seek funding to support renovation (foundations, grants, and private support).



Advancement Growth

IDENTIFY STRATEGIC DONORS: Continue to engage with the CFAES Offices of Advancement and Development to craft talking points and outreach materials that will highlight the scientific impact of CLEAR funded research projects and its education and outreach programming. Additionally, Dr. Winslow is working with CFAES to identify donors with both the desire and capacity to support the infrastructure and programmatic needs of the program. This desired support not only includes spendable funds, but also funds to build existing endowments and estate/planned gifts. The goal is to not only approach Ohio State alumni as potential donors, but to reach people that have clear connections to Lake Erie and its watershed. This includes property owners, businesses, and those who recreate on the lake. Hopefully these efforts will generate funds to support scholarships, research equipment, visiting scholars, vessel operations, and capital improvements. Metrics: (1) develop talking points with University Advancement, (2) compile list of potential donors complete with likely efforts they would be interested in supporting, and (3) start traveling with University Advancement staff to visit donors.

Challenges Facing CLEAR

BUDGET DEFICIT: On average, over the last 5 years, CLEAR has carried a deficit of approximately \$200,000. Because the center operates on two different fiscal cycles (state and federal fiscal calendars), the previous director historically sifted annual deficits from one budget to the other. As CLEAR's new director, Dr. Winslow is working to address this negative budget as this shifting of debt from state to federal fiscal budgets is not a sustainable model. The bulk of this deficit can be attributed to the following:

- › Insufficient base funding allocation when Dr. Reutter negotiated CLEAR taking full control of island operations; i.e., no formal relationship with University Housing, Dining Services, and Facilities Operations and Development.
- › Lack of support from Ohio State's colleges that benefit from Stone Lab curriculum. Annually, approximately \$50,000-\$70,000 in base program funds and Stone Lab revenue are needed to support



faculty and teaching assistants teaching Ecology, Evolution, and Organismal Biology courses. No support has historically been provided to CLEAR to offer these courses; i.e., no tuition gets transferred from Arts and Sciences to CLEAR.

- › Insufficient funding to support the required annual 2 percent university merit increases.

HOUSING: It will be very difficult to grow island programming given existing capacity constraints and facility condition. Capacity and facility condition present an issue under all of the following scenarios:

- › **Staff:** CLEAR is unable to bring on additional Biological Field Station Assistants and Research Assistants to support the research, education, and outreach efforts of CLEAR staff.
- › **Researchers:** There is room to support faculty to teach summer courses, but these individuals occupy space that can also be used to support visiting scientists, graduate students, and postdocs.
- › **Students:** The existing dorm was built in 1985. The dorm consists of 12 units with maximum capacity of 48 individuals. This facility currently



Center for Lake Erie Area Research



meets capacity needs of courses and most field trips offered at Stone Lab. However, the accommodations have both structural (e.g., cracked foundation) and comfort issues (e.g., poor air circulation and need for air conditioning) that will ultimately impact CLEAR's ability to provide a positive experience for clients. Despite not being at capacity now, proposed efforts to build enrollment with CFAES will be constrained.

➤ **Conferences:** As staff push to make more meeting space available to host conferences they quickly run into housing limitations for meeting attendees. These individuals will need to be housed at off-campus locations (island hotels) making conference logistics difficult and inhibiting a possible source of future revenue.

STAFFING: It is difficult to drive improvements in research, education, and outreach efforts without additional staff. Current operating demands are stretching existing staff such that there isn't ample time to develop timely, innovative programs or to improve upon existing programs. Unfortunately, adding staff isn't just constrained by budget issues, but it is also limited by housing capacity.

AGING FACILITY: This includes the Stone Lab Classroom Building [replace all windows (\$500,000), refinish floors (\$100,000), patch plaster walls and paint (\$60,000-\$100,000)]; Stone Cottage

[common kitchen (\$50,000), drywall throughout (\$50,000), install AC (\$30,000)]; Stone Lab Research Building [replace all windows (\$500,000)]; shoreline protection; and field gear, vehicle, vessel, and equipment storage (\$100,000).

AGING AND LIMITED VESSEL FLEET: Stone Lab currently operates a research vessel fleet consisting of four ships (43' R/V Gibraltar III, 37' R/V Biolab, 27' R/V Erie Monitor, and 27' R/V GS-III). The two largest vessels are adequate to support its education and outreach mission and the two smaller vessel allow staff to run day-long water sampling research trips. Unfortunately, staff are receiving more and more requests for a vessel capable of overnight trips and further from the Bass Islands. The current estimated cost for such a vessel is \$2.5 million. This vessel purchase will not replace any of the existing vessels, but offers a tremendous opportunity to expand Stone Lab's research capacity while maintaining the current and future demands on its older, slower vessels. The suggested new vessel will provide the length of ship needed for extended sampling cruises and the speed to cover more of Lake Erie than currently possible with Stone Lab's existing fleet. Ideally, CLEAR would like to concurrently fundraise for a \$1 million endowment to support the annual operation of this vessel and other vessels in its fleet.



APPENDICES

OHIO SEA GRANT AND STONE LABORATORY
PROGRAM DATA, ACCOMPLISHMENTS, AND METRICS

Appendix A

> FACULTY ENGAGEMENT

NAME	AFFILIATION	INTERACTION WITH THE CENTER FOR LAKE ERIE AREA RESEARCH
Christopher Tonra	Ohio State University, School of Environment and Natural Resources	Stone Laboratory Instructor for more than 2 years
Jay Martin	Ohio State University, Department of Food, Agricultural, and Biological Engineering	Ohio Sea Grant Faculty; PI funded by CLEAR on 2 or more projects; LEARN member; co-organizer of State of the Science Conference
Richard Bradley	Ohio State University, Department of Evolution, Ecology and Organismal Biology	Stone Laboratory Instructor for more than 2 years
Jiyoung Lee	Ohio State University, College of Public Health and Department of Food Science and Technology	PI funded by CLEAR on 2 or more projects
Harold Keener	Ohio State University, Department of Food, Agricultural, and Biological Engineering	PI funded by CLEAR on 2 or more projects
John Lenhart	Ohio State University, Department of Civil, Environmental and Geodetic Engineering and Ohio Water Resources Center	PI funded by CLEAR on 2 or more projects
Stuart Ludsin	Ohio State University, Department of Evolution, Ecology and Organismal Biology and Aquatic Ecology Laboratory	PI funded by CLEAR on 2 or more projects
Suzanne Gray	Ohio State University, School of Environment and Natural Resources	PI funded by CLEAR on 2 or more projects; LEARN member
Margaret Kalcic	Ohio State University, Department of Food, Agricultural, and Biological Engineering	PI funded by CLEAR on 2 or more projects
Wu Lu	Ohio State University, Department of Electrical and Computer Engineering	PI funded by CLEAR on 2 or more projects
Linda Weavers	Ohio State University, Department of Civil, Environmental and Geodetic Engineering and Ohio Water Resources Center	PI funded by CLEAR; LEARN member; member of Ohio Sea Grant Proposal Review Panels representing Ohio Water Resources Center
Joe Lucente	Ohio State University, Ohio Sea Grant	Ohio Sea Grant Faculty
Lawrence Krissek	Ohio State University, School of Earth Sciences	Stone Laboratory Instructor for more than 2 years
Jeremy Bruskotter	Ohio State University, School of Environment and Natural Resources	Stone Laboratory Instructor; PI funded by CLEAR
Joe Raczkowski	Ohio State University, Department of Entomology	Stone Laboratory Instructor for more than 2 years

CORE FACULTY AT OHIO STATE UNIVERSITY



NAME	AFFILIATION	INTERACTION WITH THE CENTER FOR LAKE ERIE AREA RESEARCH
Chris Stanton	Baldwin Wallace University	LEARN member
Michael McKay	Bowling Green State University	PI funded by CLEAR on 2 or more projects; LEARN member
George Bullerjahn	Bowling Green State University	PI funded by CLEAR on 2 or more projects; LEARN member
Shannon Pelini	Bowling Green State University	LEARN member
John Farver	Bowling Green State University	PI funded by CLEAR; LEARN member
Bob Midden	Bowling Green State University	PI funded by CLEAR on 2 or more projects; LEARN member
Tim Davis	Bowling Green State University	PI funded by CLEAR on 2 or more projects; LEARN member
Kevin McCluney	Bowling Green State University	PI funded by CLEAR; LEARN member
Kevin Neves	Bowling Green State University	LEARN member
Helen Michaels	Bowling Green State University	LEARN member
Jeffrey Miner	Bowling Green State University	LEARN member
Rex Lowe	Bowling Green State University	Stone Laboratory Instructor for more than 2 years
Fasong Yuan	Cleveland State University	PI funded by CLEAR; LEARN member
Douglas Kane	Defiance College	Stone Laboratory Instructor for more than 2 years; PI funded by CLEAR; LEARN member
Soryong Chae	University of Cincinnati	PI funded by CLEAR on 2 or more projects
Amy Townsend-Small	University of Cincinnati	LEARN member
Laura Johnson	Heidelberg University	PI funded by CLEAR on 2 or more projects, LEARN member
Joseph Ortiz	Kent State University	PI funded by CLEAR on 2 or more projects
Darren Bade	Kent State University	PI funded by CLEAR; Stone Lab Instructor for more than 2 years
Xiaozhen Mou	Kent State University	PI funded by CLEAR on 2 or more projects
John Hoornbeek	Kent State University	LEARN member
Lauren Kinsman-Costello	Kent State University	PI funded by CLEAR on 2 or more projects; LEARN member
Allen Fanzenbaker	Lake Erie College	LEARN member
Christopher Spiese	Ohio Northern University	PI funded by CLEAR on 2 or more projects
James Marshall	Rockford University	Stone Laboratory Instructor for more than 2 years
April Ames	University of Toledo	PI funded by CLEAR on 2 or more projects
Jason Huntley	University of Toledo	PI funded by CLEAR on 2 or more projects
Kenneth Hensley	University of Toledo	PI funded by CLEAR on 2 or more projects
Thomas Bridgeman	University of Toledo	PI funded by CLEAR on 2 or more projects; LEARN member
Christine Mayer	University of Toledo	LEARN member
Tim Fisher	University of Toledo	LEARN member
David Kennedy	University of Toledo	PI funded by CLEAR; LEARN member
Steven Haller	University of Toledo	PI funded by CLEAR; LEARN member
Mark McCarthy	Wright State University	PI funded by CLEAR; LEARN member
Silvia Newell	Wright State University	PI funded by CLEAR; LEARN member
Suresh Sharma	Youngstown State University	PI funded by CLEAR on 2 or more projects

Appendix A

> FACULTY ENGAGEMENT

NAME	AFFILIATION	INTERACTION WITH THE CENTER FOR LAKE ERIE AREA RESEARCH
Allison MacKay	Ohio State University, Department of Civil, Environmental and Geodetic Engineering	PI funded by CLEAR
Matt Davies	Ohio State University, College of Food, Agricultural, and Environmental Sciences, Ohio Agricultural Research and Development Center	PI funded by CLEAR
Nicholas Basta	Ohio State University, School of Environment and Natural Resources	PI funded by CLEAR
Thomas Knobloch	Ohio State University, College of Public Health and the Comprehensive Cancer Center	PI funded by CLEAR
Brent Sohngen	Ohio State University, Department of Agricultural, Environmental, and Development Economics	PI funded by CLEAR
Audrey Sawyer	Ohio State University, School of Earth Sciences	PI funded by CLEAR
Jim Hood	Ohio State University, Department of Evolution, Ecology and Organismal Biology and Aquatic Ecology Laboratory	Proposal Collaborator
Robyn Wilson	Ohio State University, School of Environment and Natural Resources	Lead author on published manuscript with Ohio Sea Grant staff
Kay Stefanik	Ohio State University, School of Environment and Natural Resources	Stone Laboratory Instructor for 1 year
Hanping Wang	Ohio State University, Department of Animal Sciences and Director of Ohio Aquaculture Research and Development Integration Program	PI funded by CLEAR

AFFILIATED FACULTY AT OHIO STATE UNIVERSITY



NAME	AFFILIATION	INTERACTION WITH THE CENTER FOR LAKE ERIE AREA RESEARCH
Helen Michaels	Bowling Green State University	PI funded by CLEAR
John Farver	Bowling Green State University	PI funded by CLEAR
Vipaporn Phuntumart	Bowling Green State University	PI funded by CLEAR
Bryan Stubbs	Cleveland Water Alliance	PI funded by CLEAR
Ed Verhamme	LimnoTech	PI funded by CLEAR
Andrew Bruening	PAST Foundation	PI funded by CLEAR
Teresa Cutright	University of Akron	PI funded by CLEAR
Catharine McGhan	University of Cincinnati	PI funded by CLEAR
Victoria Campbell-Arvai	University of Michigan	PI funded by CLEAR
Paula Mouser	University of New Hampshire	PI funded by CLEAR
Jonathan Bossenbroek	University of Toledo	PI funded by CLEAR
Brian Trease	University of Toledo	PI funded by CLEAR
Kevin Czajkowski	University of Toledo	PI funded by CLEAR
Glenn Lipscomb	University of Toledo	PI funded by CLEAR
Patrick Lawrence	University of Toledo	PI funded by CLEAR
Glenn Lipscomb	University of Toledo	PI funded by CLEAR
Saatvika Rai	University of Toledo	PI funded by CLEAR
Yvonne Vadeboncoeur	Wright State University	PI funded by CLEAR

270 CLEAR Partners

Agriculture Research Service (USDA, ARS)
Alliance for the Great Lakes
AmeriCorps
Ashtabula Remedial Action Plan (RAP)
Ashtabula Yacht Club
Baldwin-Wallace College
Battery Park Marina
Bay Point Marina
Bay View Yacht Club
Beaver Park Marina
Beaver Park North
Blue Rock State Park
Blue Water Condominiums
Boardwalk Family of Restaurants
Boating Association of Ohio
Bowling Green State University
Brenner Marine, Toledo
Buckeye Sports Center
Bulan's Boatyard
Case Western Reserve University
Castaway Bay Marina
Cedar Point Amusement Park
Cedar Point Marina
Center for Great Lakes Literacy
Chagrin River Watershed Partners, Inc
Channel Park Marina
Chautauqua Lakeside
City of Cleveland, OH
City of Fremont, Ohio
City of Huron, OH Boat Basin
City of Medina, Ohio
City of Mentor, OH
City of Oregon, Ohio
City of Painesville, OH
City of Sandusky Paper District Marina
City of Sandusky, OH
City of Toledo, OH
Clean Marina Program
Cleveland Metroparks
Cleveland Museum of Natural History
Cleveland Office of Sustainability
Cleveland State University
Cleveland Water Alliance
Cleveland-Cuyahoga County Port Authority
College of Charleston
Congressional District 9 (Marcy Kaptur)
Connecticut Sea Grant

Cooley Canal Yacht Club (CCYC)
Cooperative Institute for Great Lakes Research
Cornell University
County Commissioners from all 8 coastal counties
Customs and Border Protection
Cuyahoga County Department of Health
Defiance College
Delaware Sea Grant
Dutch Harbor Toot Toot
E. 55th Street Marina
East Harbor State Park
Edgewater Marina
Edgewater Yacht Club, Cleveland
Emerald Necklace Marina
Fairport Harbor Rod & Reel
Florida Sea Grant
Fondriest Environmental, Inc
Forest City Yacht Club, Cleveland
Gem Beach Marina
Geneva State Park Marina
Georgia Sea Grant
Gilson Gardens, Inc
Girl Scouts Destinations Program
Grand River Marine, Inc.
Great Lakes Clean Marina Network
Great Lakes Commission
NOAA Great Lakes Environmental Research Laboratory
Great Lakes Fishery Commission
Great Lakes Historical Society,
Inland Seas Maritime Museum and
Peachman Lake Shipwreck Research Center
Great Lakes National Program Office (US EPA)
Great Lakes Panel on Aquatic Invasive Species
Great Lakes Protection Fund
Great Lakes Science Center
Great Lakes Sea Grant Network
Green City Blue Lake Institute,
Cleveland Museum of Natural History
Green Cove Resort I-Condo Assn.
Guam Sea Grant
Happy Days Boating
Harbor North, Huron
Heidelberg University
Holiday Harbor Marina, Huron
Hoty Marina - Son Rise, Sandusky
Huron Lagoons Marina, Huron
Huron Yacht Club

Illinois-Indiana Sea Grant
Illinois University
International Joint Commission
Kelley's Island Board of Education
Kelley's Island Field Station
Kelley's Island Historical Society
Kelleys Island water treatment plant
Kent State University
Lake Champlain Sea Grant
Lake County Development Council
Lake County Farm Bureau
Lake County Port Authority
Lake County Soil and Water Conservation District
Lake County Yacht Club, Eastlake
Lake Erie Center
Lake Erie Charter Boat Association
Lake Erie College
Lake Erie Islands Chapter
of Black Swamp Conservancy
Lake Erie Islands Conservancy
Lake Erie Islands Historical Society
Lake Erie Islands Nature and Wildlife Center
Lake Erie Marine Trades Association
Lake Erie Millennium Network
Lake Erie Nature and Science Center
Lake Erie Percid Management Advisory Group
Lake Erie Protection Fund,
Ohio Lake Erie Commission
Lake Erie Utilities
Lake Loramie State Park
Lake Milton State Park
Lakefront Marina
Lakeside-Chautauqua
Limno-Tech, Inc.
Lucas County
Lucas County Sea Grant Advisory Committee
Marina Del Isle, Marblehead
NOAA Marine Debris Program
Maritime Archaeological Survey Team, Inc (MAST)
Mary Jane Thurston
Maumee Bay Resort Marina
Mentor Lagoons Marina
Mercury Deposition Network
Michigan Sea Grant
Michigan State University
Michigan Technological University
Middle Bass Island Yacht Club
Miller Boat Line



Minnesota Sea Grant
Monroe Co. Intermediate School District, Monroe MI
Mosquito Lake State Park
NASA Glenn Research Center
National Aeronautics and Space Administration (NASA)
National Association of Marine Laboratories
National Atmospheric Deposition Program
National Center for Water Quality Research
National Estuarine Research Reserve System
National Museum of the Great Lakes
National Oceanic and Atmospheric Administration
National Park Service
National Science Foundation
National Sea Grant Office
National Weather Service
National Wildlife Federation
Nearpod
Nemecek Insurance & Financial Services
New York State Department of Environmental Conservation
NOAA Coastal Storms Program
NOAA National Centers for Coastal Ocean Science
Northeast Ohio Regional Sewer District (NEORSDD)
Notre Dame College
Ohio 4-H Youth Development
Ohio Aquatic Invasive Species Committee
Ohio Chapter of the American Fisheries Society
Ohio Coastal Management Program
Ohio Department of Health
Ohio Department of Higher Education
Ohio Department of Natural Resources
Ohio Department of Natural Resources, Division of Wildlife
Ohio Department of Natural Resources, Offices of Coastal Management
Ohio Division of Watercraft
Ohio Environmental Protection Agency
Ohio Farm Bureau
Ohio Geological Survey
Ohio Lake Erie Commission
Ohio Sea Grant
Ohio State University
Ohio State University Extension
Ohio State University Office of Energy and the Environment
Ohio Township Association
Ohio Travel Association

Ohio Water Resources Center
Old Woman Creek National Estuarine Research Reserve
Ontario Ministry of Natural Resources
Ottawa County Community Foundation
Ottawa County Recorder
Ottawa County Soil and Water Conservation District (OCSWCD)
Ottawa County Visitors Bureau
Ottawa National Wildlife Refuge
Paint Creek State Park
Pennsylvania Sea Grant
Perry's International Peace Memorial
Piedmont Lake Marina
Point Place Business Association
Project Wet
Project Wild
Purdue University
Put-in-Bay Jet Express Ferry
Put-in-Bay Township Park District
Put-in-Bay water treatment plant
Pymatuning Livery North
Pymatuning Livery South
Reveille and the Zande Companies
River Raisin Institute, Monroe MI
Rocky Fork State Park
Romps Water Port
Salt Fork State Park
Sandusky Harbor Marina
Sandusky Yacht Club, Sandusky
School of Environment and Natural Resources, The Ohio State University
Sea Grant Law Center
Sea K's licensing service
Shawnee State Park
Sima Marine
Sippo Lake Marina
Son Rise Marina
South Bass State Park
South Shore Yacht Supply
Spitzer Harbor Walk and Rack Storage Marina
Spitzer Lakeside Marine
State University of New York, Environmental Science and Forestry (SUNY-ESF)
Sterling State Park, Monroe MI
Stoney Brook University
Sustainable Cleveland Initiative
Sutherland Marine

The Dock of the Bay Marina
The Marina at Caesar Creek
The Nature Conservancy (TNC)
The Ohio State University
The Ohio State University at Newark
The Polish Fisherman's Club
Thunder:tech
Toledo Area Sanitary District
Toledo MetroParks
Toledo Regional Chamber of Commerce
Toledo Zoo
U.S. Customs and Border Protection
United States Geological Survey
University of Akron
University of Illinois
University of Illinois at Urbana-Champaign
University of Michigan
University of Michigan
University Of Minnesota
University of North Carolina
University of Rhode Island
University of Tennessee
University of Toledo
University of Toronto
University of Vermont
University of Wisconsin, Madison
US Coast Guard
US Environmental Protection Agency
US Fish and Wildlife Service
US Geological Survey
US Naval Research Lab
Valley Harbor Marina
Venetian Marina
Vermilion Power Boats
Wayne State University
West Branch State Park
West Cleveland Walleye Association
Western Basin Sportfishing Association
Western Lake Erie Basin Conservation Effects Assessment Project (CEAP)
Westerville City Schools
Whiskey Island Marina
Willoughby School of Innovation
Wingfoot Lake Marina
Wisconsin Sea Grant
Woods Holes Oceanographic Institute
Wright State University



› EXTENSION ADVISORY COMMITTEES

ASHTABULA COUNTY AND LAKE COUNTY

Jill Bartolotta

*Extension Educator,
Ashtabula and Lake County*

Dan Donaldson

*Lake County Soil and
Water Conservatory District*

Allen Fazenbaker

Lake Erie College

Stephen Love

Cleveland Foundation

Matthew Smith

*ODNR Division of Parks
and Watercraft*

Mike Wayman

Ashtabula Township

Peter Zahirsky

*Lake County Ohio Port and
Economic Development Authority*

CUYAHOGA COUNTY AND CITY OF CLEVELAND

Scott Hardy, PhD

*Extension Educator,
Cuyahoga County*

J. Meiring Borchers

*Northeast Ohio Regional
Sewer District*

Jennifer Grieser

Cleveland Metroparks

Wendy Kellogg

Cleveland State University

Cathi Lehn

City of Cleveland

Tracey Meilander

Notre Dame College

Bryan Stubbs

Cleveland Water Alliance

LUCAS COUNTY

Joe Lucente

Extension Educator, Lucas County

Sandy Bihn

Western Lake Erie Waterkeeper

Rick Brown

North Coast Marine Services

Melissa Greene

Lucas County

Glenn Grisdale

Reveille

Robert Kneisley

Indicator Advisory Corporation

Jamie Kochensparger

Lucas County Conservation District

Ron Lamont

Sunchaser Sportfishing Charters

Tom Lemon

Reveille

Cathy Miller

*Destination Toledo Convention
& Visitors Bureau*

Ann Moore

U.S. Army Corps of Engineers

Dennis Moore

U.S. Army Corps of Engineers

Lindsay Myers

City of Oregon

Paul Pacholski

Lake Erie Charter Boat Association

Hans Rosebrock

First Energy Foundation

OTTAWA COUNTY

Tory Gabriel

*Extension Program Manager,
Ottawa County*

Larry Fletcher

Lake Erie Shores & Islands West

John Hageman, Jr.,

Outdoor Writers of Ohio

Sarah Lowe

NOAA Marine Debris Program

Virginia Park

Ottawa County Recorder

Becky Simpson

*Ottawa Soil and Water
Conservation District*

David Spangler

*Lake Erie Waterkeeper, &
Lake Erie Charter Boat Association*

SANDUSKY COUNTY AND CUYAHOGA COUNTY

Sarah Orlando

*Clean Marinas Program Manager,
Sandusky and Cuyahoga County*

Tory Gabriel

Ohio Sea Grant & Stone Laboratory

Robert Gable

ODNR Division of Parks and Watercraft

Scudder Mackey

ODNR Office of Coastal Management

Bryan Ralston

Lake Erie Marine Trades Association

Mike Solberg

Huron Lagoons Marina

Christopher Winslow

Ohio Sea Grant & Stone Laboratory



► PROPOSALS SUBMITTED, JULY 2017–JUNE 2018

CLEAR's staff PI's submitted 28 proposals during the last fiscal year for a total request of \$13,767,239. Over 85% of the proposals submitted were awarded (24/28) totaling \$10,564,602 in funding.

AMOUNT	SPONSOR	PROPOSAL DUE DATE	ROLE OF CLEAR	FUNDED?
\$57,963	International Joint Commission	6/1/18	Principal investigator and led proposal development	Yes
\$200,000	NOAA	6/12/18	Principal investigator and led proposal development	Yes
\$49,359	Ohio Lake Erie Commission	6/7/18	Principal investigator and led proposal development	Yes
\$104,000	Ohio Department of Natural Resources	4/1/18	Principal investigator and led proposal development	Yes
\$49,964	NOAA Marine Debris Program	6/1/18	Principal investigator and led proposal development	Yes
\$4,997	Great Lakes Commission	5/21/18	Principal investigator and led proposal development	Yes
\$138,335	NOAA	5/22/18	Christopher Winslow, Kristen Fussell and Emily Burbacher were Co-PI's on this proposal and played a large role in proposal development and writing.	No, resubmitting in January 2019
\$61,500	NOAA	4/6/18	Led fellowship selection process and submitted the proposal to the National Sea Grant Office.	Yes
\$61,500	NOAA	4/6/18	Led fellowship selection process and submitted the proposal to the National Sea Grant Office.	Yes
\$61,500	NOAA	4/6/18	Led fellowship selection process and submitted the proposal to the National Sea Grant Office.	No
\$61,500	NOAA	4/6/18	Led fellowship selection process and submitted the proposal to the National Sea Grant Office.	Yes
\$61,500	NOAA	4/6/18	Led fellowship selection process and submitted the proposal to the National Sea Grant Office.	Yes
\$61,500	NOAA	4/6/18	Led fellowship selection process and submitted the proposal to the National Sea Grant Office.	Yes
\$29,595	ODNR Office of Coastal Management	4/10/18	Principal investigator and led proposal development	Yes
\$42,957	Ohio Division of Wildlife	3/1/18	Principal investigator and led proposal development	Yes
\$20,000	NOAA	12/1/17	Principal investigator and led proposal development	Yes
\$2,999,980	NSF	2/28/18	Principal investigator and assisted with proposal development.	No
\$2,822	Florida Sea Grant	3/2/18	Subawardee on larger proposal submitted by Florida Sea Grant. Assisted with proposal development.	No
\$132,216	ODNR Office of Coastal Management	2/26/18	Principal investigator and led proposal development	Yes
\$2,000,000	Ohio Department of Higher Education	2/1/18	Principal investigator and led proposal development	Yes
\$2,000,000	Ohio Department of Higher Education	2/1/18	Principal investigator and led proposal development	Yes
\$27,772	NOAA Marine Debris Program	12/15/17	Principal investigator and led proposal development	Yes
\$5,303,260	NOAA	11/8/17	Principal investigator and led proposal development	Yes
\$50,714	Ohio Department of Higher Education	10/12/17	Principal investigator and led proposal development	Yes
\$53,208	Ohio Department of Higher Education	10/12/17	Principal investigator and led proposal development	Yes
\$47,000	Indiana-Illinois Sea Grant	8/31/17	Principal investigator and led proposal development	Yes
\$39,938	NOAA Marine Debris Program	8/31/17	Principal investigator and led proposal development	Yes
\$44,159	Ohio EPA	7/10/17	Principal investigator and led proposal development	Yes

› AWARDS RECEIVED, JULY 2017–JUNE 2018

CLEAR staff (6 different principal investigators) received a total of \$6,675,405 in grant and foundation support between July 1, 2017 to June 30, 2018.



Continued Population Monitoring for the Threatened Lake Erie Watersnake with a Focus on Investigating Snake Fungal Disease

Sponsor: Ohio Division of Wildlife
PI: Kristin Stanford
Period: 14-Jun-18 through 30-Jun-19
Total Award: \$42,957
Direct: \$39,052
F&A: \$3,905
Allocation: 100%
Role of CLEAR: Principal Investigator

Great Lakes Air Deposition Mercury Monitoring Services

Sponsor: Ohio Environmental Protection Agency
Co-PI's: Christopher Winslow; Justin Chaffin
Period: 1-Jul-17 through 30-Jun-19
Total Award: \$21,891
Direct: \$17,374
F&A: \$4,517
Allocation: 100%
Role of CLEAR: Principal Investigator

ECOHAB 2017 Linking Process Models and Field Experiments to Forecast Algal Bloom Toxicity in Lake Erie

Sponsor: National Oceanic & Atmospheric Admin
PI: Justin Chaffin
Period: 1-Sept-17 through 31-Aug-20
Total Award: \$248,413
Direct: \$237,618
F&A: \$10,795
Allocation: 100%
Role of CLEAR: Principal Investigator

NOAA Sea Grant Omnibus 2014-2017

Sponsor: National Oceanic & Atmospheric Admin
PI: Christopher Winslow
Period: 1-Feb-14 through 31-Jan-19
Total Award: \$847,422
Direct: \$694,966
F&A: \$152,456
Allocation: 100%
Role of CLEAR: Principal Investigator (NOAA Sea Grant funds)

Ohio Department of Higher Education Harmful Algal Bloom Research Initiative Round 4

Sponsor: Ohio Department of Higher Education
Co-PI's: Christopher Winslow; Kristen Fussell
Period: 4-Apr-18 through 30-Jun-19
Total Award: \$3,476,522
Direct: \$3,476,522
F&A: \$0
Allocation: 100%
Role of CLEAR: Manage research projects for the Ohio Department of Higher Education - Harmful Algal Bloom Research Initiative

Sandusky Bay Initiative Integrated Monitoring and Data Assessment

Sponsor: Ohio Department of Natural Resources
Co-PI's: Christopher Winslow; Kristen Fussell
Period: 1-Feb-17 through 30-Jun-18
Total Award: \$847,422
Direct: \$17,000
F&A: \$17,000
Allocation: 100%
Role of CLEAR: Manage research projects for the Ohio Department of Natural Resources—Office of Coastal Management dealing with nutrients and algal blooms in Sandusky Bay

Sandusky Bay Monitoring and Data Assessment Phase 2

Sponsor: Ohio Department of Natural Resources
Co-PI's: Christopher Winslow; Kristen Fussell
Period: 1-Jun-18 through 30-Jun-19
Total Award: \$104,000
Direct: \$103,094
F&A: \$906
Allocation: 100%
Role of CLEAR: Manage research projects for the Ohio Department of Natural Resources—Office of Coastal Management dealing with nutrients and algal blooms in Sandusky Bay

Supporting Ohio Lake Erie Commission efforts to reduce nutrient inputs into Lake Erie

Sponsor: Ohio Lake Erie Commission
Co-PI's: Christopher Winslow; Kristen Fussell
Period: 18-Jun-18 through 30-Jun-19
Total Award: \$50,000
Direct: \$45,497
F&A: \$4,503
Allocation: 100%
Role of CLEAR: Manage research projects for the Ohio Lake Erie Commission dealing with nutrient inputs into Lake Erie

Wetland Sampling for the Nature Conservancy—Cedar Point site

Sponsor: The Nature Conservancy
PI: Tory Gabriel
Period: 30-Mar-17 through 31-Jul-17
Total Award: \$5,295
Direct: \$4,202
F&A: \$1,093
Allocation: 100%
Role of CLEAR: Principal Investigator

Wetland Sampling for the Nature Conservancy—Toussaint Wildlife Area site

Sponsor: The Nature Conservancy
PI: Tory Gabriel
Period: 31-Jan-17 through 31-Jul-17
Total Award: \$8,400
Direct: \$6,666
F&A: \$1,734
Allocation: 100%
Role of CLEAR: Principal Investigator





Education

2018 Knauss Fellowship—Heather Fair-Wu, OH

Sponsor: National Oceanic & Atmospheric Admin
Co-PI's: Christopher Winslow, Romano Lanno
Period: 1-Feb-18 through 28-Feb-19
Total Award: \$71,500
Direct: \$71,500
F&A: \$0
Allocation: 100%
Role of CLEAR: Manage Knauss Fellowship as a part of the Sea Grant College Program

2018 Knauss Fellowship—Jessical Collier, OH

Sponsor: National Oceanic & Atmospheric Admin
PI: Christopher Winslow
Period: 1-Feb-18 through 28-Feb-19
Total Award: \$69,500
Direct: \$69,500
F&A: \$0
Allocation: 100%
Role of CLEAR: Manage Knauss Fellowship as a part of the Sea Grant College Program

An Interactive Harmful Algal Blooms Fact Sheet to Educate the Public

Sponsor: Great Lakes Commission
PI: Jill Jentes
Period: 15-May-18 through 31-Dec-18
Total Award: \$4,997
Direct: \$4,543
F&A: \$454
Allocation: 100%
Role of CLEAR: Principal Investigator

Enhancing Access to Hands-On Scientific Learning Opportunities at The Ohio State University's Stone Laboratory

Co-PI's: Christopher Winslow; Kristen Fussell
Period: 1-Jan-17 through 31-Dec-18
Total Award: \$25,000
Direct: \$25,000
F&A: \$0
Allocation: 100%
Role of CLEAR: Principal Investigator

International Joint Commission—Ohio Sea Grant Fellowship – Ryan Graydon

Sponsor: International Joint Commission (Canada)
Co-PI's: Christopher Winslow; Kristen Fussell
Period: 15-Jun-18 through 14-Jun-19
Total Award: \$58,000
Direct: \$58,000
F&A: \$0
Allocation: 100%
Role of CLEAR: Manage the fellowship selection process and budget for the International Joint Commission

Immersive Scientific Learning Field Trips for Toledo Area Students

Co-PI's: Christopher Winslow; Kristen Fussell
Period: 1-Oct-17 through 31-Dec-18
Total Award: \$15,000
Direct: \$15,000
F&A: \$0
Allocation: 100%
Role of CLEAR: Principal Investigator

Ohio Sea Grant College Program Omnibus 2018–2022

Sponsor: National Oceanic & Atmospheric Admin
Co-PI's: Christopher Winslow, Kristen Fussell, Tory Gabriel, Jill Jentes
Period: 1-Feb-18 through 31-Jan-22
Total Award: \$1,365,753
Direct: \$1,077,554
F&A: \$288,199
Allocation: 100%
Role of CLEAR: Principal Investigator (NOAA Sea Grant funds)

Synthesizing and Summarizing Research and Scientific Information to Aid Resource Managers, Inform Public Policy, and Promote Great Lakes Restoration

PI: Christopher Winslow
Period: 1-Jan-18 through 31-Dec-18
Total Award: \$50,000
Direct: \$50,000
F&A: \$0
Allocation: 100%
Role of CLEAR: Principal Investigator

Outreach

Enhancing Awareness and Educational Opportunities for Historic Lake Erie Lighthouses

Sponsor: Ohio Historical Society
PI: Kristen Fussell; Kristin Stanford
Period: 1-Mar-18 through 30-Sep-19
Total Award: \$18,540
Direct: \$16,122
F&A: \$2,418
Allocation: 100%
Role of CLEAR: Principal Investigator

Lake Erie Cooperative Science and Monitoring Initiative (CSMI) Outreach Initiative

Sponsor: University of Illinois
Co-PI's: Jill Jentes; Christopher Winslow
Period: 1-Dec-16 through 30-Nov-17
Total Award: \$47,000
Direct: \$30,519
F&A: \$16,481
Allocation: 100%
Role of CLEAR: Principal Investigator

Ohio Clean Marinas Program: Cycle 21

Sponsor: Ohio Department of Natural Resources
Co-PI's: Sarah Orlando; Tory Gabriel A.; Christopher Winslow
Period: 1-Jul-17 through 30-Jun-18
Total Award: \$66,015
Direct: \$52,393
F&A: \$13,622
Allocation: 100%
Role of CLEAR: Principal Investigator – Ohio Department of Natural Resources provides half of the funding for the Ohio Clean Marinas program. The other half is funded by the NOAA Sea Grant funding.

Ohio Sea Grant's Center for Great Lakes Literacy (CGLL)

Sponsor: University of Illinois
Co-PI's: Kristin Stanford; Christopher Winslow
Period: 1-Dec-15 through 30-Nov-20
Total Award: \$39,200
Direct: \$31,936
F&A: \$7,264
Allocation: 100%
Role of CLEAR: Principal Investigator

Using a Teacher Mentor Model to Expand the Impact of the Center for Great Lake Literacy's Community of Practice

Sponsor: University of Illinois
Co-PI's: Kristin Stanford; Christopher Winslow
Period: 1-Dec-17 through 30-Nov-18
Total Award: \$20,000
Direct: \$15,873
F&A: \$4,127
Allocation: 100%
Role of CLEAR: Principal Investigator

Appendix F1

PROGRAM STAFF AS PRINCIPAL INVESTIGATORS

Through competitive research competitions, nine CLEAR staff members has **29 funded projects** totaling **\$2,383,003 in funding from 13 sponsors** including private foundations, state agencies and institutions and federal agencies and organizations.

PRINCIPAL INVESTIGATOR	INSTITUTION	PROJECT TITLE	SPONSOR	AMOUNT
Christopher Winslow	Ohio Sea Grant	Sandusky Bay Initiative Monitoring and Data Phase 2	Ohio Department of Natural Resources	\$9,965
Christopher Winslow	Ohio Sea Grant	Sandusky Bay Initiative Monitoring and Data	Ohio Department of Natural Resources	\$9,986
Christopher Winslow	Ohio Sea Grant	Research Administration for the Harmful Algal Bloom Research Initiative – Round 4	Ohio Department of Natural Resources	\$100,000
Christopher Winslow	Ohio Sea Grant	Research Administration for the Harmful Algal Bloom Research Initiative – Round 3	Ohio Department of Natural Resources	\$100,000
Christopher Winslow	Ohio Sea Grant	Research Administration for the Harmful Algal Bloom Research Initiative – Round 2	Ohio Department of Natural Resources	\$99,986
Christopher Winslow	Ohio Sea Grant	NOAA Regional Collaboration	NOAA	\$50,000
Jill Jentes	Ohio Sea Grant	An interactive Harmful Algal Blooms Fact Sheet to educate the public	Great Lakes Commission	\$4,997
Jill Bartolotta	Ohio Sea Grant	Behavior change and marine debris: Behavior change and marine debris: What strategies work best to encourage reusable bags instead of single use plastic bags?	NOAA	\$39,938
Joe Lucente	Ohio Sea Grant	Revitalizing Ohio's shipwrecks and maritime tales website	Ohio Department of Natural Resources	\$39,427
Kristin Stanford	Ohio Sea Grant	Continued population monitoring for the threatened Lake Erie Watersnake with a focus on investigating Snake Fungal Disease	Ohio Division of Wildlife	\$42,957
Kristin Stanford	Ohio Sea Grant	Using a Teacher Mentor Model to expand the impact of the Center for Great Lake Literacy's Community of Practice	University of Illinois	\$20,000
Justin Chaffin	Ohio Sea Grant	Lake Erie Open Water HAB Impairment Criteria	Ohio Department of Natural Resources	\$50,716
Justin Chaffin	Ohio Sea Grant	Investigating the environmental drivers of saxitoxin production in recreational and drinking source waters	Ohio Department of Natural Resources	\$53,208
Sarah Orlando	Ohio Sea Grant	Ohio Clean Marinas Program: Cycle 22	Ohio Department of Natural Resources	\$66,088



PRINCIPAL INVESTIGATOR	INSTITUTION	PROJECT TITLE	SPONSOR	AMOUNT
Jill Bartolotta	Ohio Sea Grant	Talking with Our Tourists: A Marine Debris Awareness Initiative	NOAA	\$49,964
Kristin Stanford	Ohio Sea Grant	Ohio Sea Grant's Center for Great Lakes Literacy (CGLL)	University of Illinois	\$39,200
Sarah Orlando	Ohio Sea Grant	Ohio Clean Marinas Program: Cycle 21	Ohio Department of Natural Resources	\$66,015
Christopher Winslow	Ohio Sea Grant	Great Lakes Air Deposition Mercury Monitoring Services	Ohio Environ Protection Agency	\$44,159
Tory Gabriel	Ohio Sea Grant	FCGX02: Statewide management of aquatic invasive species	Ohio Division of Wildlife	\$10,304
Justin Chaffin	Ohio Sea Grant	ECOHAB 2017 Linking process models and field experiments to forecast algal bloom toxicity in Lake Erie	NOAA	\$905,686
Kristen Fussell	Ohio Sea Grant	Enhancing awareness and educational opportunities for historic Lake Erie Lighthouses	Ohio Historical Society	\$18,540
Kristin Stanford	Ohio Sea Grant	Ohio Sea Grant's center for Great Lakes Literacy (CGLL)	University of Illinois	\$58,890
Tory Gabriel	Ohio Sea Grant	GLSGN habitattitude collaborative and surrender initiative	University of Minnesota	\$34,999
Justin Chaffin	Ohio Sea Grant	Effectiveness of data buoys as early warning systems for cHABs (cyanobacterial harmful algal blooms) in Lake Erie	US Geological Survey	\$33,139
Christopher Winslow	Ohio Sea Grant	iEvolue with STEM: Inquiry and engagement to invigorate and optimize learning for everyone	Bowling Green State University	\$230,019
Justin Chaffin	Ohio Sea Grant	An investigation of Central Basin harmful algal blooms	Ohio Department of Higher Education	\$29,819
Kristen Fussell	Ohio Sea Grant	Enhancing Access to Hands-On Scientific Learning Opportunities at The Ohio State University's Sotne Laboratory	Andrews Foundation	\$50,000
Kristen Fussell	Ohio Sea Grant	Immersive Scientific Learning Field Trips for Toledo Area Students	Toledo Community Foundation – First Solar	\$25,000
Christoher Winslow	Ohio Sea Grant	Synthesizing and Summarizing Research and Scientific Information to Aid Resource Managers, Inform Public Policy, and Promote Great Lakes Restoration	Joyce Foundation	\$100,000

Appendix F2

› NOAA SEA GRANT FUNDING

As a part of the National Sea Grant College Program, CLEAR had **\$5,704,540 in NOAA Omnibus funding** active between July 1, 2017 and June 30, 2018. Of that funding, **\$4,035,820 is in core funding** to support the CLEAR extension, management, communications and development. The remaining funds are Ohio Sea Grant College Program large and small grant pass-through dollars and we had funded **60 projects totaling \$1,668,720** given to **26 principal investigators at 12 institutions**.

SPONSOR: NOAA	PRINCIPAL INVESTIGATOR	INSTITUTION	PROJECT TITLE	AMOUNT
	Christopher Winslow	Ohio Sea Grant	Ohio Sea Grant Omnibus Management	\$182,482
	Christopher Winslow	Ohio Sea Grant	Ohio Sea Grant Omnibus Management	\$750,631
	Christopher Winslow	Ohio Sea Grant	Ohio Sea Grant Omnibus Development	\$30,550
	Christopher Winslow	Ohio Sea Grant	Ohio Sea Grant Omnibus Development	\$40,227
	Tory Gabriel	Ohio Sea Grant	Ohio Sea Grant Omnibus Extension Program	\$558,657
	Tory Gabriel	Ohio Sea Grant	Ohio Sea Grant Omnibus Extension Program	\$1,798,852
	Tory Gabriel	Ohio Sea Grant	Ohio Sea Grant Omnibus Extension Program, Community Development	\$225,000
	Jill Jentes	Ohio Sea Grant	Ohio Sea Grant Omnibus Communications Program	\$84,643
	Jill Jentes	Ohio Sea Grant	Ohio Sea Grant Omnibus Communications Program	\$364,778
	Tim Davis	Bowling Green State University	Hindcasting cyanobacterial harmful algal bloom timing and extent in western Lake Erie using lake surface temperature variability	\$10,000
	Wu Lu	Ohio State University	BioFET Sensors for Detection of Saxitoxins and Anatoxins	\$10,000
	Helen Michaels	Bowling Green State University	Effects of nutrients on invasive Flowering Rush in Lake Erie diked wetlands	\$9,998
	John Farver	Bowling Green State University	Trace Element Uptake in Grass Carp Otoliths	\$9,974
	Tim Davis	Bowling Green State University	Metagenomic and metatranscriptomic surveys of Ohio lakes with emerging toxins of concern	\$9,997
	Bryan Stubbs	Cleveland Water Alliance	Software Defined Network/IoT (SDN) for phosphorous data collection, analytics, speed, low latency, security, and security” for the full amount requested	\$10,000
	Lauren Kinsman-Costello	Kent State University	Sampling Sandusky Bay Sediments for Phosphorus Biogeochemistry Analysis	\$4,500
	Brian Trease	University of Toledo	Development of Persistent, High-Resolution Remote Sensing of Cyanobacterial Distributions	\$10,000
	Justin Chaffin	Ohio Sea Grant	Research Experience for Undergrads 2017	\$9,986
	Christopher Spiese	Ohio Northern University	Phosphorus mobilization by glyphosate	\$10,000
	Lauren Kinsman-Costello	Kent State University	Opening the black box of nutrient processing in a Great Lakes coastal wetland	\$59,268
	Andrew Bruening	PAST Foundation	Design and implementation of aquatics based after school program at PAST Innovation Lab	\$9,950
	Suresh Sharma	Youngstown State University	Investigating Temporal and Spatial Variability of Streamflow and Salinity Level in the Mentor Marsh Watersheds for Phragmites Control and Ecological Benefit	\$9,993



SPONSOR: NOAA

PRINCIPAL INVESTIGATOR	INSTITUTION	PROJECT TITLE	AMOUNT
Jill Jentes	Ohio Sea Grant	Equipment for development of multi-media outreach products at Stone Laboratory	\$9,265
Stuart Ludsin	Ohio State University	Stock structure and contribution of west and east basin walleye to recreational and commercial fisheries in Lake Erie	\$59,958
Suzanne Gray	Ohio State University	Seeing the bait on the hook: Assessing the impact of harmful algal blooms on the recreational Walleye fishery in Lake Erie	\$59,988
Xiaozhen Mou	Kent State University	Occurrence of pharmaceuticals and personal care products (PPCPs) in source and finished waters for public supply in Northeast Ohio	\$60,000
Brent Sohngen	Ohio State University	Valuing Lake Erie Beaches and the impact of Impairments on Beach Users	\$59,295
Laura Johnson	Heidelberg University	Glyphosate runoff dynamics in tributaries draining into the Sandusky River	\$59,270
Vipaporn Phuntumart	Bowling Green State University	Development of an efficient approach to quantify and control a fish disease caused by Saprolegnia sp.	\$60,000
Victoria Campbell-Arvai	University of Michigan	Beyond the medicine cabinet: Public perceptions of the risks of pharmaceuticals and personal care products to aquatic systems and related disposal behaviors	\$50,522
Mark McCarthy	Wright State University	Sediment nitrogen dynamics in the western basin of Lake Erie relative to cyanobacterial blooms	\$120,000
Audrey Sawyer	Ohio State University	Hydrologic controls on legacy phosphorus release to Lake Erie	\$119,360
Suzanne Gray	Ohio State University	Can fish see the bait on the hook? Linking effects of algal and sedimentary turbidity on fish vision to the Lake Erie recreational fishery through research and outreach	\$119,839
Silvia Newell	Wright State University	Characterizing ammonium dynamics affecting harmful algal blooms in Lake Erie	\$120,000
Yvonne Vadeboncoeur	Wright State University	From the headwaters to the littoral zone: using attached algae as indicators of ecosystem impairment and nutrient processing in the Lake Erie watershed	\$119,552
Fasong Yuan	Cleveland State University	Anthropogenic phosphorus storage, bioavailability, and cycling in the Maumee Bay and western Lake Erie	\$119,855
George Bullerjahn	Bowling Green State University	What makes Planktothrix bloom? An examination of physiological ecology from a genomics perspective	\$119,137
Linda Weavers	Ohio State University	Delivery of sediment amendments using far-field ultrasounds	\$119,350
Hanping Wang	Ohio State University	Developing superior neomale broodstocks and genetically fast-growing monosex female populations in yellow perch and evaluating their growth and production potential at different culture regimes	\$119,663

Appendix F3

PROJECTS MANAGED

Ohio Sea Grant is managing **\$6,321,518 in grant dollars** on behalf of 6 different state, national, and bi-national agencies resulting in **59 projects awarded to 35 principal investigators** at 10 institutions.

PRINCIPAL INVESTIGATOR	INSTITUTION	PROJECT TITLE	AMOUNT
Allison MacKay	Ohio State University	Kinetic Models for Oxidative Destruction of Cyanotoxins in Raw Drinking Water	\$254,306
April Ames	University of Toledo	Characterization of recreational exposures to cyanotoxins in western Lake Erie basin	\$21,213
April Ames	University of Toledo	HAB associated health effects and airborne microcystin levels among recreational lake users	\$133,737
Bob Midden	Bowling Green State University	Tracking and Attenuating Nutrient Loads from Manure Fertilization	\$207,123
Catharine McGhan	University of Cincinnati	HABSat-1 (Harmful Algae Bloom Satellite-1)	\$131,083
David Kennedy	University of Toledo	Novel therapies for microcystin induced hepatotoxicity in pre-existing liver disease	\$147,708
David Kennedy	University of Toledo	High-throughput analysis of human toxicity and therapeutics targets of cyanotoxins across organ systems in health and disease	\$148,404
George Bullerjahn	Bowling Green State University	Seasonal quantification of toxic and nontoxic Planktothrix in Sandusky Bay by qPCR	\$31,571
Glenn Lipscomb	University of Toledo	Evaluating Home Point-of-Use Reverse Osmosis Membrane Systems for Cyanotoxin Removal	\$99,328
Greg Labarge	Ohio State University	Farmer/farm advisor water quality sampling network	\$148,380
Harold Keener	Ohio State University	Evaluation of the effects of changing on-farm manure management practices on reduction of dissolved phosphorus runoff	\$119,273
Jason Huntley	University of Toledo	Discovery of Enzymes and Pathways Responsible for Microcystin Degradation	\$95,216
Jason Huntley	University of Toledo	Testing and Optimization of Microcystin Detoxifying Water Biofilters	\$156,405
Jiyoung Lee	Ohio State University	A comprehensive approach for evaluation of acute toxic responses after microcystin ingestion	\$184,292
Jiyoung Lee	Ohio State University	Environmental Fate and Persistence of Microcystin in Land Applied Drinking Water	\$52,699
John Lenhart	Ohio State University	Optimization of carbon barriers for effective removal of dissolved cyanotoxins from Ohio's fresh water	\$105,746
John Lenhart	Ohio State University	Optimizing the Use of Powdered Activated Carbon for Saxitoxin Removal	\$124,188
Laura Johnson	Heidelberg University	Determining sources of phosphorus to western Lake Erie from field to lake	\$169,266
Laura Johnson	Heidelberg University	Expanding the Heidelberg Tributary Loading	\$500,000
Margaret Kalcic	Ohio State University	How quickly can target phosphorus reductions be met? Robust predictions from multiple watershed models.	\$255,757

SPONSOR: OHIO DEPARTMENT OF HIGHER EDUCATION



PRINCIPAL INVESTIGATOR	INSTITUTION	PROJECT TITLE	AMOUNT
Margaret Kalcic	Ohio State University	Critical model improvements for simulating promising conservation actions for tile- drained fields in the Maumee River watershed	\$118,119
Matt Davies	Ohio State University	Tracking and Attenuating Nutrient Loads from Manure Fertilization	\$3,600
Michael McKay	Bowling Green State University	Early season (March) phosphorus inventory of offshore waters of Lake Erie	\$17,947
Michael McKay	Bowling Green State University	Quantifying viral activity associated with microcystin-producing cyanobacteria to inform water treatment options for Ohio's public water systems	\$79,916
Nicholas Basta	Ohio State University	Environmental Fate and Persistence of Microcystin in Land Applied Drinking Water	\$107,976
Patrick Lawrence	University of Toledo	Spatial Distribution Model for Manure from Permitted Livestock Facilities (CAFOs/CAFFs) in the Lake Erie Western Basin and Maumee Watershed, Ohio	\$34,846
Paula Mouser	Ohio State University	Determining sources of phosphorus to western Lake Erie from field to lake	\$30,000
Saatvika Rai	University of Toledo	Effectiveness in Implementation: Mapping Agricultural Management Practices, Farmer Perceptions and Outcomes	\$120,889
Soryong Chae	University of Cincinnati	Optimization of carbon barriers for effective removal of dissolved cyanotoxins from Ohio's fresh water	\$104,949
Steven Haller	University of Toledo	Effects of inflammatory bowel disease on susceptibility to microcystin-LR	\$149,715
Stuart Ludsin	Ohio State University	Development of the MMPB method for quantifying total microcystins in water edible Lake Erie fish tissues	\$156,617
Stuart Ludsin	Ohio State University	Physiological, growth and survival response of age-0 yellow perch and walleye to toxic cyanobacteria	\$152,886
Teresa Cutright	University of Akron	Evaluation of Optimal Algaecide Sources and Dosages for Ohio Drinking Water Sources	\$137,842
Thomas Bridgeman	University of Toledo	HAB Avoidance: Vertical Movement of Harmful Algal Blooms in Lake Erie	\$206,145
Thomas Bridgman	University of Toledo	Lake Erie Open Water HAB Impairment Criteria	\$97,125
Thomas Knobloch	Ohio State University	Metabolomic Biomarkers of Acute and Chronic Cyanotoxin Exposure During the Promotion of Hepatic Carcinogenesis	\$140,718
Tim Davis	Bowling Green State University	Investigating the environmental drivers of saxitoxin production in recreational and drinking source waters	\$145,900
Wu Lu	Ohio State University	ImmunoFET Sensors for Detection of Microcystins in Human Biological Samples	\$189,307
Wu Lu	Ohio State University	GaN ImmunoFET Biosensors for Multiplexing Detection of Cyanotoxins in Water	\$110,981

Appendix F3

› PROJECTS MANAGED (CONTINUED)

Ohio Sea Grant is **managing \$6,321,518 in grant dollars** on behalf of 6 different state, national, and bi-national agencies resulting in **59 projects awarded to 35 principal investigators** at 10 institutions.

SPONSOR: OHIO LAKE ERIE COMMISSION	PRINCIPAL INVESTIGATOR	INSTITUTION	PROJECT TITLE	AMOUNT
	Bob Midden	Bowling Green State University	Tracking and Attenuating Nutrient Loads from Manure Fertilization	\$16,370
	Christopher Winslow	Ohio Sea Grant	Supporting Ohio Lake Erie Commission efforts to reduce nutrients and identify beneficial uses of dredged material	\$4,089
	Harold Keener	Ohio State University	Evaluation of the effects of changing on-farm manure management practices on reduction of dissolved phosphorus runoff	\$17,130
	Kevin McCluney	Bowling Green State University	Evaluating nutrient retention and removal associated with ditch management and restoration and exploring the role of biota	\$15,729
	Laura Johnson	Heidelberg University	Glyphosate runoff dynamics in tributaries draining into the Sandusky River	\$16,500
	Lauren Kinsman-Costello	Kent State University	Nutrient biogeochemistry consequences of beneficial re-use of dredge material (Sandusky Bay)	\$14,432
	Tim Davis	Bowling Green State University	Hindcasting cyanobacterial harmful algal bloom timing and extent in western Lake Erie using lake surface temperature variability	\$15,750

SPONSOR: INTL JOINT COMMISSION (CANADA)	PRINCIPAL INVESTIGATOR	INSTITUTION	PROJECT TITLE	AMOUNT
	Jennifer Boehme	International Joint Commission	International Joint Commission – Ohio Sea Grant Fellowship – Ryan Graydon	\$58,000



SPONSOR: OHIO DEPT OF NATURAL RESOURCES	PRINCIPAL INVESTIGATOR	INSTITUTION	PROJECT TITLE	AMOUNT
	Ed Verhamme	LimnoTech	LimnoTech:Sandusky Bay monitoring and data Phase 2	\$18,095
	George Bullerjahn	Bowling Green State University	BGSU: Sandusky Bay monitoring and data Phase 2	\$34,820
	George Bullerjahn	Bowling Green State University	BGSU: Sandusky Bay initiative integrated monitoring and data assessment	\$107,410
	Laura Johnson	Heidelberg University	Heidelberg: Sandusky Bay initiative integrated monitoring and data assessment	\$25,850
	Lauren Kinsman-Costello	Kent State University	Kent: Sandusky Bay monitoring and data Phase 2	\$41,120
	Lauren Kinsman-Costello	Kent State University	Kent: Sandusky Bay initiative integrated monitoring and data assessment	\$41,050
	Laura Johnson	Heidelberg University	Expanding the Heidelberg tributary loading program	\$500,000

SPONSOR: NOAA	PRINCIPAL INVESTIGATOR	INSTITUTION	PROJECT TITLE	AMOUNT
	Christopher Winslow	Ohio Sea Grant	2018 Knauss Fellowship - Heather Fair-Wu	\$71,500
	Jonathan Bossenbroek	University of Toledo	2018 Knauss Fellowship - Jessica Sherman-Collier	\$69,500
	Tom Crane	Great Lakes Commission	Great Lake Commission 2018 Fellowship	\$21,000
	Tom Crane	Great Lakes Commission	Great Lake Commission 2017 Fellowship	\$21,000
	Tom Crane	Great Lakes Commission	Great Lakes Commission 2016 Fellowship	\$21,000

Major Activities > CLEAR 2017

CLEAR has worked with university, government and private sector partners to lead projects that have brought research, education and outreach together to help restore Lake Erie, Ohio's most important natural resource. Below are major partnered projects that are creating that impact and helping The Ohio State University empower the citizens of Ohio and the Great Lakes region.

OUTREACH ACCOMPLISHMENTS

1 > NOAA HABS FORECAST EVENT HELPS OHIO COASTAL COMMUNITIES PLAN FOR LAKE ERIE SUMMER HABS

Primary Partners: NOAA OAR, NOAA NOS, NOAA GLERL, Heidelberg University, The University of Toledo, University of Michigan, LimnoTech

Since 2012, Ohio Sea Grant has hosted NOAA's annual Lake Erie Harmful Algal Bloom (HAB) Forecast at Stone Laboratory. The forecast, which brings NOAA and university scientists together for a four-hour media event, unveils what NOAA and partners' models predict will be the summer's Lake Erie algal bloom size and toxicity. Attending guests include more than 20 media outlets, as well as stakeholders from coastal communities including elected officials, sectors of the tourism industry, and local businesses. To expand its reach, the program provides a webinar where more than 300 people from across the country can ask questions to the HABs experts and obtain educational materials about HABs created by Sea Grant and its partners.

2 > OHIO'S DECISION MAKERS LEARN ABOUT LAKE ERIE SCIENCE THROUGH HANDS-ON OUTREACH EVENT

Primary Partners: Miller Boat Line, local Put-in-Bay businesses

Local, state and federal lawmakers and officials make important decisions every day that ultimately impact Ohio's Great Lake. To help these officials better understand the issues, Ohio Sea Grant hosts Decision Maker and Coastal County Commissioner Days on Lake Erie. Governmental officials not only hear about the challenges and opportunities facing the region's environmental health and economy, but get the chance to appreciate the lake by participating in hands-on activities. Over the years, this educational program has significantly helped elected officials to cast more informed votes on a number of key programs and issues affecting Lake Erie and Ohio's aquatic resources. In 2017, 45 officials from state and local coastal communities came to the two-day event.

3 > LAKE ERIE TOURISM COMMITMENT LINKS ECONOMIC DEVELOPMENT WITH RESOURCE PROTECTION

Primary Partners: Ohio Travel Association, Ohio's lake county tourism bureaus

Generating more than \$15 billion in economic impact every year, Lake Erie tourism has the power to transform communities. Ohio Sea Grant has long recognized the importance of coastal tourism and has created eco-tourism programming at Stone Lab, conducted research, created publications and helped develop partnerships to promote and protect Lake Erie. Ohio Sea Grant also works with the Ohio Travel Association to produce the Ohio Tourism Academy, which educates future industry leaders to make informed decisions about Lake Erie and Ohio travel. With 150 graduates, the Leadership Academy is shaping the future of tourism in Ohio, as 85% of graduates campaign for leadership positions within three years of graduation.

4 > CHARTER CAPTAINS GAIN BUSINESS TOOLS TO LURE NEW CUSTOMERS AND PROFITS

Primary Partners: ODNR Division of Wildlife, Lake Erie Charter Boat Association, U.S. Customs and Border Protection, U.S. Coast Guard

Nearly 700 charter captains do business in Ohio along Lake Erie, and their customers spend millions in restaurants, hotels, retail shops, bait shops, and other area businesses. Keeping up with new fishing techniques and business practices is easier for these Ohio business owners thanks to Ohio Sea Grant's annual Charter Captains Conference. In fact, more than half of all captains attending 2017's conference report an increase in their bottom line due to what they learned. With 85% of these captains reporting they've changed their way of doing business as a result, Ohio Sea Grant's Charter Captains Conferences continue to help these local businesses succeed.



Lake Erie tourism generates

\$15 BILLION



IN ECONOMIC IMPACT ANNUALLY



700

CHARTER CAPTAINS

do business in Ohio along Lake Erie





5 > CHARTER BOAT CAPTAINS COLLECT WATER SAMPLES; PROVIDE SCIENCE EXPERIENCE TO FISHERMEN

Primary Partners: OEPA, & Lake Erie charter boat captains

Harmful cyanobacterial blooms in Lake Erie are an annual summer occurrence that can foul beaches, contribute to low dissolved oxygen concentrations, and produce toxins that have harmful effects on the human liver, skin, and nervous system. To help researchers track blooms and collect samples for study, Lake Erie charter boat captains have been helping Stone Lab monitor water quality since 2013, when the lab took over the sampling program from the Ohio EPA. The captains collect water samples during their regular fishing cruises, greatly expanding the number of water samples available for analysis during HAB season. Since 2013, the captains have collected 517 samples while educating 1,463 clients about Lake Erie water quality, HABs and statewide research efforts. The data from the captains' samples are used by NOAA scientists to validate satellite image data, by researchers from several universities studying blooms, and by lake managers to track bloom toxicity.

6 > PARTNERING TO HELP PRESERVE COASTAL LANDS

Primary Partners: Lake Erie Islands Conservancy, Put-in-Bay Township Park District

The Lake Erie Islands are a unique environment in Ohio, providing critical habitat for many indigenous animals and plants. They have been identified as one of the most vulnerable regions to development in the Great Lakes, while also holding significant value both biologically and economically. Ohio Sea Grant has maintained long-standing partnerships with the Lake Erie Islands Conservancy since 2003 and the Put-in-Bay Township Park District (PIBTPD) since 2007, assisting to conserve and protect the islands for future generations. This partnership led to the preservation of coastal and inland lands that benefit both island residents and businesses (e.g. birding ecotourism) and endemic island wildlife, and provide outdoor education for students. OSG educators have served on the board of directors of the LEIC since 2003, assisting with writing grants and providing letters of support that helped preserve more than 72 acres of coastal lands. In 2017, land protection efforts resulted in permanent protection of 13,039 acres of property that provide biological, educational and economic value to the region.



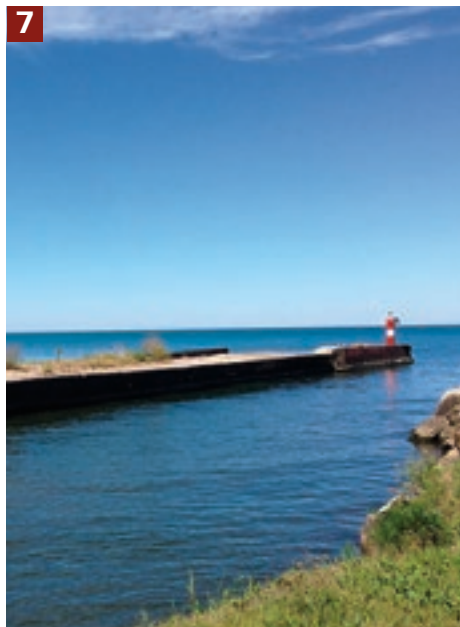
CLEAR helps to conserve and protect the islands for future generations through partnerships with the Lake Erie Islands Conservancy and the Put-in-Bay Township Park District.

Major Activities (CONTINUED)

7 > PROTECTING LAKE ERIE BY CLEANING UP ITS TRIBUTARY

Primary Partners: US EPA GLNPO, OEPA, US Army Corps of Engineers, Ashtabula City Port Authority

A clean river protects Lake Erie from contamination, allows increased commercial shipping, and provides new opportunities for marinas and other tourism-related businesses. In 2008, the Ashtabula River Partnership achieved its long-term goal of removing more than 635,000 cubic yards of contaminated sediment from the Ashtabula River and placing it in a specially designed landfill. Ohio Sea Grant Extension was one of the founding partners of the Ashtabula River Partnership in 1994 and continues as a member of the advisory committee to develop strategies to remove the existing Beneficial Use Impairments and advise the EPA in continuing to clean up this important tributary.



8 > OHIO PUBLIC OFFICIALS LEARN TO MAKE SUSTAINABLE DECISIONS

Primary Partners: Ohio Township Association

The Ohio Township Association (OTA), representing 1,308 townships, wanted to enable elected and appointed officials to make more sustainable decisions for future generations. Based on lessons learned from its Local Government Leadership Academy, Ohio Sea Grant worked with OTA to create curriculum geared toward decision making that focuses on environmental sustainability, economic stability and societal health, educating 136 Ohio township trustees and fiscal officers throughout the state in 2017. A survey of 58 participants shows that 60 percent of participants learned information that either helped them keep their jobs or prepared them to advance professionally, 15 percent have become elected officials, 4 percent have become appointed officials and 92 percent have pursued a career in public service or continued working for the State of Ohio. Three percent of participants report using Ohio Sea Grant facilitated curricula in formal or informal education courses.





9 > CREATING LAKE ERIE ISLANDS WATER TRAILS GUIDE TO INCREASE INTEREST IN PADDLING SPORTS

Primary Partners: U.S. National Park Service, Put-in-Bay Township Park District, lake county tourism bureaus

Kayaking and paddling sports continue to thrive in the Lake Erie islands but no guides exist to keep people safe while enjoying the landscape responsibly. The National Park Service, Put-in-Bay Township Park District and Ohio Sea Grant worked together in 2016 to create a branded effort which included a brochure, Lake Erie Islands Water Trails Guide and corresponding access point signs. The publications were distributed through the lake tourism bureaus and local Put-in-Bay businesses to help support Lake Erie paddling tourism.

10 > STEERING SOCIAL CHANGE TO REDUCE PLASTIC IN LAKE ERIE

Primary Partners: City of Cleveland Mayor's Office Sustainability, thundertech::tech, NOAA Marine Debris Program

Plastic in the Great Lakes affects water quality, human and animal safety, and shoreline aesthetics. When 87% of items found on Great Lakes beach cleanups are single-use plastic, there is a need to educate the public to decrease use. In 2017, Ohio Sea Grant partnered with the City of Cleveland Mayor's Office of Sustainability and thundertech::inc to study consumer behavior around single-use plastic items like water bottles, shopping bags, and cigar tips. Coupled with a \$40,000 grant from the NOAA Marine Debris Program to continue the research focused on plastic bags used at grocery stores, Ohio Sea Grant is identifying the type of bag used (single-use plastic versus reusable) in the store before and after behavior change reminder strategies are implemented. Results have informed the social marketing campaign "Don't Break the Lake". The plastic bag results were also instrumental in providing Cuyahoga County legislators with scientific data on consumer opinion for a potential plastic bag levy, and led to the hire of a new communication and education position for the Cleveland Water Department.

11 > LEADERSHIP ACADEMY ENCOURAGES GOOD GOVERNMENT

Primary Partners: OSU Extension Community Development, County Commissioners Association of Ohio, Ohio Township Trustee Association, Toledo Area Chamber of Commerce

Good government is the goal of the Local Government Leadership Academy in Toledo. Developed by Ohio Sea Grant Extension through partnerships with OSU Community Development, the County Commissioners Association of Ohio, Ohio Township Trustee Association, and the Toledo Area Chamber of Commerce, this 10- week course helps elected officials improve their leadership and negotiation skills and relevant Ohio knowledge to become better community leaders. Nearly 400 people have participated since 2002, when the academy graduated its first class, including mayors, State Senators, and State Representatives. Sea Grant has assisted many other Ohio counties in developing similar programs.

12 > EMPOWERING LAKE ERIE PUBLIC TO STOP SPREAD OF INVASIVE SPECIES

Primary Partners: Great Lakes Sea Grant Network

Aquatic Invasive Species (AIS) threaten inland lakes, rivers, wetlands, estuaries and oceans. Over 185 AIS are documented in the Great Lakes, carrying tremendous economic costs to the region. Unfortunately many people don't realize individual activities remain a major vector to spread AIS. The Great Lakes Sea Grant Network, led by Minnesota Sea Grant, developed a comprehensive AIS public outreach initiative to help prevent AIS introductions, and two additional projects to address organisms in the aquarium trade. Programs use existing and effective "Stop Aquatic Hitchhikers!" and Habitattitude campaigns to relay project messages, including to "Clean, Drain, Dry" all equipment used in water and never release aquatic pets and plants in the wild. Ohio Sea Grant reached an estimated 11,210 individuals in 2017 with information on AIS, Asian carps, and methods to stop AIS from spreading.



Since 2002, nearly

**400
PEOPLE**

**HAVE PARTICIPATED
IN THE LOCAL
GOVERNMENT
LEADERSHIP ACADEMY**



**OHIO SEA GRANT
HAS REACHED**

11,210

INDIVIDUALS

with information on
aquatic invasive species,
and Asian carp

Major Activities (CONTINUED)

13 > SEA GRANT HELPS MARINAS REDUCE NONPOINT SOURCE POLLUTION IN OHIO'S LAKES AND RIVERS

Primary Partners: Lake Erie Marine Trades Association, Ohio Department of Natural Resources, Ohio Coastal Management Program

Marinas, like many industries, generate pollution. Because of their nearshore location, marinas serve as a "last chance" to address this pollution before it enters Lake Erie. Ohio Sea Grant's Clean Marinas Program, a partnership with the Lake Erie Marine Trades Association and the Ohio Department of Natural Resources, encourages marinas to voluntarily adopt EPA-approved pollution control practices that help minimize potential for water pollution. In 2017 the program offered six Clean Marinas educational workshops to 62 individuals, organizations and marinas, and provided 20 site reviews to evaluate marinas' efforts to lessen their impacts on Lake Erie. Through a voluntary process, seven marinas were certified in 2017, implementing 497 best management practices in the Lake Erie and Ohio River watersheds. Three marinas were recertified for continuing to meet requirements, and four marinas pledged to become certified. The Certified Marinas comprise ~30 percent of the wet slips on Lake Erie.

14 > LEADING REGIONAL OUTREACH EFFORT FOR EPA'S CSMI GREAT LAKES RESEARCH INITIATIVE

Primary Partners: U.S. EPA, Environment and Climate Change Canada, 7 Great Lakes Sea Grant Programs

The binational coordination of research efforts of EPA's Cooperative Science and Monitoring Initiative (CSMI) has been successful, with research coordination among the Great Lakes, but getting that information out to state and local agencies, as well as the general public, has been limited.

To help increase awareness of the program, EPA asked the Great Lakes Sea Grant Network in 2016 to coordinate the research, communication and outreach efforts of each lake's cycle, with Ohio Sea Grant leading the outreach strategy. The program produced summaries of the most recent research projects and plans to create a website to house findings from future CSMI years.

15 > EDUCATING THOUSANDS ON LAKE ERIE MARINE DEBRIS

Primary Partners: City of Cleveland, City of Painesville, Clean Marinas Program, Cleveland Museum of Natural History, Erie County Soil and Water, Lake Erie Nature and Science Center, NOAA Marine Debris Program, Ohio Department of Natural Resources

Marine debris in the Great Lakes is becoming increasingly more problematic as it affects the environment, human health, and the economy. Marine debris education and prevention strategies that individuals can apply daily will be useful tools as communities struggle to clean up the vast amounts of debris found in coastal areas. To help educate the public about what role they can play to decrease marine debris, Ohio Sea Grant developed an interactive curriculum for use in classrooms and at outreach events. Ohio Sea Grant has also organized several beach cleanups engaging students and coastal residents so they can see the effects of marine debris first-hand. Through educational programming, outreach events, and exhibit displays, Ohio Sea Grant has educated 52,555 people on the impacts of and prevention strategies for marine debris. 71% of participants have changed their actions and 8.25 acres of shoreline have been restored.

16 > CREATING AN ECONOMIC DEVELOPMENT ASSESSMENT FOR A CITY

Primary Partners: OSU Extension, City of Perrysburg

Located 12 miles southwest of Toledo along the south side of the Maumee River, the City of Perrysburg has a diverse economy but is limited in space for businesses to expand or relocate. Ohio Sea Grant partnered with the City of Perrysburg and OSU Extension to lead a business retention and expansion program to survey existing businesses in Perrysburg and assess plans and concerns regarding job retention, creation and business expansion activities. The group learned that 116 businesses will retain 1,721-2,880 jobs and 40 of 116 businesses reported plans to expand, modernize or renovate. Firms plan to add jobs within the next 12 months. The number of new employees is estimated to represent 58-177 new full-time jobs with an estimated value of \$33,117-\$101,063 in additional income tax revenue, and an estimated addition of \$2.2-\$6.7 million in personal income to Perrysburg's local economy.



OHIO SEA GRANT HAS EDUCATED

52,555
PEOPLE

on the impacts of and prevention strategies for marine debris.



71% of participants have changed their actions



The number of new jobs in Perrysburg is estimated to bring an additional

\$2.2-\$6.7
MILLION



IN PERSONAL INCOME TO THE LOCAL ECONOMY



17 > MARINE TRADES INDUSTRY BENEFITS FROM OHIO SEA GRANT ENVIRONMENTAL EDUCATION AND PROFESSIONAL DEVELOPMENT

Primary Partners: Ohio Department of Natural Resources, Ohio Office of Coastal Management Program

In 2016, the Ohio Clean Marinas Program conducted a program evaluation to assess current and future needs of the marina industry in Ohio. Certified marinas reported the most important training needs as regulatory updates, education for boaters, and continuing education. Ohio Clean Marinas staff developed a marina conference to provide in-person training for certified Clean Marinas and interested personnel. The 2017 conference included presentations from experts on electric shock drowning, dredging, harmful algal blooms, boat bottom washing, tourism and marketing, and invasive species.

Over 50 marina managers and staff attended the conference, with 100% of attendees surveyed intending to use the information in future decision making, and 90% intending to share what they learned. 75% of attendees surveyed received information at the event that will help them keep their business going or advance professionally, and 90% of survey respondents felt that the conference was a good use of their time.

18 > DEVELOPING A TIERED CERTIFICATION PROGRAM FOR OHIO MARINAS

Primary Partners: Ohio Department of Natural Resources, Ohio Office of Coastal Management Program, OEPA

In 2015, the Ohio Clean Marinas Program celebrated 10 years since the first marina was certified for adopting environmental best management practices (BMPs). In 2017, Ohio Clean Marinas Program staff worked with certified marinas, agency representatives, and advisory board members to restructure the BMP checklist into a tiered certification. The program grandfathers currently certified marinas into a base certification while providing additional tiers of innovative, impactful practices for marinas to achieve. The 78-item checklist was rooted in regulatory compliance with recommended BMPs, but has been revised to include new practices based on best available science and enhance focus on priority areas such as nutrient runoff, habitat, and community engagement. Compliance with regulatory requirements are a part of the base certification, with additional tiers of the certification program requiring practices that go well beyond what is required by law.



In 2017, Ohio Clean Marinas Program staff worked with certified marinas, agency representatives, and advisory board members to restructure the BMP checklist into a tiered certification.



Major Activities (CONTINUED)

EDUCATION ACCOMPLISHMENTS

1 > HANDS-ON LEARNING AT STONE LAB SHAPES FUTURE OF AQUATIC PROFESSIONALS IN THE SCIENCES

Primary Partners: 15 Ohio State Departments (including OR, CFAES, ASC, EEOB, SENR, Graduate School, Continuing Education, Enrollment Services, Student Life), ODNR, OEPA, Bowling Green State University, Kent State University, Heidelberg University, The University of Toledo, Friends of Stone Lab

Lake Erie is a living laboratory for science students, offering 19 science and education courses to 147 teachers and high school and college students for college credit in 2017. From capturing fish and insects to examining lake sediments, Stone Lab students experience firsthand what it takes to be a scientist and gives them access to cutting edge curriculum and exposure to scientists conducting research that is directly relevant to the Great Lakes region. A survey sent to 1516 students that took courses and workshops at Stone Lab since 2012 highlights the success of the program: Of the 299 individuals that responded to the survey, 79 graduated and were employed in a career related to their degree within two years of graduation (STEM job, M.S. or Ph.D. degree programs, Post-doc, or professional school).

2 > USING APPLIED LEARNING ACTIVITIES TO EDUCATE THOUSANDS OF STUDENTS ABOUT LAKE ERIE SCIENCE

Primary Partners: 91 elementary schools, Miller Boat Line, Friends of Stone Lab

For more than 35 years, Stone Lab has offered students in grades 5 through 12 opportunities to go on Stone Lab research vessels, huddle over microscopes in the lab, and experience invertebrate, bird, and plant walks, things that are often unavailable in traditional classroom settings. Located on Lake Erie's Gibraltar Island, Stone Lab is The Ohio State University's island campus and the education arm of Ohio Sea Grant. Stone Lab offers students the chance to be a scientist for a day, participating in activities such as fish trawling and seining, fish identification and dissection, plankton identification, and water quality monitoring to show them real-world science applications outside the classroom. In 2017, 7392 participants from 91 elementary groups experienced the lab's hands-on outdoor field trip program and participated in ongoing studies concerning current Lake Erie issues such as harmful algal blooms. They gained both awareness and understanding of Lake Erie's natural, cultural, environmental and economic importance to Ohio and the U.S. through this interactive learning opportunity.



In 2017, the outdoor field trip program had

7,392
PARTICIPANTS



FROM 91
ELEMENTARY
SCHOOLS





3 > INTEGRATING CURRICULA, INSTRUCTIONAL TECHNOLOGY, AND GREAT LAKES SCIENCE TO IMPROVE EDUCATORS' TEACHING STRATEGIES

Primary Partners: Center for Great Lakes Literacy, Great Lakes Sea Grant Network

Science educators not only seek opportunities to improve content knowledge, but also to develop pedagogical strategies and instructional technology skills; they also desire place-based education that adds relevance and authenticity to learning. To foster environmental literacy and fill this need, Ohio Sea Grant integrated nationally recognized curricula and cutting edge instructional technology with local Great Lakes science. In 2017, Ohio Sea Grant facilitated two immersive, place-based professional learning opportunities through Lake Erie's Stone Laboratory with formal and informal educators trained to use inquiry-based STEM teaching strategies to implement more than 30 lessons from five national Project Wild and Project Wet curricula and Nearpod presentations. Following up with participant surveys, Ohio Sea Grant found the 19 formal and informal educators improved their teaching strategies and fostered environmental literacy to more than 800 learners.

4 > CREATING E-LEARNING PROGRAMS TO EXPAND PROGRAM'S EDUCATION REACH

Primary Partners: Ohio Supercomputer Center, Office of Research, CFAES, Great Lakes Sea Grant Network

As stakeholders continue to require information faster and through convenient media (smartphones, tablets, etc.) there was a need for swift and cost-effective dissemination of real-time Great Lakes research and outreach information to our coastal stakeholders beyond what we can do at in-person conferences and training workshops. Beginning in 2009, Ohio Sea Grant developed an eLearning program that allows researchers and educators to deliver education and training to environmental professionals across the Great Lakes region and around the world through various webinar series. More than 79,000 people have attended or accessed education and training webinars offered by Ohio Sea Grant. The program provides one- and two-hour educational sessions to environmental professionals in numerous specialties. Different series include the OSU Climate webinar series (also available on iTunes U), Stone Lab guest lecture series, annual Harmful Algal Bloom education session, and oil transport. It was the largest live eLearning program at Ohio State University in 2015.



More than 79,000 people have attended or accessed education and training webinars offered by Ohio Sea Grant.

Major Activities (CONTINUED)

5 > SUPPORTING COMMUNITY SCIENCE EDUCATION THROUGH PARTNERSHIPS

Primary Partners: Lake Erie Islands Nature and Wildlife Center

Ohio Sea Grant and Stone Lab partnered with the Lake Erie Islands Nature and Wildlife Center (LEINWC) to foster an effective combination of informal environmental education with higher education standards. The program directly supports the LEINWC by providing faculty and staff for LEINWC programming through guest lectures, hands-on presentations and letters of support for grant opportunities. In turn, LEINWC provides staff and programming at Sea Grant- sponsored events and facilities, enhancing the experience for constituents and the community. In 2017, Ohio Sea Grant helped the LEINWC offer 4 weeks of adult outdoor education to 69 participants from 20 states and Canada (Island Birding, Island Photography, Island Science and History), 4 weeks of Nature Camp for children ages 4 -14, 10 weeks of WILD Tuesday animal programs averaging 100 weekly participants, daily tours of the museum and nature trails (> 5000 visitors) as well as other special programs on astronomy, birding and pollinators.

7 > AQUATIC VISITORS CENTER EDUCATES THOUSANDS OF TOURISTS ON LAKE ERIE ISSUES

Primary Partners: ODNR Wildlife

The Lake Erie island region, specifically South Bass Island, is a flourishing summer travel hot spot within Ohio, attracting more than 10,000 daily tourists. Interested visitors seek knowledge on Lake Erie topics and issues. Through a partnership with the Ohio Department of Natural Resources Division of Wildlife, Ohio Sea Grant has expanded programming at the Aquatic Visitors Center, providing a hands-on fishing experience for children under 16 and free tours of the facility highlighting information on the historic fish hatchery, Lake Erie fishes and food webs, aquatic invasive species, sustainable sport fishing practices and other issues facing Lake Erie. In 2017, nearly 13,000 visitors experienced tours with modern, hands-on displays; children had a free opportunity to fish in the lake while learners of all ages could view native fish, invertebrates and microscopic organisms found in Lake Erie's western basin.



13,000
VISITORS

experienced the Aquatic Visitor Center in 2017



6 > NEW SCIENCE CURRICULUM TO IMPROVE STEM INTEREST IN CLASSROOMS

Primary Partners: Bowling Green State University, Sandusky Schools

Research shows a declining state of STEM education in the United States and Ohio, but also emphasizes that if kids get involved in citizen science research projects, there is a potential to improve their interest in STEM disciplines. Ohio Sea Grant partnered with Bowling Green State University as part of an NSF grant to create “iEvolve” curriculum, which incorporates a stream-based citizen science project into 6th and 7th grade science classes at Perkins School District in Sandusky, Ohio. The project was designed to evaluate the health of streams that pass through their community and influence Lake Erie (iEvolve = “Inquiry and Engagement to Invigorate and Optimize Learning for Everyone”). Ohio Sea Grant staff assisted teachers as they took their classes into the field and were available to teachers and their students via webcasts throughout the academic year, reaching over 300 students.





RESEARCH ACCOMPLISHMENTS

1 > GLYPHOSATE, PRESENT IN COMMON HERBICIDES, RELEASES PHOSPHORUS FROM FARM FIELDS INTO LAKE ERIE

PI: Christopher Spiese, Ohio Northern University

Dissolved phosphorus can lead to algal blooms in Lake Erie, and remains a nutrient of concern for lake managers. Glyphosate (the scientific name for the active ingredient in products like RoundUp), a previously unexamined source of phosphorus that's commonly used in agriculture, has the potential to move phosphorus from soils to the lake, significantly fueling bloom development. Researchers have examined soil samples from the Maumee River watershed to determine how much phosphorus was released when glyphosate was applied at different concentrations. They also analyzed soil chemistry to figure out the characteristics that control phosphorus release, and used this data to model how much dissolved phosphorus could be released from soils due to glyphosate application. They found that glyphosate significantly contributes to releasing dissolved phosphorus from soils into Lake Erie, potentially fueling harmful algal blooms by making more nutrients available to the cyanobacteria that cause them.



2 > BUILDING A LAKE ERIE AREA RESEARCH NETWORK

Primary Partners: 17 Ohio universities

Complex stressors on Lake Erie such as harmful algal blooms, land use demands, and population shifts operate on a large scale, and thus the solutions to these issues must also be grand. In 2016, Ohio Sea Grant began to create a network for Lake Erie scientists to share field stations, scientific equipment and research ideas to address the intricate challenges facing Lake Erie. Over 50 researchers from 17 institutions around Ohio continue to invest their time into the development of this new Lake Erie consortium.



Major Activities (CONTINUED)

3 > LEGACY PHOSPHORUS CONTAINED IN FARM FIELD DITCHES COULD HELP FUEL HARMFUL ALGAL BLOOMS

PI: Audrey Sawyer, The Ohio State University
Partners: USDA-ARS

Phosphorus in Lake Erie has increased since the mid-1990s, despite efforts to reduce runoff from the surrounding agricultural watershed. Heavy use of fertilizers in the past may have deposited "legacy phosphorus" in the soil and sediment that flows to rivers, but little is known about whether that legacy contamination affects the harmful algal blooms caused by excess nutrients in the water. Researchers are sediment sampling in agricultural drainage ditches to measure the amount of phosphorus contained there, and whether that phosphorus is easily released into Lake Erie. They are finding that the amount of phosphorus in drainage ditches varies strongly from farm to farm and even within farm sites. Only a small fraction of that phosphorus is easily dissolved, but about a third is contained in minerals that can potentially release it under particular water movement and water chemistry conditions.



4 > CONTINUED IMPROVEMENT OF YELLOW PERCH BROODSTOCKS HELPS MAKE OHIO AQUACULTURE MORE PROFITABLE

PI: Hanping Wang, The Ohio State University
South Centers

Yellow perch aquaculture has become a growing industry in Ohio, due to high market prices and decline in wild populations. Yellow perch are small and grow slowly, restraining growth of this new Midwest industry, particularly in mixed-sex stocks because males grow much more slowly and not as large as females. Researchers have developed broodstocks of yellow perch that are almost exclusively female, based on previous generations of performance-bred yellow perch that already grow faster than wild populations. Growth performance tests showed that the all-female group of yellow perch had grown 26.3% faster than a mixed-sex group and 66% faster than an all-male group after six months in indoor tanks. Larger-scale pond studies are underway and will finish by the end of 2018. Young fast-growing all-female yellow perch will become available to the aquaculture industry in the summer of 2018.





5 > LEADING GRANT MANAGEMENT OF FIRST STATE-LED RESEARCH INITIATIVE TO SOLVE HARMFUL ALGAL BLOOMS

Primary Partners: The University of Toledo, Office of Research, CFAES

Harmful algal blooms (HABs) have been a concern for Lake Erie since their return in 2002, with the worst ever recorded in 2015. Between the toxins HABs produce, the 11 million residents who rely on Lake Erie for their drinking water, and recent HAB occurrence throughout Ohio, there was a need for the state of Ohio to find a solution. Through a partnership among The Ohio State University, The University of Toledo and the Ohio Department of Higher Education, Ohio Sea Grant was asked to coordinate and manage the Harmful Algal Bloom Research Initiative (HABRI) in 2015. The research initiative consists of 33 science teams from across Ohio working on critical HAB knowledge gaps identified by front-line agencies. Ohio Sea Grant manages those research projects, which add up to \$4 million in leveraged research efforts. Ohio Sea Grant also published a comprehensive report on the projects involved in the second year of HABRI, which included an update to funders as well as project summaries for the general public. Sea Grant worked with University Communications to add the report to the university's front page, and collaborated with university communicators to distribute the information through their communication and outreach channels.

6 > TESTING DRINKING WATER FOR HARMFUL ALGAL BLOOM TOXINS WITHIN COASTAL COMMUNITIES

*PI: Justin Chaffin, The Ohio State University
Primary Partners: OEPA, Lake Erie island water treatment plants*

Cyanobacterial blooms are a threat to human health because the microcystin toxins they produce damage the liver. When microcystins are found at high levels in drinking water, the public is told not to drink the water until all toxins have been removed. Such an event occurred in Toledo, Ohio in early August 2014. Partnering with Ohio EPA and water treatment plant operators, Stone Lab tests the Lake Erie Islands' drinking water weekly (or more frequently if needed) for microcystins throughout the summer and biweekly during winter. Since July 2014, Stone Lab analyzed 866 drinking water samples for the islands' public water systems. During a weekend in late-July 2015, Stone Lab detected microcystins at low levels in the post-treatment samples from Put-in-Bay and Kelleys Island, and worked with plant operators to address the issue. By testing water treatment plant samples for microcystins, Stone Lab helps ensure safe drinking water for residents and visitors of the Lake Erie Islands.

7 > WORKING TOWARD A HARMFUL ALGAL BLOOM TOXICITY FORECAST

*PI: Justin Chaffin, The Ohio State University
Primary Partners: The University of Toledo, Bowling Green State University, Wayne State University, Michigan Technological University, University of Michigan, LimnoTech, NOAA GLERL, NOAA NCCOS. Also with input from Ohio EPA, Charter captains, Toledo water plant, and Cleveland water plant*

Contamination of drinking water by freshwater cyanobacterial toxins may be the most significant threat to human health associated with harmful algal blooms (HABs). This was demonstrated dramatically by the drinking water ban in Toledo, Ohio in 2014, which affected almost 500,000 people who depend on Lake Erie as their water supply. In recent years, NOAA and Stone Lab have issued a HAB forecast in early July based on spring phosphorus load from the Maumee River. Although researchers can forecast HAB size and location reasonably well, fundamental questions remain about the controls and predictability of HAB toxin production. Stone Laboratory is leading a research project that will develop a HAB toxicity forecast, with collaborators from several universities and state and federal agencies. Toxin data from 6,843 samples from Lake Erie was obtained from water treatment plants, state and federal agencies, and university researchers. Data analysis is ongoing, and experiments are planned for summers 2018 and 2019 to better understand the relationships between toxicity, HABs, and environmental variables.

8 > CAN FISH SEE BAIT ON THE HOOK WHEN WATER IS MURKY DUE TO ALGAL BLOOMS OR STIRRED-UP SEDIMENTS?

*PI: Suzanne Gray, The Ohio State University
Partners: Lake Erie Charter Boat Association*

Walleye, an important Ohio sportfish, hunt primarily by sight, meaning that reduced water clarity due to algal blooms or stirred-up sediments can keep them from finding food and mates. The increased severity and spread of harmful algal blooms and sediment runoff into Lake Erie has the potential to directly affect these fish, their prey, and Ohio's \$1.8 billion sportfishing industry. Dr. Suzanne Gray has been testing the ability of Lake Erie fishes to see under various conditions, such as algal blooms or stirred-up sediment in the water with results showing that walleye and their prey, emerald shiners, have compromised vision when there are algal blooms in the water, compared to when murky waters are caused by sediments. Both species can also detect prey from farther away when the water is clear. A phone app has so far recruited 17 Lake Erie charter boat captains in a citizen science project aimed at gathering fishing success information under different water conditions.



Toxin data was obtained from

6,843

WATER SAMPLES



FROM LAKE ERIE



A phone app has so far recruited 17 Lake Erie charter boat captains in a citizen science project aimed at gathering fishing success information under different water conditions.

Major Activities (CONTINUED)

9 > A BETTER UNDERSTANDING OF SALINITY LEVELS IN MENTOR MARSH WILL AID *PHRAGMITES* CONTROL EFFORTS THAT COULD IMPROVE THE MARSH'S ECONOMIC VALUE THROUGH ECOTOURISM

PI: Suresh Sharma, Youngstown State University

Elevated salinity levels in Mentor Marsh allowed invasion by *Phragmites*, significantly altering the marsh habitat and leading to an increase in brush fires. In addition to the invasive plant, flooding has also caused stress for marsh vegetation and its inhabitants, leading to an overall decrease in the economic value of the area for ecotourism activities such as birdwatching. Researchers are trying to quantify the salinity coming from the marsh's upstream tributaries to help stakeholders restore the marsh and harness its economic potential better. Two monitoring stations continuously keep track of water levels and salinity in the marsh, and a hydrological model establishes the correlation between streamflow from the marsh's tributaries and salinity levels in the marsh. Analysis and monitoring are ongoing, but results will inform restoration efforts and *Phragmites* control programs planned by the Cleveland Museum of Natural History and the Lake County Soil and Water Conservation District.

10 > MONITORING THE RECOVERY OF THE NATIVE LAKE ERIE WATERSNAKE

PI: Kristin Stanford, The Ohio State University

After an intensive 10-year effort, the Lake Erie Watersnake (LEWS) became the 23rd species removed from the list of federally threatened species in 2011. Because of the snakes' limited distribution and 'threatened' status in Ohio, monitoring and outreach remains an important component of its continued conservation. Led by Stone Lab staff, Ohio Sea Grant-supported research partners continue to monitor the population of this endemic snake and conduct an intensive outreach campaign, educating local residents, transient boaters and tourists about the species. In 2017, population monitoring, which processed more than 2,000 snakes on 5 islands, focused on assessing a newly emerging threat, Snake Fungal Disease (SFD). Of 393 snakes, 75.4 percent may be harboring this fungus. Other monitoring included analysis of diet samples showing round gobies as the dominant prey item (72 of 80 samples obtained – 90 percent) and stable reproduction – 56 females produced 1,327 live offspring, all of which were tagged and released for future first-year survival estimates. Additionally, outreach programs reaching 9,006 people highlighted ongoing protection efforts.



In 2017, population monitoring processed more than

2,000 WATERSNAKES



ON 5 ISLANDS

10





11 > DEVELOPING A “POWER-WASH” SYSTEM FOR CONTAMINATED LAKE ERIE SEDIMENTS USING ULTRASOUND

PI: Linda Weavers, *The Ohio State University*

Contaminants that don't dissolve in water, such as oil and creosote, can pose long-term risks to Lake Erie and its inhabitants. Common remediation techniques like dredging can be expensive and cause additional harm to the environment, and often simply transfer the problem to another site. Alternative treatment techniques are needed to better address these issues. Researchers are studying the use of ultrasound to clean contaminated sediments in Lake Erie. The system creates “cavitation bubbles” that produce tiny shockwaves, pushing heated water against sediment particles and removing stuck-on contaminants. Adding the chemical persulfate into the mix should then neutralize the effects of the contaminants. Tracer compounds also show that ultrasound allows water to spread deeper into sediments, reaching more areas for cleaning. The heat created by the collapsing cavitation bubbles also activates the persulfate. The research is ongoing, moving the researchers slowly but surely toward a full-fledged technology that can be used in the field.

12 > ORGANIC MATTER LIKE LEAF DEBRIS SIGNIFICANTLY REDUCES EFFECTIVENESS OF COMMON WATER TREATMENT METHODS FOR THE REMOVAL OF HAB TOXINS

PI: Soryong Chae, *University of Cincinnati*

Partners: *Greater Cincinnati Water Works*

Cyanobacteria are found in most bodies of water, but their excessive growth forms harmful algal blooms under favorable conditions like excess nutrients, strong sunlight, and high temperatures. These blooms can also produce toxic compounds, threatening the health of humans and wildlife that come in contact with or drink affected water. New methods for degrading toxins are being developed to keep drinking water safe, but it's largely unknown how organic matter like leaf debris in the water affects them. A partnership between scientists and a local water treatment plant is studying the effects of water chemistry on the degradation of cyanobacterial toxins in drinking water. Laboratory experiments showed that a combination of ultrasound and ultraviolet light can be used to degrade algal toxins, especially if hydrogen peroxide is added to the water. Various treatment combinations degraded 100% of algal toxins in 35-60 minutes. However, the addition of compounds often present in leaf debris significantly reduced the effectiveness of these treatments to below 45% in the same time frames.



Appendix H

› CLEAR BUDGET, JULY 2017–JUNE 2018

GENERAL FUNDS						
	2014	2015	2016	2017	2018	2019 BUDGET (BUCKIQ PROJECTIONS)
Beginning Equity Balance	47,354	90,855	64,618	36,272	(268,009)	(356,720)
Total Sources	605,555	760,136	445,610	404,605	421,113	706,593
Total Uses	(439,385)	(569,440)	(341,333)	(342,239)	(401,356)	(547,415)
Net Margin Before Transfers	166,170	190,696	104,277	62,366	19,757	159,178
Net Transfers	(122,670)	(216,933)	(132,623)	(366,647)	(120,000)	100,000
Net Margin After Transfers	43,500	(26,237)	(28,346)	(304,281)	(100,243)	259,178
Ending Equity Balance	90,855	64,618	36,272	(268,009)	(368,252)	(97,542)

DESIGNATED FUNDS						
	2014	2015	2016	2017	2018	2019 BUDGET
Beginning Equity Balance	0	0	0	0	7,440	5,140
Total Sources	0	0	0	7,440	14,960	8,000
Total Uses	0	0	0	0	(10,317)	(10,503)
Net Margin Before Transfers	0	0	0	7,440	4,643	(2,503)
Net Transfers	0	0	0	0	0	0
Net Margin After Transfers	0	0	0	7,440	4,643	(2,503)
Ending Equity Balance	0	0	0	7,440	12,083	2,637

*2018 includes June Final Close actuals | Source Data: BuckIQ Financials – Income Statement



EARNINGS						
	2014	2015	2016	2017	2018	2019 BUDGET
Beginning Equity Balance	124,567	169,984	43,394	49,413	313,991	389,672
Total Sources	478,042	479,080	454,087	540,958	554,327	520,189
Total Uses	(858,338)	(915,315)	(1,043,067)	(1,093,028)	(1,154,855)	(1,314,409)
Net Margin Before Transfers	(380,297)	(436,234)	(588,980)	(552,070)	(600,528)	(794,220)
Net Transfers	425,713	309,644	595,000	816,647	570,000	550,000
Net Margin After Transfers	45,417	(126,590)	6,020	264,577	(30,528)	(244,220)
Ending Equity Balance	169,984	43,394	49,413	313,991	283,463	145,452

DEVELOPMENT AND ENDOWMENT INC/EXP						
	2014	2015	2016	2017	2018	2019 BUDGET
Beginning Equity Balance	10,150	3,387	(1,996)	3,666	4,940	1,090
Total Sources	5,770	11,039	5,930	7,467	10,474	7,300
Total Uses	(11,119)	(9,972)	2,021	(4,093)	(3,629)	(2,545)
Net Margin Before Transfers	(5,349)	1,067	7,951	3,374	6,845	4,755
Net Transfers	(1,415)	(6,450)	(2,290)	(2,100)	(4,280)	(5,845)
Net Margin After Transfers	(6,764)	(5,382)	5,662	1,274	2,565	(1,090)
Ending Equity Balance	3,387	(1,996)	3,666	4,940	7,505	0

*2018 includes June Final Close actuals | Source Data: BuckIQ Financials – Income Statement

Appendix H

> CLEAR BUDGET, JULY 2017–JUNE 2018

GRANTS AND CONTRACTS						
	2014	2015	2016	2017	2018	2019 BUDGET
Beginning Equity Balance	673	(1,824)	(451)	(344)	(39,855)	0
Total Sources	285,000	285,000	299,251	299,250	299,250	299,250
Total Uses	(287,498)	(283,626)	(299,144)	(338,761)	(261,911)	(326,716)
Net Margin Before Transfers	(2,498)	1,374	107	(39,511)	37,339	(27,466)
Net Transfers	0	0	0	0	0	0
Net Margin After Transfers	(2,498)	1,374	107	(39,511)	37,339	(27,466)
Ending Equity Balance	(1,824)	(451)	(344)	(39,855)	(2,517)	(27,466)

OSP FUNDS						
	2014	2015	2016	2017	2018	2019 BUDGET
Beginning Equity Balance	0	0	0	0	0	0
Total Sources	1,589,198	1,965,591	2,575,028	2,859,299	2,837,296	2,556,402
Total Uses	(1,589,198)	(1,965,591)	(2,575,028)	(2,859,299)	(2,837,296)	(2,556,402)
Net Margin Before Transfers	0	0	0	0	0	0
Net Transfers	0	0	0	0	0	0
Net Margin After Transfers	0	0	0	0	0	0
Ending Equity Balance	0	0	0	0	0	0

*2018 includes June Final Close actuals | Source Data: BuckIQ Financials – Income Statement



PLANT FUNDS						
	2014	2015	2016	2017	2018	2019 BUDGET
Beginning Equity Balance	48,739	78,298	635,475	630,763	515,840	357,740
Total Sources	34	41	51	74	145	100
Total Uses	0	0	(309,232)	(128,322)	(66,986)	(75,990)
Net Margin Before Transfers	34	41	(309,181)	(128,248)	(66,841)	(75,890)
Net Transfers	29,525	557,137	304,469	13,326	(33,515)	0
Net Margin After Transfers	29,559	557,178	(4,713)	(114,922)	(100,356)	(75,890)
Ending Equity Balance	78,298	635,475	630,763	515,840	415,484	281,850

ALL FUNDS (EXCLUDES AGENCY FUNDS AND ENDOWMENT PRINCIPAL)						
	2014	2015	2016	2017	2018	2019 BUDGET
Beginning Equity Balance	231,484	340,699	741,040	719,770	534,347	396,922
Total Sources	2,963,599	3,500,888	3,779,957	4,119,093	4,137,565	4,097,834
Total Uses	(3,185,539)	(3,743,944)	(4,565,783)	(4,765,743)	(4,736,351)	(4,833,980)
Net Margin Before Transfers	(221,939)	(243,056)	(785,827)	(646,650)	(598,786)	(736,146)
Net Transfers	331,154	643,398	764,557	461,226	412,206	644,155
Net Margin After Transfers	109,215	400,342	(21,270)	(185,423)	(186,580)	(91,991)
Ending Equity Balance	340,699	741,040	719,770	534,347	347,767	304,931

*2018 includes June Final Close actuals | Source Data: BuckIQ Financials – Income Statement

Appendix H

> CLEAR BUDGET, JULY 2017–JUNE 2018

AGENCY FUNDS						
	2014	2015	2016	2017	2018	2019 BUDGET
Beginning Equity Balance	0	0	0	0	0	0
Total Sources	0	0	0	0	0	0
Total Uses	0	0	0	0	0	0
Net Margin Before Transfers	0	0	0	0	0	0
Net Transfers	0	0	0	0	0	0
Net Margin After Transfers	0	0	0	0	0	0
Ending Equity Balance	0	0	0	0	0	0

ENDOWMENT PRINCIPAL						
	2014	2015	2016	2017	2018	2019 BUDGET
Beginning Equity Balance	29,000	29,460	29,720	29,980	30,240	0
Total Sources	460	260	260	260	360	0
Total Uses	0	0	0	0	0	0
Net Margin Before Transfers	460	260	260	260	360	0
Net Transfers	0	0	0	0	0	0
Net Margin After Transfers	460	260	260	260	360	0
Ending Equity Balance	29,460	29,720	29,980	30,240	30,600	0

*2018 includes June Final Close actuals | Source Data: BuckIQ Financials – Income Statement



UNKNOWN FUNDS						
	2014	2015	2016	2017	2018	2019 BUDGET
Beginning Equity Balance	0	0	0	0	0	0
Total Sources	0	0	0	0	0	0
Total Uses	0	0	0	0	0	0
Net Margin Before Transfers	0	0	0	0	0	0
Net Transfers	0	0	0	0	0	0
Net Margin After Transfers	0	0	0	0	0	0
Ending Equity Balance	0	0	0	0	0	0

*2018 includes June Final Close actuals | Source Data: BuckIQ Financials – Income Statement

Appendix I

> PERFORMANCE METRICS

Education

NUMBER OF STUDENTS SUPPORTED:



73

UNDERGRADUATE STUDENTS



50

MASTER'S STUDENTS



12

DOCTORAL STUDENTS



79

OHIO SEA GRANT-SUPPORTED GRADUATES

become employed in a career related to their degree within two years of graduation.



1,040

P-12 EDUCATORS

participated in education programs

25,641

P-12 STUDENTS

reached through Sea Grant-trained educators or directly by its education programs



1,577

PROFESSIONALS RECEIVED CONTINUING EDUCATION/TRAINING



from Ohio Sea Grant and Stone Lab that helps them keep their jobs or advance professionally in their career.



86

PRODUCTS



developed by Ohio Sea Grant and Stone Lab were used to advance environmental literacy and workforce development



29,575



PEOPLE WERE ENGAGED

IN SUPPORTED INFORMAL EDUCATION PROGRAMS



Outreach + Extension

1,270

VOLUNTEER HOURS



12

COMMUNITIES

implemented **sustainable economic and environmental development practices and policies** (e.g., land-use planning, working waterfronts, energy efficiency, climate change planning, smart growth measures, green infrastructure) as a result of program activities.



four

INDIVIDUALS HACCP CERTIFIED



COMMUNITIES

implemented **hazard resiliency practices** to prepare for, respond to, or minimize coastal hazardous events as a result of Sea Grant activities.



3,156

FISHERMEN, SEAFOOD PROCESSORS AND AQUACULTURE INDUSTRY PERSONNEL

who modify their practices using knowledge gained in fisheries sustainability and seafood safety as a result of program activities.



38,113

ATTENDEES

at public and professional presentations

2,099

ACRES OF COASTAL HABITAT

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



329

RESOURCE MANAGERS

use **ecosystem-based approaches** in the management of land, water, and living resources as a result of program activities.

249

PROGRAM-SPONSORED + ORGANIZED EVENTS

1,766

MEETING + WORKSHOP ATTENDEES

688

PUBLIC + PROFESSIONAL PRESENTATIONS

Appendix I

> PERFORMANCE METRICS

Economic Benefit

\$3,558,602
IN ECONOMIC IMPACTS 



169
BUSINESSES
SUSTAINED



59
JOBS
CREATED



1,789
JOBS
SUSTAINED

> ECONOMIC ACTIVITIES

	ECONOMIC BENEFIT	BUSINESSES SUSTAINED	JOBS CREATED	JOBS SUSTAINED
<p>Results from a Business Retention and Expansion program held in Perrysburg, Ohio, showed that 40 of the 116 businesses who responded to the BR&E survey reported that they plan to expand, modernize, or renovate their businesses with firms planning to add jobs within the next 12 months. Added jobs are projected in the professional services, retail, and commercial service sectors. As a result of the BR&E business survey, the City of Perrysburg has learned that 116 businesses plan to retain between 1,721–2,880 FTE jobs and create an estimated 58–177 new FTE jobs. The addition of 58 new jobs would represent \$33,117 in additional income tax revenue to Perrysburg and would contribute an estimated \$2,207,770 in personal income to Perrysburg’s economy.</p>	\$2,240,887	166	58	1,721
<p>In 2017, Ohio Sea Grant continued to support the land protection efforts of the Lake Erie Island Conservancy and Put-in-Bay Township Park District on the Lake Erie islands. These efforts resulted in preserving 3.5 acres on South Bass Island and 9.539 acres of inland wet woods on Middle Bass Island, totaling 13.039 acres preserved in 2017 and 72.719 acres since the partnership began. Ohio Sea Grant also supported an Americorp intern who restored an additional 0.5 acres on South Bass Island. Based on a 2004 estimate by the Worldwide Fund for Nature, the value of wetlands in North America is \$5,582 per acre, resulting in a total economic benefit from these efforts of \$75,575.</p>	\$75,575	0	0	0



ECONOMIC ACTIVITIES (CONTINUED)

	ECONOMIC BENEFIT	BUSINESSES SUSTAINED	JOBS CREATED	JOBS SUSTAINED
In 2017, Miller Ferry derived an estimated economic benefit from the 13, 124 visitors to Ohio Sea Grant's Aquatic Visitors Center of \$30,579. Because the Aquatic Visitors Center is likely only one of approximately six venues that ferry passengers might visit while on the island, rather than claim the economic benefit of a full roundtrip ticket (\$14), CLEAR claims one sixth of each fare (1/6 x \$14 = \$2.33) to arrive at this economic impact.	\$30,579	0	0	0
Miller Ferry also derived an estimated economic benefit of \$40,446 as a result of the Stone Lab Field Trip Program (2,889 participants = 2,889 passengers transported by ferry to reach Stone Lab x \$14 roundtrip fare = \$40,446).	\$40,446	0	0	0
At the 2017 Charter Captain Conference, 66 of the captains surveyed reported that the previous year's conference helped them retain their jobs or advance professionally. For charter captains, 2010 survey data showed the average revenue of all businesses reporting was \$15,123. Of these respondents, 81 percent reported themselves as charter firms, making them count as businesses retained. The remainder are listed as jobs retained. This would be an economic benefit of \$988,118 (66 x \$15,123) in business revenue, 53 businesses retained and 13 jobs retained.	\$998,118	53	0	13
The Ohio Clean Marinas Program has been extremely successful on the shores of Lake Erie. In 2015, the program expanded statewide through an ongoing partnership with the Ohio Department of Natural Resources (ODNR). As a result of this expansion, two new jobs were retained at a combined salary of \$104,987.	\$104,987	0	0	2
In 2017, Ohio Sea Grant partnered with the City of Cleveland Mayor's Office Sustainability and thunder::tech on a grant from the NOAA Marine Debris Program to conduct a study to understand consumer behavior in regards to three single-use plastic items: water bottles, shopping bags, and cigar tips. Coupled with a second grant from the NOAA Marine Debris Program to continue the research with a focus on plastic bags used at grocery stores, Ohio Sea Grant is identifying the type of bag used (single-use plastic vs. reusable) in the store before and after behavior change reminder strategies are implemented. Results from this study provided Cuyahoga County legislators with scientific data on consumer opinion for a plastic bag levy which is currently in development, and has led to the creation of a new communication and education position for the Cleveland Water Department to help educate the public about single-use plastics. The current pay of this employee is unknown.	\$68,010	0	1	0

2014-2018 Strategic Plan

OHIO SEA GRANT COLLEGE PROGRAM



including
F.T. STONE LABORATORY
the CENTER FOR LAKE ERIE AREA RESEARCH (CLEAR)
and the GREAT LAKES AQUATIC ECOSYSTEM RESEARCH CONSORTIUM (GLAERC)



OHSU-TB-112-2013

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FROM THE DIRECTOR

I am pleased to present the 2014-2018 Strategic and Implementation Plan for the Ohio Sea Grant College Program at The Ohio State University. Because Ohio Sea Grant is a partnership of government, academia and the private sector, this plan was developed with input from each of those partners and continues to address our 3 E's (environment, economy, and education) using our broad-based approach of research, education, and outreach.

The plan builds on the program's 2010-2014 Strategic Plan and is structured to match the plan of the National Sea Grant College Program with four national focus areas: healthy coastal ecosystems, sustainable coastal development, safe and sustainable seafood supply, and hazard resilience in coastal communities. Among other things, the plan also addresses major problems/issues impacting Lake Erie: sedimentation and dredging, nutrient loading and phosphorus, harmful algal blooms, the dead zone, aquatic invasive species, climate change, coastal community and economic development, and toxic substances and pharmaceutical pollution.

Lake Erie is the southernmost, shallowest, and warmest of the Great Lakes, arguably Ohio's most valuable natural resource and one of the most important lakes in the world. It receives more sediment and nutrients and frequently produces more fish annually than the other four Great Lakes combined. However, it is possible to have too much

of a good thing, and excessive nutrient loading is leading to the region's most severe harmful algal blooms and one of this country's largest dead zones. When the Cuyahoga River burned in 1969, Lake Erie became the poster child for pollution problems in the country. In the early 1980s it became the "Walleye Capital of the World" and the best example of ecosystem recovery in the world. Unfortunately, since 1995, the lake has been deteriorating and we must stop the decline and turn the trend around.

In this plan, we have attempted to support and incorporate needs and priorities identified by the Great Lakes Executive Committee of the U.S. and Canada, the Cooperative Science and Monitoring Initiative, the Great Lakes Restoration Initiative, the Lake Erie Lakewide Management Plan, various task teams working on the 10 Annexes of the Great Lakes Water Quality Agreement, the International Joint Commission, the Ohio Lake Erie Commission and its component agencies, the Ohio Phosphorus Task Force II, the Western Lake Erie Basin Partnership, The Ohio State University, the Friends of Stone Lab and Ohio Sea Grant's Private Sector Advisory Committees, and surveys of elected officials, decision makers, charter captains, science writers, farmers, and participants in our workshops and programs. This plan is a living document that is reviewed and modified annually as needs and opportunities change. Your input, suggestions and criticisms are requested and always welcome.

Sincerely,
Jeffrey M. Reutter, Ph.D.
Director
Ohio Sea Grant College Program



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Ohio Sea Grant College Program 2014-2018 Strategic Plan

A PROGRAM OF ACTION

For more than 30 years, Ohio Sea Grant has worked to help restore and rejuvenate Lake Erie and its regional economy. With the unique combination of research, education, and outreach efforts, Ohio Sea Grant has become a program of action, working progressively with its stakeholders and partners, to solve the Lake's most pressing environmental and economic issues.

To share some of our stories, we have included spotlights within this strategic plan, highlighting just some of the work we've done within our four key focus areas. Through these stories, you'll learn more about recent research important for the restoration of our great lake, hands-on educational efforts to train tomorrow's workforce, and ways we have reached out to help communities and industries prepare for a stronger tomorrow.

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EXECUTIVE SUMMARY

OHIO SEA GRANT MISSION

The mission of the Ohio Sea Grant College Program is to increase the public's understanding and improve development and conservation of our Great Lakes and ocean resources, with particular emphasis on Lake Erie.

The Ohio Sea Grant College Program is a statewide program aimed at improving the environmental health and economic vitality of this country's Great Lakes resources with an emphasis on Lake Erie and its watershed. Ohio Sea Grant is a partnership among academia, government and the private sector, and uses a combination of research, education and outreach to focus on the 3 Es: the economy, the environment and education.

At its core, Ohio Sea Grant aims to be a good leader and a good partner. With its unique combination of research, education and outreach, Ohio Sea Grant is sought-after for its unbiased and science-based approach toward addressing pressing environmental and economic issues, often in collaboration with other federal, state and local entities, as well as nonprofit organizations at all levels. Using the National Sea Grant Network, local collaborations and a strong relationship with the community, Ohio Sea Grant is a program of action, investigating Lake Erie issues and sharing solutions with those likely to shape the region's future.

RESEARCH

Annually, Ohio Sea Grant supports the work of scientists from a dozen universities throughout Ohio as they work to solve the most pressing problems facing Lake Erie – from addressing solutions to harmful algal blooms in the western basin to uncovering the economic value of a cleaner environment. The program has supported more

than 500 projects, with 287 principal investigators from over 20 colleges and universities, and more than 500 graduate and undergraduate students, all from its base NOAA budget. The program's annual research component supports approximately 20 research projects each year, providing the necessary science to address the lake's emerging issues.

EDUCATION

With support from The Ohio State University and private sector donors, Ohio Sea Grant has provided scholarships, fellowships, employment opportunities and research experiences to over 1,500 graduate and undergraduate students at Stone Laboratory, The Ohio State University's island campus. In addition to college-level and professional courses, Stone Lab instructors lead Lake Erie field trips for more than 7,000 students in grades 4–12 and other groups. Education efforts also focus on the classroom through teacher training and curriculum development.

OUTREACH

Researching Great Lakes questions only does so much. Providing findings and other information on Great Lakes issues to the public is key. Ohio Sea Grant has six extension/outreach specialists from Toledo to Conneaut and a central administrative and communications office based at The Ohio State University in Columbus, all prepared and enthusiastic to answer community questions and ensure Great Lakes information is easily accessible.

EXECUTIVE SUMMARY

FOCUS AREA: HEALTHY COASTAL ECOSYSTEMS (HCE)

Lake Erie faces a number of threats to coastal health, which Ohio Sea Grant and its partners are working to address. Ohio Sea Grant has identified the following key challenges to coastal health: sedimentation and dredging, nutrient loading and phosphorus, harmful algal blooms, the Dead Zone, aquatic invasive species, climate change, toxic substances and pharmaceutical pollution, and coastal community and economic development. Lake Erie offers countless coastal resources to the 12 million residents within its watershed and the millions of visitors who spend more than \$11 billion in local businesses each year. Therefore, protecting the health of the coastal ecosystem is of utmost concern, from cultural, environmental and economic viewpoints.

Goal: Lake Erie and Great Lakes ecosystem services are improved by enhanced health, diversity and abundance of Lake Erie's fish, wildlife and plants.

- Dynamic ecological systems continue to provide a wide range of ecological, economic and societal services for the Lake Erie coast and watershed, and are more resilient to change.
- Greater public stewardship leads to participatory decision-making and collaborative ecosystem-based management decisions.

Goal: Ecosystem-based approaches are used to manage Lake Erie's land, water and living resources.

- Land, water and living resources are managed using ecosystem-based approaches.
- Based on Ohio Sea Grant research and monitoring efforts, managers are able to use adaptive management to modify ecosystem-based management approaches to reach desired outcomes.

Goal: Lake Erie and Great Lakes ecosystems and their habitats are protected, enhanced or restored.

- Great Lakes habitats are protected, enhanced or restored.
- Degraded ecosystem function and productivity are restored throughout the Lake Erie watershed and the Great Lakes.

FOCUS AREA: SUSTAINABLE FISHERIES AND AQUACULTURE (SFA)

Lake Erie's fishery is part of the economic and cultural identity of many coastal communities. Although valuable, the Lake Erie fishery is finite. It is imperative to strike a balance between demand and sustainability of the fishery. Ohio Sea Grant recognizes the need to understand how changes in the ecosystem impact these resources and to identify how to help the fishing industry and public understand these impacts. By supporting ongoing research, educating the public and maintaining open communication with the fishing community, Ohio Sea Grant works toward a more sustainable future for fisheries in Lake Erie.

Goal: A safe, secure and sustainable Lake Erie fishery to meet public demand.

- The seafood supply from Ohio waters is sustainable and safe.

Goal: Informed consumers who understand the health benefits of fish consumption and how to evaluate the safety and sustainability of the fish they buy and catch



FOCUS AREA: RESILIENT COMMUNITIES AND ECONOMIES (RCE)

The coastline provides countless economic, social and recreational opportunities for millions of Lake Erie residents and visitors. This concentration of residents and visitors puts additional strain on already finite coastal resources and leaves the population and its economic stability vulnerable to natural hazards, such as climate change, flooding, erosion and harmful algal blooms. By increasing awareness and providing hazard preparedness training, as well as building resiliency and value of ecosystem-dependent businesses and communities, Ohio Sea Grant can help the coastal community function within the limits of the ecosystem.

Goal: Development of vibrant and resilient Lake Erie coastal economies.

- Great Lakes communities have diverse, healthy economies and industries without displacing traditional working waterfronts.

Goal: Communities use comprehensive planning to make informed strategic decisions.

- Quality of life in Great Lakes communities, as measured by economic and social well-being, improves without adversely affecting environmental conditions.

Goal: Improvements in Lake Erie and Great Lakes coastal water resources sustain human health and ecosystem services.

- Lake Erie and Great Lakes water supplies are sustained.
- Lake Erie and Great Lakes water quality improves

Goal: Resilient Lake Erie and Great Lakes coastal communities adapt to the impacts of hazards and climate change.

- Great Lakes communities effectively prepare for hazardous events and climate change.
- Great Lakes communities are resilient and experience minimum disruption to life and their economies following hazard event.

FOCUS AREA: ENVIRONMENTAL LITERACY AND WORKFORCE DEVELOPMENT (ELWD)

An engaged, environmentally literate public is the most effective tool to address the environmental challenges facing the Great Lakes. Furthermore, a workforce skilled in science, technology, engineering, math (the STEM disciplines) and communication is a powerful weapon in the innovation needed to preserve vital coastal resources and to combat future coastal hazards. Ohio Sea Grant recognizes the need to continue providing education and skills training to the Lake Erie coastal community to develop workforce capacity and promote superior resource management. By expanding formal and informal education both within and beyond traditional classrooms, Ohio Sea Grant will continue to encourage active Great Lakes stewardship.

Goal: An environmentally literate public supported and informed by a continuum of lifelong formal and informal engagement opportunities.

- Members of the public incorporate broad understandings of their actions on the environment into personal decisions.

Goal: A future workforce reflecting the diversity of Ohio Sea Grant programs, skilled in science, technology, engineering, mathematics and other disciplines critical to local, regional and national needs.

- A diverse workforce trained in science, technology, engineering, mathematics, law, policy or other related fields is employed and has high job satisfaction.





INTRODUCTION

OHIO SEA GRANT COLLEGE PROGRAM

The Ohio Sea Grant College Program at The Ohio State University, including Stone Laboratory, the Center for Lake Erie Area Research (CLEAR) and the Great Lakes Aquatic Ecosystem Research Consortium (GLAERC), is a statewide program aimed at improving the environmental health and economic vitality of this country's Great Lakes resources with an emphasis on Lake Erie and its watershed. Ohio Sea Grant is a partnership among academia, government and the private sector, and uses a combination of research, education and outreach to focus on the 3 Es: the economy, the environment and education.

The Ohio Sea Grant College Program is one of 33 state programs in the National Oceanic and Atmospheric Administration (NOAA), US Department of Commerce. The NOAA Sea Grant College Program is focused on sustaining our nation's ocean, coastal and Great Lakes resources and is a matching program. For every dollar Ohio Sea Grant receives from NOAA Sea Grant, Ohio Sea Grant must provide a minimum of \$0.50 of matching support from non-federal sources. Therefore, seeking partnerships to leverage resources for maximum impacts is a key strategy in attaining the program's goals and fulfilling its mission. Ohio Sea Grant receives support from many of its partners, including the State of Ohio, The Ohio State University (e.g. Ohio State University Extension, Office of Research, College of Food, Agricultural, and Environmental Sciences), collaborating universities, state agencies, private businesses and concerned citizens.

With its unique combination of research, education and outreach, Ohio Sea Grant is sought-after for its unbiased and science-based approach toward addressing pressing environmental and economic issues, often in collaboration with other federal, state and local entities as well as nonprofit organizations at all levels. At its core, Ohio Sea Grant aims to be a good leader and a good partner. Using the National Sea Grant Network, local collaborations and a strong relationship with the community, Ohio Sea Grant is a program of action, investigating Lake Erie issues and sharing solutions with those likely to shape the region's future.

Ohio Sea Grant celebrated its 35th anniversary in 2013. During that span, Ohio Sea Grant has supported more than 600 projects, with 287 principal investigators from over 20 colleges and universities and more than 500 graduate and undergraduate students, all from its base NOAA budget. The program's annual research component supports approximately 20 research projects each year, providing the necessary science to address the lake's emerging issues. Over the same time span, using support from The Ohio State University and private sector donors, Ohio Sea Grant has



provided scholarships, fellowships, employment opportunities and research experiences to over 2,000 graduate and undergraduate students at Stone Laboratory, The Ohio State University's island campus, and other Ohio colleges and universities. The program has six extension/outreach specialists from Toledo to Conneaut (two additional positions are currently open), eight seasonal and part-time science education instructors, approximately 20 part-time faculty members teaching at Stone Lab, six visiting research supervisors at Stone Lab, and a central administrative and communications office based at The Ohio State University in Columbus. Dr. Jeff Reutter is the Ohio Sea Grant College program director. Dr. Christopher Winslow is the associate director for research and administration, Jill Jentes Banicki is the assistant director for communications, Bryan Ford is the business manager, Matt Thomas is Stone Laboratory's manager, Dr. Kristin Stanford is the education and outreach coordinator at Stone Laboratory, Dr. Justin Chaffin is the research coordinator at Stone Lab and Frank Lichtkoppler is the extension program leader. The program also has a strong base of volunteers, from its private sector Sea Grant Advisory Committees to its active alumni and volunteer organization called "the Friends of Stone Laboratory."

CORE STRATEGIES AND TOOLS

Research

Annually, Ohio Sea Grant supports the work of scientists from a dozen universities throughout Ohio as they work to solve the most pressing problems facing Lake Erie – from addressing solutions to harmful algal blooms in the western basin to uncovering the economic value of a cleaner environment. Many of these scientists take advantage of facilities at The Ohio State University's Stone Laboratory, a fully equipped freshwater research laboratory and island campus.

Typically, one third to one half of Ohio Sea Grant's core budget from NOAA is dedicated to competitively funded projects. Proposals for small grants (requesting up to \$10,000) from the program's development fund can be submitted at any time. Proposals for larger research grants (up to \$60,000 per year for up to two years) are requested through a biennial request for proposals (RFP). Submissions are welcome from anyone, and the RFP is disseminated to every college and university in Ohio. The most recent RFP is publicly accessible through the research pages on ohioseagrant.osu.edu/research.

Pre-proposals submitted to the RFP cycle are subject to review by a panel of experts consisting of both Ohio Sea Grant employees and external professionals. Based upon that panel's review, full proposals are either invited or discouraged; however, no proposal is rejected based upon pre-proposal evaluations.

Full proposals submitted to the RFP cycle are all subject to external written peer review. Investigators are also permitted to draft written responses to blinded peer reviews before proposals and written peer reviews are evaluated by an external panel of experts from agencies, academia, industry and other stakeholders. A representative from the NOAA Sea Grant Program in Washington, DC attends the panel meeting to ensure fairness and the absence of conflicts of interest. The director of Ohio Sea



Grant takes the recommendations of the panel into consideration when selecting and submitting full proposals to the NOAA Sea Grant Program with Ohio Sea Grant's biennial omnibus proposal submission.

Education

The Franz Theodore Stone Laboratory serves as the main educational facility for Ohio Sea Grant, offering approximately 25 college-credit courses each summer to undergraduate and graduate students, advanced high school students, educators and professionals. Stone Laboratory also offers non-college-credit workshops and conferences to educate and train future Great Lakes stewards. In addition to those taking college-level classes and workshops, as many as 8,000 students in grades 4-12 and other groups take part annually in Stone Laboratory's Lake Erie Science Field Trip Program.

Training educators to better address coastal issues is also a key component of Ohio Sea Grant's strategy. Educator workshops provide hands-on experiences conducting water sampling and monitoring, while curricula development takes a Great Lakes focus on addressing climate change and other key topics.

In 2010, Lake Erie Literacy Principles were developed by Ohio Sea Grant and its partners to build upon the NOAA Ocean Literacy Principles, yet with a regional focus. These literacy principles were later used as models for the development of Great Lakes Literacy Principles, coordinated by COSEE Great Lakes (i.e. Centers for Ocean Sciences Education Excellence). The Lake Erie Principles are now being used in both formal and informal educational settings to ensure consistent messaging and lifelong learning.

Outreach

Lake Erie is Ohio's most valuable natural aquatic resource and is regarded by many as the most important lake in the world. As a result, the lake is used for multiple, and sometimes conflicting,

purposes. Therefore, Ohio Sea Grant and its partners must circulate the best information available to lake managers, decision-makers, elected officials and stakeholders in order to encourage sustainability and stewardship of Lake Erie resources. Informed clientele make better decisions regarding the wise use and protection of Lake Erie, which requires the services of an active Sea Grant Outreach and Extension Program.

Getting timely and relevant information to the public is key to Ohio Sea Grant's outreach endeavors. The program's extension/outreach specialists, with offices spread across Ohio's Lake Erie counties, interact with Ohio citizens to help them solve problems related to Lake Erie and help them identify opportunities including: sustainable economic development, fisheries, boating, beaches, birding, shipping, water use, ecosystem rehabilitation, sustainability and tourism.



Activities vary depending on the need being addressed; however, many of these tasks involve facilitating community discussions and planning retreats, providing one-on-one consultations with elected officials and other decision makers, and linking research efforts to emerging needs to solve problems. Also, the Ohio Sea Grant Communication Network supports web-based initiatives, including

webinars, to increase information dissemination. Ohio Sea Grant Extension is a partnership among academia, government and the private sector that combines the use of current and emerging technology and a network of personal relationships to identify coastal issues and potential solutions. Ohio Sea Grant Extension is fully engaged within coastal communities, and they have earned credibility by helping residents and visitors make informed decisions and implement solutions based on good science and clientele-driven educational programs. The program helps people use science-based information to make informed decisions about real-world problems, issues and opportunities.

OHIO SEA GRANT FACILITIES AND COLLABORATIVE PROGRAM

Franz Theodore Stone Laboratory

The mission of the Franz Theodore Stone Laboratory is to serve The Ohio State University, the Ohio Sea Grant College Program, the State of Ohio and the people of Ohio as their research, education and outreach facility on Lake Erie. Established in 1895, Stone Laboratory is the oldest freshwater biological field station in the country and the center of The Ohio State University's teaching and research on Lake Erie. Annually, the Lab serves as the base for more than 65 researchers from over a dozen agencies and academic institutions, all working to explore the origins and solutions for Great Lakes challenges.

Currently, the research facilities and the grounds are undergoing extensive renovations in order to continue providing advanced, cutting-edge research opportunities and to incorporate green infrastructure (e.g. solar panels and solar thermal heating) to minimize its ecological footprint.

Stone Laboratory's place-based educational programming is intended to address the needs of the following audiences: students in grades 4-12, college undergraduate and graduate students, K-12 teachers, research scientists, decision-makers and elected officials, technical staff in state and federal agencies and the general public.

Stone Laboratory strives to:

- Improve the quality of science education in Ohio by creating high-quality, hands-on science education opportunities for students in grades 4-12 and adults;
- Provide undergraduate and graduate research training;
- Create special educational opportunities for teachers;
- Forge strong community partnerships that help enhance and sustain the local coastal economy;



- Help decision-makers and elected officials make more informed decisions through education and training programs; and
- Encourage and support research on critical issues and problems facing Lake Erie, the Great Lakes and the environment, to foster more informed management decisions.



Additionally, Ohio Sea Grant and Stone Laboratory entered into an exciting collaboration with the Ohio Department of Natural Resources to offer outreach programming at the historic Put-In-Bay Fish Hatchery and Aquatic Visitors Center on South Bass Island. Debuted in 2009, this interactive education facility is a unique addition to Ohio Sea Grant outreach and education and attracts more than 13,000 people annually.

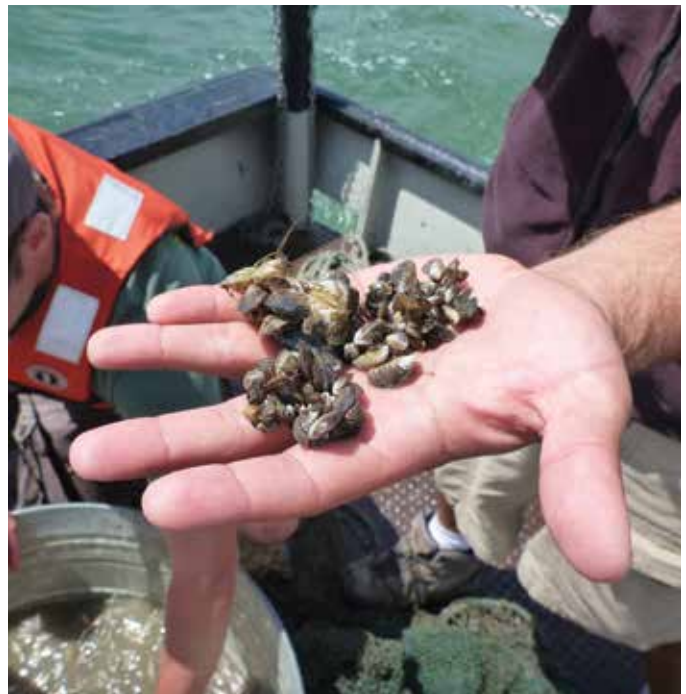
CENTER FOR LAKE ERIE AREA RESEARCH (CLEAR)

The Ohio State University created CLEAR in 1970 after the burning of the Cuyahoga River to focus the expertise of Ohio State's faculty on Lake Erie problems and issues. CLEAR is part of the Ohio Sea Grant College Program. Ohio Sea Grant, CLEAR, and Stone Lab led and served as the base for much of the research and outreach that brought about the rebirth of Lake Erie in the 1970s and 80s and

moved the Lake from its "dead lake" image to the "Walleye Capital of the World."

GREAT LAKES AQUATIC ECOSYSTEM RESEARCH CONSORTIUM (GLAERC)

Ohio Sea Grant formed GLAERC in 1992 to bring together aquatic scientists from 12 colleges and universities across Ohio, including Bowling Green State University, Case Western Reserve University, Cleveland State University, Heidelberg University, John Carroll University, Kent State University, Miami University, Mount Union College, The Ohio State University, Ohio University, University of Toledo and Wright State University. The mission of GLAERC is to enhance collaboration, cooperation and communication and to aid in sharing of equipment and facilities. This collaborative approach makes Ohio's top scientists more effective and competitive for federal funding, improving their ability to address the critical issues and problems affecting Ohio's surface waters. Stone Laboratory serves as the Consortium's shared research facility.



OHIO SEA GRANT VISION AND MISSION

The mission of the Ohio Sea Grant College Program is to increase the public's understanding and improve development and conservation of our Great Lakes and ocean resources, with particular emphasis on Lake Erie. Within this mission, the program has several overarching goals:

- Promote sustainable economic development on the Lake Erie coast and watershed by applying scientific knowledge to solve resource problems;
- Develop the critical knowledge and technology to help coastal industries in Ohio as they work to enhance their bottom line;
- Identify, protect and conserve valuable coastal habitats and strive to improve environmental conditions in the Lake Erie and Great Lakes ecosystems;
- Enable coastal and Great Lakes communities to successfully adapt to changing climate, social and economic conditions; and
- Improve the quality of marine and aquatic education in Ohio to foster a more informed citizenry with a higher quality of life.

OHIO SEA GRANT COLLEGE PROGRAM RELATIONSHIPS AND REPORTING STRUCTURE

Dr. Jeffrey M. Reutter is director of the Ohio Sea Grant College Program at The Ohio State University which includes Stone Laboratory, the Center for Lake Erie Area Research (CLEAR) and the Great Lakes Aquatic Ecosystem Research Consortium (GLAERC). Dr. Reutter reports to two vice presidents at Ohio State: Dr. Caroline Whitacre, vice president for research, and Dr. Bruce McPheron, vice president for agricultural administration. Stone Laboratory is the shared research facility for GLAERC and the base for many of Ohio Sea Grant's research, education and outreach programs.

PLANNING PROCESS AND STRATEGIC APPROACH

Alignment with the National Sea Grant College Program Strategic Plan

A majority of the 2014-2018 Ohio Sea Grant Strategic Plan contains wording consistent with the national plan in an effort to instill a national focus to the Sea Grant College Program. All modifications of the national plan were done in an effort to align the plan with Lake Erie coastal and watershed issues as well as the needs and requests of Ohio Sea Grant's constituents.

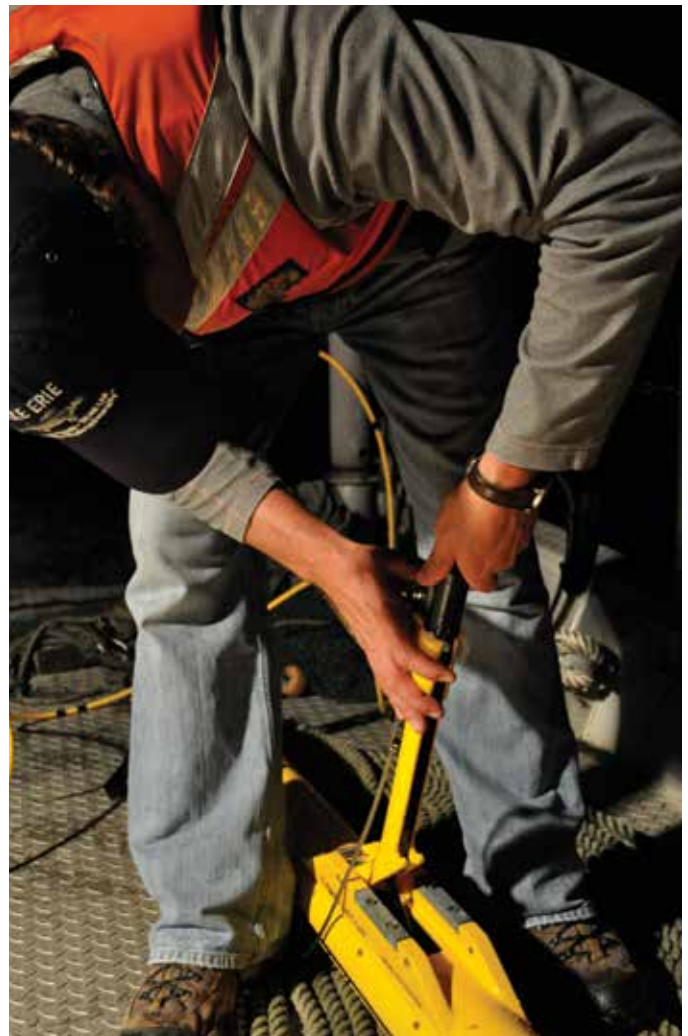


Self-Evaluation Activities and Strategies to Receive External Input

In addition to focusing on priorities and actions for the future, Ohio Sea Grant has a regular planning process that includes a number of self-evaluation activities designed to improve the operation and effectiveness of the program. These activities include:

- Meetings with external Sea Grant Extension Advisory Committees, the Friends of Stone Laboratory and The Ohio State University's vice presidents for research and agriculture (and their administrative staffs) to review efforts and priorities;
- One-on-one meetings between the director and each staff member to discuss his or her position and ideas; and
- Quarterly/monthly meetings of the Sea Grant Administration, Extension and Communication staff.

These activities provide dedicated time to reflect on the past, plan for the future and modify goals. As a result, this strategic plan reflects an ongoing planning and self-reflection process and is a living document that is reviewed and modified throughout the year as needs and opportunities change. This is essential for Ohio Sea Grant to remain a program of action addressing emerging issues, challenges and opportunities as well as allowing the program to respond to constituency needs based on an ever-changing economic and ecological environment.





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Ohio Sea Grant

FOCUS AREAS AND STRATEGIC PLAN STRUCTURE

To help the nation understand, manage and use its coastal resources wisely, NOAA Sea Grant identified four focus areas central to what the Sea Grant College Program does. The focus areas are:

1. *Healthy Coastal Ecosystems*
2. *Sustainable Fisheries and Aquaculture*
3. *Resilient Communities and Economies*
4. *Environmental Literacy and Workforce Development*

These focus areas evolved from the NOAA Sea Grant College Program's 2009-2013 Strategic Plan and reflect America's most urgent needs along our coasts, as well as NOAA goals and Sea Grant's strengths and core values. The focus areas also reflect the integration of Sea Grant's research and engagement programs. These functional areas provide the foundation for implementing a successful four-year plan, and Ohio Sea Grant has adopted these focus areas due to their relevancy and importance to its constituents.

Each focus area has goals, outcomes and performance measures. The goals describe the desired long-term direction for each focus area. The outcomes are benchmarks from which Ohio Sea Grant can track progress toward achieving each goal. Performance measures are quantitative ways of measuring outcomes with targets.

Outcomes are commonly categorized as short-, medium- and long-term. In this plan, learning, action and consequence outcomes are synonymous to short-, medium- and long-term outcomes and have been chosen to more easily identify the transition across outcome categories. For example, progress toward a goal starts with an achievable and measurable learning outcome and is followed by a series of "what happens next" questions until the goal is met (action and consequence). Using this approach, it is easier to demonstrate in a linear process how goals are achieved.

- Learning (short-term) outcomes lead to increased awareness, knowledge, skills, changes in attitudes, opinions, aspirations or motivations through research and/or constituent engagement.
- Action (medium-term) outcomes lead to behavior change, social action, adoption of information, changes in practices, improved decision-making or changes in policies.
- Consequence (long-term) outcomes are long-term, and in most cases, require focused efforts over multiple strategic planning cycles. Consequence outcomes in a four-year strategic plan serve as reference points toward reaching focus area goals between the current and future strategic plans.

There are two types of performance measures identified in this plan. Performance measures that are most closely linked to a single focus area are listed at the end of each focus area section. Cross-cutting performance measures – broad measures of progress toward goals for all focus areas – are listed following the Education and Workforce Development Focus Area.

Collectively, the four focus areas include 11 goals, 93 outcomes and 13 performance measures. This plan directly aligns to NOAA's goals and objectives as articulated in NOAA's Next Generation Strategic Plan: climate adaptation and mitigation, weather-ready nation, healthy oceans, and resilient coastal communities and economies. The 2014-2018 Ohio Sea Grant Strategic Plan capitalizes on the program's unique capacities and strengths and provides the program with the flexibility and creativity required to adapt to emerging needs.

FOCUS AREA: HEALTHY COASTAL ECOSYSTEMS (HCE)

Lake Erie offers countless coastal resources to the 12 million residents within its watershed and the millions of visitors who spend more than \$11 billion in local businesses each year. Therefore, protecting the health of the coastal ecosystem is of utmost concern, from cultural, environmental and economic viewpoints. As one of the world's most productive freshwater fisheries, Lake Erie must maintain a healthy and consistent aquatic food web to ensure economic vitality for coastal communities, many of which support businesses and jobs that rely on the fishery industry. Beyond sport fish, the lake provides crucial habitat to a myriad of living creatures; the Lake Erie coastline is a major pathway on the migratory bird route and provides shelter for a variety of reptiles, amphibians and mammals. Furthermore, the beauty of the shoreline has enticed many residents and businesses; nearly 11 million people depend on Lake Erie for drinking water alone. Therefore, a healthy coastal ecosystem provides the foundation for life both within and surrounding Lake Erie.

However, Lake Erie faces a number of threats to coastal health, which Ohio Sea Grant and its partners are working to address. Ohio Sea Grant has identified the following key challenges to coastal health: sedimentation and dredging, nutrient loading and phosphorus, harmful algal blooms, the Dead Zone, aquatic invasive species, climate change, toxic substance and

pharmaceutical pollution, and coastal community and economic development (see Appendix A for details on each challenge). Although these issues jeopardize coastal health and functioning, the Ohio Sea Grant network has experience restoring vital coastal resources. The network was instrumental in identifying eutrophication as the cause of poor ecosystem health in the 1960s and 1970s. This research was conducted by experts still in the network today and has since led to modified policy, a change in public behavior and the restoration of shoreline health. Based on this experience and a wealth of new knowledge, Ohio Sea Grant is well positioned to address current threats.

The Ohio Sea Grant network prioritizes regional approaches and understands the need to be both a leader and a partner in overcoming observed and emerging threats to coastal ecosystem health. Therefore, Ohio Sea Grant's continuing goal is to understand how changes on land impact coastal and water resources. To do this, it is essential for Ohio Sea Grant and its partners to educate the public and decision-makers about ecosystem-based management – an integrated approach to management that considers the entire ecosystem, including humans, and the cumulative impacts of different sectors¹. By implementing this management strategy across the Great Lakes, Ohio Sea Grant can better protect the health of this vital coastal ecosystem.

¹ NOAA National Sea Grant College Program 2014 – 2017 Strategic Plan

FOCUS AREA: HEALTHY COASTAL ECOSYSTEMS (HCE)

1. **Goal:** Lake Erie and Great Lakes ecosystem services are improved by enhanced health, diversity and abundance of Lake Erie's fish, wildlife and plants.

Strategy

Ohio Sea Grant intends to support research, education and outreach focused on habitat protection and restoration. It will do this by encouraging a reduction of nutrient loading from the watershed, increased sustainable land-use planning and lake-wide monitoring efforts used to evaluate and improve the Lake Erie ecosystem, its fisheries and water regulations. Ohio Sea Grant will also continue to support promising research focused on ecosystem health. Additionally, the program will facilitate research, education and outreach on emerging issues that may threaten Lake Erie ecosystem services.

Learning Outcomes

- 1.1. Develop and calibrate new standards, measures and indicators of Great Lakes coastal and ecosystem health and sustainability.
- 1.2. Identify critical uncertainties that impede progress toward achieving sustainability of Great Lakes' ecosystems and the goods and services they provide.

Action Outcomes

- 1.3. Resource managers and policy- and decision-makers use standards and indicators to support Great Lakes and Lake Erie watershed ecosystem-based management.

Consequence Outcomes

- 1.4. Dynamic ecological systems continue to provide a wide range of ecological, economic and societal services for the Lake Erie coast and watershed, and are more resilient to change.
- 1.5. Greater public stewardship leads to participatory decision-making and collaborative ecosystem-based management decisions.

FOCUS AREA: HEALTHY COASTAL ECOSYSTEMS (HCE)

- 2. Goal:** Ecosystem-based approaches are used to manage Lake Erie's land, water and living resources.

Strategy

Ohio Sea Grant will continue supporting research, education and outreach programs geared toward the agricultural community throughout the Lake Erie watershed in an effort to change behavior and thereby reduce nutrient and sediment loading to Lake Erie. Ohio Sea Grant will also continue targeting special programs for other nutrient sources including CSOs, failing septic tanks, water treatment plants and lawn fertilizer. The program has renovated its research facilities at Stone Lab and entered into partnerships with Ohio EPA and the Lake Erie Charter Boat Association to allow it to monitor nutrient levels, toxin levels and algal concentrations in order to evaluate the effectiveness of its ecosystem-based management efforts.

Using its education expertise, the program will provide the information and training necessary to implement ecosystem-based management. Through its outreach program, Ohio Sea Grant will continue to alert Ohio communities of any improved practices, resources or policies regarding watershed-based management approaches. The program will provide information and resources

OHIO SEA GRANT ASSISTS CITY OF TOLEDO IN ADDRESSING HARMFUL ALGAL BLOOM PROBLEM

When a drinking water ban was issued in Toledo, Ohio in early August 2014, it was due to toxins from a harmful algal bloom (HAB). When the news was made public, staff from Ohio Sea Grant and Stone Lab, who have decades of experience monitoring and preventing harmful algal blooms in Lake Erie, jumped into action.

Ohio Sea Grant director Dr. Jeff Reutter worked with a number of media outlets, as well as government officials like Toledo mayor D. Michael Collins and the local water plant to help educate the public on the issue and manage the bloom and its impacts on Toledo residents. And Stone Lab limnologist Dr. Justin Chaffin worked with scientists and utilities along the Lake Erie shore to test water samples and estimate the extent of the bloom. Chaffin also led water testing around the Lake Erie islands for their coastal residents.



The Ohio Sea Grant team also created an easy-to-update website for the public that answered some of the most common questions Dr. Reutter was receiving from journalists, government officials, and the public. The site, found at go.osu.edu/toledohab, also houses a recording of a webinar Ohio Sea Grant held shortly after the drinking water ban was lifted again, as well as other information about harmful algal blooms, their impacts and potential preventive measures.

FOCUS AREA: HEALTHY COASTAL ECOSYSTEMS (HCE)

through the Ohio Sea Grant website, social media outlets and the formal and informal education opportunities at Stone Laboratory, the Aquatic Visitors Center and throughout the Ohio Sea Grant network. Ohio Sea Grant will continue facilitating workshops, consultations and field trips that bring together residents, resource managers, businesses and industries, educating these sectors on the most up-to-date information regarding ecosystem-based management.

Learning Outcomes

- 2.1. Farmers learn best management practices to reduce nutrient runoff and erosion.
- 2.2. Coastal communities learn their roles in both causing and preventing harmful algal blooms.
- 2.3. Stakeholders have access to data, models, policy information and training that support Great Lakes ecosystem-based planning, decision-making and management approaches.
- 2.4. Baseline data, standards, methodologies and indicators are developed to assess the health of Lake Erie ecosystems and watersheds.
- 2.5. Residents, resource managers, businesses and industries understand the effects of human activities and environmental changes on Lake Erie fisheries, water quality and Great Lakes' coastal resources.
- 2.6. Resource managers have an understanding of the policies that apply to coastal protected species, such as the Lake Erie watersnake.

Action Outcomes

- 2.7. Methodologies are developed and used to evaluate a range of practical ecosystem-based management approaches for planning and are adaptable to future management needs.
- 2.8. Resource managers apply ecosystem-based management principles when making decisions about Lake Erie and its watershed.
- 2.9. Resource managers incorporate laws and policies to facilitate and implement ecosystem-based management throughout Lake Erie and its watershed.
- 2.10. Residents, resource managers and businesses integrate social, natural and physical science when managing resources and work with all sectors in the decision-making process.

Consequence Outcomes

- 2.11. Land, water and living resources are managed using ecosystem-based approaches.
- 2.12. Based on Ohio Sea Grant research and monitoring efforts, managers are able to use adaptive management to modify ecosystem-based management approaches to reach desired outcomes.

FOCUS AREA: HEALTHY COASTAL ECOSYSTEMS (HCE)

3. **Goal:** Lake Erie and Great Lakes ecosystems and their habitats are protected², enhanced or restored.

Strategy

Ohio Sea Grant intends to engage residents, resource managers and businesses through informal education opportunities, public presentations, workshops, trainings and web-based media to share why Lake Erie is important and what they can do to enhance their coast. It will continue to expand the Clean Marinas and Clean Boaters programs, and the program will support sustainable coastal community and economic development in order to define, build value, protect and highlight non-degraded systems. Ohio Sea Grant will also help residents, resource managers and businesses understand emerging threats to help Ohio communities remain aware and prepared. Additionally, the program will continue wetlands restoration programs, develop collaborations with groups involved in restoration and conservation and support research proposals seeking to restore or enhance coastal ecosystems.

Learning Outcomes

- 3.1. Residents, resource managers and businesses understand the importance of the benefits provided by preserving non-degraded ecosystems throughout the Great Lakes.
- 3.2. Residents, resource managers and businesses understand the threats to Lake Erie and the consequences of degraded ecosystems.
- 3.3. Scientists develop technologies and approaches to restore degraded ecosystems within the Lake Erie watershed.

Action Outcomes

- 3.4. Decision-makers, resource managers and businesses set realistic and prioritized goals to protect, enhance and restore habitats throughout the Lake Erie watershed by incorporating scientific information and public input.
- 3.5. Resource managers, businesses and residents adopt innovative approaches and technologies to maintain or improve the function of ecosystems throughout the Lake Erie watershed.

Consequence Outcomes

- 3.6. Great Lakes habitats are protected, enhanced or restored.
- 3.7. Degraded ecosystem function and productivity are restored throughout the Lake Erie watershed and the Great Lakes.

² In the context of this goal, protected areas are those places in some form of conservation management program

FOCUS AREA: HEALTHY COASTAL ECOSYSTEMS (HCE)

Healthy Coastal Ecosystems Performance Measures

1. By 2018, 200 Ohio Sea Grant tools, technologies and information services will have been used by our partners/customers to improve ecosystem-based management.
2. By 2018, 12 ecosystem-based approaches will be used to manage land, water and living resources in coastal areas as a result of Ohio Sea Grant activities.
3. By 2018, 40 acres of coastal habitat will be protected, enhanced or restored as a result of Ohio Sea Grant activities.

COMMUNITY PARTNERSHIP REMOVES LAKE ERIE TRIBUTARY FROM AREAS OF CONCERN LIST

The Ashtabula River was removed from the U.S. EPA's Areas of Concern list in September 2014, after more than two decades of work by the Ashtabula River Partnership (ARP) and its partners, which include Ohio Sea Grant's Frank Lichtkoppler, a founding member of the ARP.

A dredging project was completed in 2009, making the river one of the cleanest, deepest harbors in Lake Erie. The project moved 635,000 cubic yards of contaminated sediment, including 25,000 tons of polychlorinated biphenyls (PCBs) and other pollutants, to a special landfill. Beyond the environmental benefits, having the deep draft available will allow for increased shipping and boating traffic.

"A lot of people worked very long and very hard to see the dredging completed," says Lichtkoppler. "The ARP members really came together to make this happen."

In recent years, the ARP focused on restoring the environment around the river, to help provide new opportunities for local marinas and businesses that come with a cleaner environment.

The Ashtabula River was designated as one of 43 Areas of Concern by the International Joint Commission (IJC) in 1987. Although a Remedial Action Plan to clean up the river was published in 1991, no real progress was made until the community itself chose to organize the ARP in 1994. Funding for the project was found in 2002, and dredging began in October 2007.



FOCUS AREA: SUSTAINABLE FISHERIES AND AQUACULTURE (SFA)³

Lake Erie's fishery is part of the economic and cultural identity of many coastal communities. The Lake Erie sport fishery is known for its extensive Smallmouth Bass, Steelhead, Yellow Perch, and Walleye populations and the commercial fishery is the most valuable freshwater commercial fishery in the world. Furthermore, Lake Erie often produces more fish for human consumption than the other four Great Lakes combined, explaining why the Ohio portion of the lake hosts more than 40 percent of Great Lakes' charter boats and supports one of the world's largest charter boat industries.

Although valuable, the Lake Erie fishery is finite. In the past few decades, an uptick in the number of threats that could jeopardize a sustainable fishery has caught the attention of the public and media and underscored the need to remain vigilant on protecting fishery and ecosystem resources. Specifically, aquatic invasive species like the zebra/quagga mussels and round goby have altered food web dynamics in the lake. Asian

Carp (Bighead and Silver) have the potential to disrupt the system further if they establish in Lake Erie, compromising sport-fish populations and changing the entire fish community composition. These impending threats may lead to catastrophic consequences, which is why focused research, management and public awareness are essential to protect this freshwater community.

It is imperative to strike a balance between demand and sustainability of the fishery. Ohio Sea Grant recognizes the need to understand how changes in the ecosystem impact these resources and to identify how to help the fishing industry and public understand these impacts. Understanding the genetic makeup of the fishery has been the focus of recent years, leading to a better understanding of spawning rituals and prioritized habitats. By supporting ongoing research, educating the public and maintaining open communication with the fishing community, Ohio Sea Grant works toward a more sustainable future for fisheries in Lake Erie.

- 4. Goal:** A safe, secure and sustainable Lake Erie fishery to meet public demand.

Strategy

Ohio Sea Grant will continue to provide up-to-date information to fishery managers, anglers and the public regarding changes in policy and regulations, new research findings and responsible fishing techniques and tools through presentations, training workshops and informal and formal education opportunities at Stone Laboratory, the Aquatic Visitors Center and throughout the Ohio Sea Grant network. Ohio Sea Grant will continue the annual Ohio Charter Captain's Conference, a source of information and updates on good fishery management for more than 30 years, which has a proven track record of increasing attendee profits and economic resiliency. Additionally, the program will support research focused on wild fish population studies, the food web, sustainable fishing techniques, innovations in aquaculture and the economic impact of the Ohio charter fishing industry.

³ Ohio Sea Grant uses a working definition of "fishery sustainability" that is based on the NOAA Fishwatch concept. Sustainability involves "meeting today's needs without compromising the ability of future generations to meet their needs. In terms of fish, this means catching or farming fish responsibly, with consideration for the long-term health of the environment and the livelihoods of the people who depend upon the environment."

FOCUS AREA: SUSTAINABLE FISHERIES AND AQUACULTURE (SFA)

Learning Outcomes

- 4.1. Fishery managers and fishermen understand the dynamics and drivers of wild fish populations.
- 4.2. The charter boat and fishery industries⁴ are knowledgeable about innovative technologies, approaches and policies.
- 4.3. Lake Erie commercial and recreational fishers are knowledgeable about efficient and responsible fishing techniques and fishery sustainability.
- 4.4. Lake Erie commercial and recreational fishers are knowledgeable about fishing regulations and why they are important.
- 4.5. The fishery industry is knowledgeable about best practices to minimize aquatic invasive species.

NEW BREED OF YELLOW PERCH GROWS FASTER AND MORE RELIABLY IN AQUACULTURE OPERATIONS

Yellow Perch is a staple of Lake Erie restaurant menus, ranging from classic fish fry to local specialties. Some of these fish come from aquaculture: fish farms across the Great Lakes raise Yellow Perch, and aquaculture sales in Ohio tripled from \$1.8 million to \$6.6 million in 2010.

Researchers at the Ohio State University's South Centers in Piketon, partially funded by Ohio Sea Grant, are selectively breeding Yellow Perch to thrive in aquaculture operations, using DNA markers to separate sibling fish. This method helps to avoid inbreeding, which can affect future generations by slowing growth rates and making fish more susceptible to disease. When combined with more traditional selection of favorable traits, this leads to a marked improvement in the fish.



Now in the third generation, these improved Yellow Perch can reach marketable size about 30% faster than unimproved fish, in 12 or 13 months instead of 18 months. “They genetically utilize the feed better,” explains Dr. Han-Ping Wang, Director and Principal Scientist for the Ohio Aquaculture Research & Development Integration Program (OARDIP) at OSU South Centers. “So that means they use the same amount of feed, but they can reach market size in a shorter time. And that saves a lot of time, a lot of labor, a lot of feed, and a lot of cost.”

⁴ The seafood industry includes all sectors of the industry, including aquaculturists, commercial fishermen, haulers, bait dealers, retailers and supporting businesses.

FOCUS AREA: SUSTAINABLE FISHERIES AND AQUACULTURE (SFA)

- 4.6. Ohio consumers have an increased knowledge of the nutritional benefits and risks of local fish species, how to judge fish safety and quality and appropriate fish preparation techniques.
- 4.7. The charter boat industry is aware of innovative and required business opportunities, fishing and marketing strategies.

Action Outcomes

- 4.8. Lake Erie fishers employ efficient fishing techniques.
- 4.9. Lake Erie fishers apply techniques to reduce negative impacts on depleted, threatened or endangered species.
- 4.10. Recreational fishers fish sustainably.
- 4.11. The Lake Erie fishery sector adopts techniques and approaches to minimize its environmental impact.
- 4.12. Lake Erie watershed resource managers establish policies and regulations that achieve a better balance between economic benefit and conservation goals.
- 4.13. Natural and human threats to the long-term viability of Lake Erie's fish populations are minimized.

Consequence Outcomes

- 4.14. The seafood⁵ supply from Ohio waters is sustainable and safe.
 - 4.15. There is an expansion of the sustainable Ohio fishing and aquaculture industries.
5. **Goal:** Informed consumers who understand the health benefits of fish consumption and how to evaluate the safety and sustainability of the fish they buy and catch.

Strategy

Ohio Sea Grant will continue to provide up-to-date information to the public regarding safe and sustainable seafood consumption through presentations, training workshops and informal and formal education opportunities at Stone Laboratory, the Aquatic Visitors Center and throughout the Ohio Sea Grant network. The program will also support research focused on determining contaminant levels in Lake Erie-based seafood.

⁵ Seafood includes product originating from all sectors of the fishing and aquaculture industries in Ohio waters.

FOCUS AREA: SUSTAINABLE FISHERIES AND AQUACULTURE (SFA)

Learning Outcomes

- 5.1. The Lake Erie fishery industry is aware of the standards for safe seafood.
- 5.2. Ohio seafood consumers have the knowledge to evaluate sustainable seafood choices.
- 5.3. Ohio seafood consumers have an increased knowledge of the nutritional benefits of seafood products and know how to judge seafood safety and quality.

Action Outcomes

- 5.4. Recreational fishers follow advice in consumption advisories and minimize contaminant uptake.

Consequence Outcomes

- 5.5. Consumers avoid excessive contaminant uptake.

Sustainable Fisheries and Aquaculture Performance Measures

4. By 2018, 300 fishers, seafood processors and aquaculture industry personnel will have modified their practices using knowledge gained in fisheries sustainability and seafood safety as a result of Ohio Sea Grant activities.
5. By 2018, 100 seafood consumers will modify their practices using knowledge gained in fisheries sustainability, seafood safety and health benefits of seafood as a result of Ohio Sea Grant activities.

OHIO SEA GRANT HELPS GUIDE COMPREHENSIVE MANAGEMENT PLAN FOR AQUATIC INVASIVE SPECIES

Ohio Sea Grant personnel Eugene Braig and Dave Kelch collaborated with the Ohio Department of Natural Resources (ODNR), Division of Wildlife to revise the comprehensive State Management Plan for Aquatic Invasive Species. This document guides Ohio policy and interagency activities within the state. The revised plan was submitted to the national Aquatic Nuisance Species Task Force (ANSTF) in October 2012 and approved and implemented in March 2013.

This ongoing collaboration was initiated by an \$8,750 grant from the Great Lakes Commission in 2007 and continued as two grants from the ODNR totaling \$25,000 and running to 2012. Braig continues to chair the state's stakeholder advisory committee on aquatic invasive species and serves as Ohio's alternate representative to the Mississippi River Basin Panel of the ANSTF; Tory Gabriel serves as the state's alternate representative on the Great Lakes Panel.

"Partnering with Ohio's management agencies and other regional groups like the Great Lakes Sea Grant Network allows us to combat the threat of aquatic invasive species on multiple fronts," explains Gabriel. "Working together results in a more efficient and effective effort to reduce the spread and impacts of AIS, whether it's through regulation changes, training sessions, or outreach programs."



FOCUS AREA: RESILIENT COMMUNITIES AND ECONOMIES (RCE)⁶

The coastline provides countless economic, social and recreational opportunities for millions of Lake Erie residents and visitors. Tourism alone accounts for more than \$11 billion in revenue for the eight Ohio coastal counties. Sport fishing supports nearly 23,000 Ohio jobs and provides \$1 billion to the coastal economy⁷. In addition, 41 percent of Ohio's population lives in the Lake Erie basin. This concentration of residents and visitors puts additional strain on already finite coastal resources and leaves the population and its economic stability vulnerable to natural hazards, such as climate change, flooding, erosion and harmful algal blooms. To accommodate more people and activity while balancing demands on coastal resources, Ohio Sea Grant must support the development of innovative policies, institutional capacities and management approaches to increase community resilience and coastal sustainability⁸.

Furthermore, Lake Erie is the southernmost, shallowest and warmest of the Great Lakes. Due to the lake's physical characteristics, impacts of emerging issues often appear here first and with greater intensity. Lake Erie's watershed is also the most populated of the Great Lakes, meaning not only is there a greater dependency on the lake for local communities and economies, but increased

media exposure and public awareness when things go wrong. Its watershed is also the least forested and the most urbanized and agricultural, increasing the chances of human-related impacts. Although this creates a greater demand for Ohio Sea Grant research, education and outreach, the increased saliency creates additional opportunities to engage stakeholders in discussions about Lake Erie, its value and stewardship.

It is Ohio Sea Grant's priority to change public behavior while maximizing economic benefits and minimizing losses, especially in the face of emerging coastal threats. Ohio Sea Grant recognizes the need to continue its work with the fisheries and birding communities, tourism and other economic sectors to increase business resiliency and increase awareness of and preparedness for impending hazards. Additionally, the program must maintain efforts to increase access to the coastline, support current coastal industries and encourage sustainable coastal development. By increasing awareness and providing hazard preparedness training, as well as building resiliency and value of ecosystem-dependent businesses and communities, Ohio Sea Grant can help the coastal community function within the limits of the ecosystem.

6. **Goal:** Development of vibrant and resilient Lake Erie coastal economies.

Strategy

To strengthen Lake Erie-based economies, Ohio Sea Grant will continue supporting the sustainable use of coastal resources and educate elected officials, community leaders and the public on why this is important and how to gain value from such efforts. The program will continue developing an aquatic invasive species rapid response plan and other hazard trainings. Also, to educate the public on Lake Erie's economic value, Ohio Sea Grant will continue to partner with the tourism sector, produce webinars, informational sessions and factsheets that discuss sustainable tourism issues

⁶ Resilience is determined by the degree to which a community is capable of organizing itself to increase its capacity for learning from past economic, natural or technological disasters.

⁷ The Ohio Environmental Council, 2009: http://www.theoec.org/pdfs/factsheets/ohiowater_factsheet_9-09.pdf

⁸ NOAA National Sea Grant College Program 2014-2017 Strategic Plan

FOCUS AREA: RESILIENT COMMUNITIES AND ECONOMIES (RCE)

and support economic valuation of coastal resources through social science research. Through partnerships with other state and federal agencies, Ohio Sea Grant will continue building upon the successes of the Ohio Coastal Training Program to reach decision-makers. The program will also continue to use its unique array of education and outreach programs, such as Stone Laboratory and Aquatic Visitors Center tours and workshops, Clean Marinas and Clean Boater programs, resource-based tourism product development activities, elected officials trainings, Ohio Sea Grant Extension network presentations and informal education opportunities to make communities aware of the balance between the health of the economy and the health of Lake Erie's natural and cultural systems.

Learning Outcomes

- 6.1. Ohio communities⁹ are aware of the interdependence between the health of the economy and the health of Great Lakes natural and cultural systems.
- 6.2. Ohio communities have access to information needed to understand the value of waterfront and tourism-related economic activities.
- 6.3. Ohio communities understand the strengths and weaknesses of alternative development scenarios on resource consumption and local economies.
- 6.4. Ohio communities are aware of regulatory regimes affecting economic sustainability.
- 6.5. Ohio communities are knowledgeable about economic costs and benefits from energy planning and conservation.

Action Outcomes

- 6.6. Ohio citizens are actively engaged in management and regulatory decisions concerning Lake Erie and the surrounding watershed.
- 6.7. Ohio communities engage in economic development initiatives that capitalize on the value of their natural and cultural resources while balancing Lake Erie watershed resource conservation and economic growth.

Consequence Outcomes

- 6.8. Great Lakes communities have diverse, healthy economies and industries without displacing traditional working waterfronts¹⁰.

⁹ Communities are defined broadly to include governments, businesses, residents, visitors and non-governmental organizations.

¹⁰ Working waterfront is a term broadly used in this plan to include water-dependent and water-related industries, such as energy production, tourism, ports and harbors, marine transportation, shipyards, marinas, commercial fishing, recreational fishing, aquaculture, fishing piers and public access.

FOCUS AREA: RESILIENT COMMUNITIES AND ECONOMIES (RCE)

7. **Goal:** Communities use comprehensive planning to make informed strategic decisions.

Strategy

Ohio Sea Grant will support sustainable community development by providing unbiased, science-based resources and expertise to local businesses, decision-makers and the public, highlighting the methods and benefits of effective planning. Ohio Sea Grant will continue to offer leadership training for elected and appointed officials and emerging community leaders, which includes sessions about community planning and sustainable development, and the program will maintain relationships and open communication with land-use planners along the coast. Additionally, the program will educate coastal communities about hazard rapid response plans. Ohio Sea Grant will also identify barriers to sustainable development and determine key issues facing policymakers to guide future work in this area.

Learning Outcomes

- 7.1. Ohio coastal communities understand the connection between planning and natural resource management issues and make management decisions that minimize conflicts, improve resource conservation efforts and identify potential opportunities.

Action Outcomes

- 7.2. Ohio communities make use of tools and information to explore the different patterns of coastal development, including community visioning exercises, resource inventories and coastal planning.
- 7.3. Ohio communities adopt and implement coastal plans that include sustainable development principles.
- 7.4. The public, leaders and businesses within the Lake Erie watershed work together to implement plans for the future that include sustainable development principles and to balance multiple uses of coastal areas.

Consequence Outcomes

- 7.5. Quality of life in Great Lakes communities, as measured by economic and social well-being, improves without adversely affecting environmental conditions.

FOCUS AREA: RESILIENT COMMUNITIES AND ECONOMIES (RCE)

8. **Goal:** Improvements in Lake Erie and Great Lakes coastal water resources sustain human health and ecosystem services.

Strategy

Ohio Sea Grant intends to support research exploring the human impact on and value of Lake Erie water resources. Using a variety of outlets, such as the program's magazine, *Twine Line*, web-based media and presentations, Ohio Sea Grant will share results with Lake Erie stakeholders. Stone Laboratory, the Aquatic Visitors Center and the Ohio Sea Grant Extension Network will disseminate the most up-to-date information about water laws, policies and research findings, and explore and communicate how community actions can improve or hinder water resource quality and quantity. The program intends to expand the Clean Marinas and Clean Boater programs as well as enhance the reach and visibility of extension educators to provide resources to a wider audience, all in an effort to spread the value of Lake Erie stewardship. By communicating the value of water to the Lake Erie public, Ohio Sea Grant hopes to encourage sustainable practices with water resources and improvements in ecosystem services.

OHIO TOURISM LEADERSHIP ACADEMY PROVIDES TOOLS TO MOVE OHIO FORWARD

Tourism is an \$11 billion industry for Lake Erie communities, representing nearly a third of Ohio's total economic impact. Lake Erie tourism is vital for Ohio, and policy decisions made by state industry leaders contribute to the health of the industry, yet many lack the interdisciplinary experience, understanding, and knowledge to take on leadership roles.

Recognizing the powerful role tourism industry leaders could play if they were armed with the necessary tools and contacts to make informed decisions, the Ohio Travel Association and Ohio Sea Grant launched the Ohio Tourism Leadership Academy in 2008. Leadership Academy classes focus on arts, humanities, economic development, media, natural resources and heritage, as well as legislative advocacy.

To date, 67 industry members have graduated from the program, and 19 are enrolled in the 2014 class. Evaluations show that class members experience a 26.3% increase in their perception that their activities will make a difference, and an 18.5% increase in their level of confidence, and 82% of graduates have campaigned for leadership positions within three years of graduation.

Recent graduates have run for local elected offices, statewide association board seats, and regional boards, and five have earned accolades from national industry associations. An alumni association of graduates has formed to collaborate in policy activity, mentor new class members, perform community service, and maintain relationships forged during their academy experience.



FOCUS AREA: RESILIENT COMMUNITIES AND ECONOMIES (RCE)

Learning Outcomes

- 8.1. Ohio communities are aware of the impact of human activities on water quality and supply.
- 8.2. Ohio communities understand the value of clean water, adequate supplies and healthy watersheds.
- 8.3. Ohio communities within the Lake Erie watershed understand water laws and policies affecting the use and allocation of water resources.

Action Outcomes

- 8.4. Ohio communities engage in planning efforts to protect water supplies and improve water quality.
- 8.5. Ohio communities adopt mitigation measures, best management practices and improved site designs in local policies, ordinances and other measures to address water supplies and water quality.

Consequence Outcomes

- 8.6. Lake Erie and Great Lakes water supplies are sustained.
 - 8.7. Lake Erie and Great Lakes water quality improves.
9. **Goal:** Resilient Lake Erie and Great Lakes coastal communities adapt to the impacts of hazards and climate change.

Strategy

Ohio Sea Grant intends to inform the public about adaptation strategies and best management practices for impending threats through research, education and outreach. Through developing printed material, presentations, formal and informal education at Stone Laboratory and the Aquatic Visitors Center, sector-specific training sessions and conferences and cutting-edge use of technology, Ohio Sea Grant will integrate communication techniques to deliver these messages to the widest audience possible, while still being able to tailor messages for specific user groups. Ohio Sea Grant will also continue developing rapid response plans in conjunction with local, state and federal partners, and it will support research exploring the potential impacts of emerging threats and climate change.

Learning Outcomes

- 9.1. Great Lakes residents and decision-makers are aware of and understand the processes that produce climate change and other hazards and the implications of those processes for them and their communities.
- 9.2. Great Lakes decision-makers are aware of existing and available hazard- and climate-related data and resources and have access to information and skills to assess local risk vulnerability.

FOCUS AREA: RESILIENT COMMUNITIES AND ECONOMIES (RCE)

- 9.3. Great Lakes communities have access to data and innovative and adaptive tools and techniques to minimize the potential negative impact from hazards.
- 9.4. Ohio and Great Lakes decision-makers understand the legal and regulatory regimes affecting adaptation to climate change and other impending hazards, like harmful algal blooms or aquatic invasive species.

Action Outcomes

- 9.5. Ohio communities apply best-available hazards and climate change information, tools and technologies in the planning process.
- 9.6. Great Lakes decision-makers apply data, guidance, policies and regulations to hazard planning and recovery efforts.
- 9.7. Ohio communities develop and adopt comprehensive hazard mitigation and adaptation strategies suited to local needs.
- 9.8. Ohio residents take action to reduce the impact of coastal hazards on their life and property.

CLIMATE WEBINAR SERIES HELPS GREAT LAKES RESIDENTS BETTER UNDERSTAND A GLOBAL ISSUE

When people think about the effects of climate change, many will still picture that iconic lone polar bear clinging to a shrinking iceberg in the arctic. But many don't realize that climate change's effects in the Great Lakes could also be severe, directly affecting people's food, their health, and their environments.

To help better explain those impacts for Great Lakes residents, 10 departments within The Ohio State University, including Ohio Sea Grant, partnered in 2008 to create the Global Change, Local Impact webinar series. The monthly series brings in experts from around the region to discuss Great Lakes-related issues, with more than 5,700 attendees representing 500 organizations in governmental agencies, academia, non-profit groups, private industry, and the legislature from across the country and abroad.

The series has also become the largest live e-learning program at Ohio State, with more than 38,000 accessing training and education information archived at GreatLakesClimate.com. For these attendees, real-time and recorded webinars provide access to current research data, with evaluation surveys showing that 93% of responders find the information provided by the webinars useful, and 67% of responders saying that they have learned information to improve their job performance.



FOCUS AREA: RESILIENT COMMUNITIES AND ECONOMIES (RCE)

- 9.9. Ohio communities adopt a comprehensive risk communications strategy for hazardous events.

Consequence Outcomes

- 9.10. Great Lakes communities effectively prepare for hazardous events and climate change.
- 9.11. Great Lakes communities are resilient and experience minimum disruption to life and their economies following hazard events.

Resilient Communities and Economies Performance Measures

6. By 2018, 12 communities will have implemented sustainable economic and environmental development practices and policies (e.g., land-use planning, working waterfronts, energy efficiency, business retention and expansion, climate change planning, smart growth measures, green infrastructure) as a result of Ohio Sea Grant activities.
7. By 2018, 80 communities will have implemented hazard resiliency practices to prepare for, respond to or minimize coastal hazardous events as a result of Ohio Sea Grant activities.

OHIO CLEAN MARINAS PROGRAM ENCOURAGES SUSTAINABLE MARINA DEVELOPMENT, RECYCLING

The Ohio Clean Marinas Program encourages marinas to help protect some of Lake Erie's most valuable resources: clean air and water. The program also rewards marinas that go above and beyond to adopt best management practices.

Forest City Yacht Club in Cleveland is one of those certified Ohio Clean Marinas. The club uses information provided by the program to help club leadership understand and prioritize environmentally sound marina practices, such as participating in the Ohio Clean Marinas Shrinkwrap Recycling Program. Forest City has also planned ahead during some recent construction work to make sure its boat wash area could eventually be connected to the sewer system instead of draining into the lake.



"Membership certainly agrees that they are all outdoor enthusiasts, so it makes a lot of sense to do the vast majority of the requirements to be a part of the program," says John Hanson, chairman of the marina's Environmental & Clean Marina Committee. "It's really driven a lot of very good conversations."

Since the beginning of the shrinkwrap recycling program in 2006, marinas and greenhouses along Lake Erie have recycled more than 2.2 million pounds of shrinkwrap, the equivalent of filling 47 buses full of plastic. The shrinkwrap was recycled into guardrail blocks, which have been used along 411 miles of road in Ohio and neighboring states.

FOCUS AREA: ENVIRONMENTAL LITERACY AND WORKFORCE DEVELOPMENT (ELWD)

An engaged, environmentally literate public is the most effective tool to address the environmental challenges facing the Great Lakes. Furthermore, a workforce skilled in science, technology, engineering, math (the STEM disciplines) and communication is a powerful weapon in the innovation needed to preserve vital coastal resources and to combat future coastal hazards. Overall, a skilled and engaged citizenry can more effectively develop the tools, technologies and strategies necessary to protect and enhance the Great Lakes.

Ohio Sea Grant prides itself in its efforts toward guiding an environmentally literate public. The program works closely with state agencies and local non-governmental organizations, such as the Department of Natural Resources Division of Wildlife and The Nature Conservancy, to offer formal¹¹ and informal training to the public. Ohio Sea Grant Extension Educators organize a variety of conferences and training sessions to keep the coastal workforce up-to-date on the newest strategies, technologies and policies in their sectors. Also, Ohio Sea Grant's Stone Laboratory research facility and the Aquatic Visitors Center provide informal and formal education to more than 13,000 visitors annually, ranging in age from elementary to adult learners. Stone Laboratory organizes and facilitates field trips, workshops, conferences and lecture series that allow EPA managers to work side-by-side with water treatment operators, and high schoolers to learn next to decision-makers. Furthermore, a portion of the Stone Laboratory summer curriculum is

devoted to educators, giving them the skills and tools necessary to further public environmental literacy. By organizing collaborative, focused educational and training opportunities, Ohio Sea Grant sets the stage for the creativity and passion needed to defend Lake Erie's coastal health.

Ohio Sea Grant and its partners (the Ohio Lake Erie Commission, the Ohio Department of Natural Resources (ODNR) Office of Coastal Management, and ODNR Division of Wildlife – Old Woman Creek National Estuarine Research Reserve) were the first on the Great Lakes to develop literacy principles tailored to regional education standards and information needs. Linked to the NOAA Ocean Literacy Principles, the Lake Erie Literacy Principles will be used to continue to support lifelong learning. Place-based educational venues, such as museums, nature centers and aquaria, reach thousands of residents and visitors each year. Through the use of the Literacy Principles, accurate and important messages about Lake Erie will be linked to formal education messaging and instruction, creating a path of learning beyond the classroom.

Ohio Sea Grant recognizes the need to continue providing education and skills training to the Lake Erie coastal community to develop workforce capacity and promote superior resource management. By expanding formal and informal education both within and beyond traditional classrooms, Ohio Sea Grant will continue to encourage active Great Lakes stewardship.

¹¹Formal is defined as training or education that is done for a credit or certification

FOCUS AREA: ENVIRONMENTAL LITERACY AND WORKFORCE DEVELOPMENT (ELWD)

- 10. Goal:** An environmentally literate public supported and informed by a continuum of lifelong formal and informal engagement opportunities.

Strategy

Ohio Sea Grant intends to continue its pursuit of this goal with the programming, courses, field trips, workshops, tours and seminars offered at Stone Laboratory, the Aquatic Visitors Center and throughout the state. Through continued collaboration with informal science education centers, as well as providing formal courses, seminars and various programs geared toward formal and informal educators, the program's reach will be magnified by training the trainers. Additionally, Ohio Sea Grant will continue encouraging the adoption of Great Lakes Literacy Principles throughout Great Lakes' classrooms and informal education centers.

Learning Outcomes

- 10.1. Formal and informal educators are knowledgeable of the best available science on the effectiveness of environmental science education.
- 10.2. Formal and informal educators understand Great Lakes environmental literacy principles and they understand how best to apply them in the classroom or informal settings.
- 10.3. Lifelong learners know where to engage in Great Lakes informal science education opportunities focused on coastal topics.
- 10.4. Students in grades 4-12 and adults participate in Ohio Sea Grant courses, field trips, workshops and conferences and gain information and experiential learning that impacts their attitudes and decisions about coastal, ocean and Great Lakes issues.

Action Outcomes

- 10.5. Formal and informal educators use Great Lakes environmental literacy principles in their teaching activities.
- 10.6. Formal and informal curricula are developed and refined using the best available research on the effectiveness of environmental and science education.
- 10.7. Formal and informal education programs take advantage of the knowledge of Ohio Sea Grant-supported scientists and engagement professionals.
- 10.8. Formal and informal educators, students and/or the public collect and use Great Lakes coastal weather data in inquiry and evidence-based activities.
- 10.9. Lifelong learners make choices and decisions based on information they learned through informal Great Lakes science education opportunities.

FOCUS AREA: ENVIRONMENTAL LITERACY AND WORKFORCE DEVELOPMENT (ELWD)

10.10. Educators work cooperatively to leverage federal, state and local investments in Great Lakes coastal environmental education.

Consequence Outcomes

10.11. Members of the public incorporate broad understandings of their actions on the environment into personal decisions.

11. Goal: A future workforce reflecting the diversity of Ohio Sea Grant programs, skilled in science, technology, engineering, mathematics and other disciplines critical to local, regional and national needs.

Strategy

Ohio Sea Grant intends to continue offering and improving upon science, technology, engineering and mathematics (STEM) programming at Stone Laboratory and the Aquatic Visitors Center. Stone Laboratory will continue providing formal and informal STEM education opportunities, such as tours, courses, field trips and workshops, geared toward K-gray (adult) students. The program will

SEA GRANT EDUCATION HOOKS STUDENTS EARLY ON SCIENCE

Stone Laboratory's Lake Erie Science Field Trip Program started in 1973 with the idea that kids learn better and retain information longer if they can participate in hands-on activities. "We saw early on that if students are wading in Lake Erie water with nets in their hands, they're going to remember what they learned much better than in a classroom," explains Matt Thomas, Stone Lab's manager.

Located on Ohio State's island campus on Lake Erie, Stone Lab uses the lake as a living laboratory to provide student groups from all over the country with one-of-a-kind, interactive science experiences. Kids become Lake Erie scientists for the day, venturing out on Stone Lab research vessels to take water samples, heading into the lab to analyze the catch, and scouring the island for native species. Teachers appreciate that Stone Lab applies science concepts that the students could never fully internalize elsewhere.



For many kids, the experience is the first time they have ever seen Lake Erie, Ohio's most valuable natural resource. "When they see firsthand all the life that Lake Erie holds, it's hard not to want to preserve and protect it," says Thomas. That may be why so many of the more than 100,000 students who have gone through the program over the years end up returning later in college to take Stone Lab summer courses.

FOCUS AREA: ENVIRONMENTAL LITERACY AND WORKFORCE DEVELOPMENT (ELWD)

also highlight the benefits of STEM skillsets and make students aware of potential career paths involving STEM topics. Additionally, Ohio Sea Grant will provide presentations throughout Ohio on STEM education opportunities offered through the program. Ohio Sea Grant will support STEM curriculum development for educators and continue training educators on Great Lakes-oriented STEM education techniques.

Learning Outcomes

- 11.1. Ohio students and teachers are aware of opportunities to participate in Ohio Sea Grant science, technology, engineering, mathematics and active stewardship programs.

REGIONAL EDUCATION COLLABORATION BRINGS TEACHERS, STUDENTS CLOSER TO GREAT LAKES

To help students in Great Lakes states connect things they learn in class with hands-on experiences that bring them closer to their environment, NOAA created the Bay Watershed Education & Training (B-WET) program in 2002.

One B-WET project, a team effort from Pennsylvania and Ohio Sea Grant educators, combines a summer teacher workshop with year-long support for a student project, to be completed at the teachers' home schools. That support includes everything from funding to having B-WET staff help teachers come up with service projects and other ideas.

“So many times, you go to a workshop and get ideas, but you never get any follow-up from the program,” says Lyndsey Manzo, Ohio Sea Grant Educator. “You want to take students to a water treatment plant, but you don’t have any money to cover a substitute teacher or the bus. Here we were providing all of that, and one of our goals was to be able to really let teachers implement what they learned with their students.”

Ohio teachers Bonnie Sansenbaugher and Lisa Bircher from East Palestine High School have taken the ideas they got during the initial workshop and run with them back in their classrooms. They started a science club at their high school, whose 22 members are currently designing an outdoor learning area for their school.



FOCUS AREA: ENVIRONMENTAL LITERACY AND WORKFORCE DEVELOPMENT (ELWD)

Action Outcomes

- 11.2. A diverse and qualified pool of applicants pursues professional opportunities for career development in natural, physical and social sciences and engineering.
- 11.3. Graduate and undergraduate students are trained in research and engagement methodologies.
- 11.4. Research projects support undergraduate and graduate training in fields related to understanding and managing our coastal resources.
- 11.5. Private sector donations to Ohio Sea Grant and Stone Lab allow students to receive scholarships, fellowships and employment opportunities from the program.
- 11.6. Volunteers enhance the quality of the program and assist in training participants.

Consequence Outcomes

- 11.7. A diverse workforce trained in science, technology, engineering, mathematics, law, policy or other related fields is employed and has high job satisfaction.

Environmental Literacy and Workforce Development Performance Measures

8. By 2018, 50 Ohio Sea Grant-facilitated curricula will have been adopted by formal and informal educators.
9. By 2018, 160,000 people will have been engaged in Ohio Sea Grant-supported informal education programs.
10. By 2018, 16 Ohio Sea Grant-supported graduates will be employed in a career related to their degree within two years of graduation.
11. State Performance Measure : 5,000 professionals will have received continuing education and/or training from Ohio Sea Grant that helps them keep their jobs or advance professionally in their career.



CROSS-CUTTING PERFORMANCE MEASURES

12. Economic (market and non-market; jobs and businesses created or retained) benefits derived from Ohio Sea Grant activities.
 - a. By 2018, \$10 million total economic (market and non-market) benefits will be derived from Ohio Sea Grant activities. (\$2.5 million per year)
 - b. 1 business will be created annually as a result of Ohio Sea Grant activities.
 - c. 3 businesses will be retained annually as a result of Ohio Sea Grant activities.
 - d. 2 jobs will be created annually as a result of Ohio Sea Grant activities.
 - e. By 2018, 40 jobs will be retained as a result of Ohio Sea Grant activities.
 - f. 0 patents will be derived annually as a result of Sea Grant activities.
 - g. By 2018, 60 peer reviewed publications will result from Ohio Sea Grant work.

13. By 2018, 60 peer-reviewed publications will be produced by the Ohio Sea Grant network, and TBD citations will accrue for all peer-reviewed publications from the previous four years.



APPENDIX A

SEDIMENTATION AND DREDGING

When storms rage across the Lake Erie region in the spring and summer months, new sediment is washed from the landscape. Sediment that had previously settled to the bottom of its tributaries is stirred up and flushed downstream to Lake Erie. The Maumee River, in Lake Erie's western basin, contributes more sediment to the lake than Lake Superior receives from all of its tributaries combined. At times the sediment is visible, creating a murky and muddy plume that not only reduces property values by creating a less-than-enticing view, but also creates the

perfect incubator for the growth of *Microcystis*, a common species of cyanobacteria that can produce toxins harmful to animals and people. Over time, the build-up of sediment reduces the depth of harbors, making it necessary to dredge and remove the excess sediment to restore safe boat passage. With dredging comes an additional risk of spreading nutrients and other pollutants like mercury and PCBs, which often rest at the bottom of these harbors attached to sediment particles. Communities must carefully assess the risks involved with any dredging project, taking care to properly dispose of contaminated sediment, often in specialized landfills or confined disposal facilities in the lake. However, an even better solution would be to prevent the sediment from leaving agricultural fields or collect it during dredging activities and reuse it on land in beneficial ways.

NUTRIENT LOADING AND PHOSPHORUS

Nutrients provide the foundation of Lake Erie's food web. Phosphorus and nitrogen are essential nutrients for algae, which are then eaten by tiny zooplankton. Larval fish feed on zooplankton, and those young fish are often devoured by the bigger fish that people love to catch and/or eat. In Lake Erie, the right balance of nutrients is an essential part of maintaining safe drinking water as well as the lake's role as a world-class fishery. But when the levels of nutrients become too high, there are often consequences. Phosphorus, a key ingredient in many fertilizers, animal waste and weed killers, finds its way to Lake Erie from many sources, including sewage treatment plants and combined sewer overflows (CSO). When water runs off agricultural fields and treated lawns, it takes phosphorus with it. Most living things



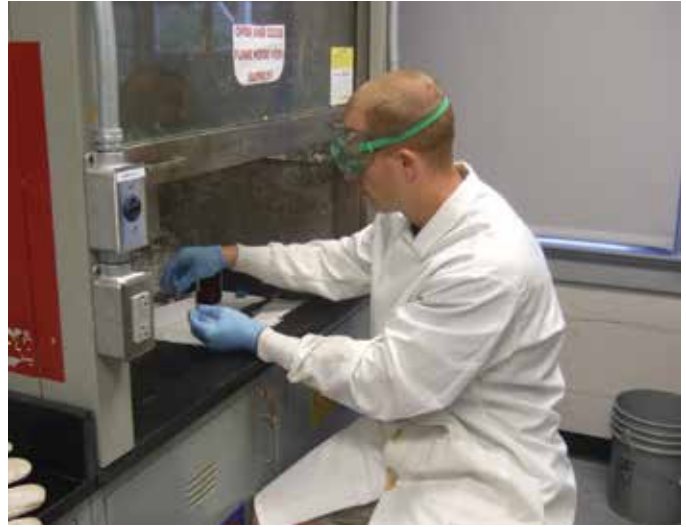
need phosphorus to survive, but in Lake Erie, it's possible to have too much of a good thing. Nuisance and harmful algae will grow until their supply of phosphorus runs out (phosphorus is often the limiting nutrient in freshwater – the nutrient that is in the shortest supply), causing the blooms that make Lake Erie look like pea soup and contribute to the dead zone.

HARMFUL ALGAL BLOOMS

In Lake Erie, the most common type of harmful algae is the cyanobacteria *Microcystis*, which thrives in the warm, phosphorus-laden water of the western basin and sometimes produces a toxin called microcystin that can cause illness and death in people and animals. Aside from these health effects, harmful algal blooms can also cause taste and odor problems in drinking water, pollute beaches and reduce oxygen levels for fish and other animals that live in Lake Erie. Zebra and quagga mussels are also thought to add to the problem by selectively filtering only beneficial algae from the water, leaving behind cyanobacteria and by concentrating nutrients in the nearshore zone. Though the blooms often originate in the Maumee and Sandusky bays in Lake Erie's western basin, currents cause them to drift out to the central basin where they die and sink to the lake bottom. Oxygen near the lake floor is then used up in the decomposition process, resulting in a dead zone. Decreasing the amount of phosphorus that enters Lake Erie could go a long way toward reducing the size of these blooms.

THE DEAD ZONE

Lake Erie is the shallowest of the Great Lakes, with an average depth of 24 feet in the western basin, 60 feet in the central basin and 80 feet in the eastern basin. The water stratifies each summer in May or June, forming a warm top layer and a cold bottom layer with a transitional line between called the thermocline. Since this split generally forms about 50 feet below the surface, the central basin is left with only 10 feet of water below the thermocline where sunlight and the mixing action of wind



cannot penetrate to replenish the supply of oxygen. The dead zone forms when the oxygen is completely consumed and remains in the central basin until the water mixes again in the fall. Any animals trapped in the area die, sometimes washing onto the Lake Erie shore in large numbers, as in a fish kill. Although there is evidence that areas of low oxygen have existed in Lake Erie for centuries, the problem is exacerbated by the increasing levels of cyanobacteria that form harmful algal blooms. Since animals such as zebra and quagga mussels will not eat cyanobacteria, much of it dies and falls to the lake bottom, where it consumes large amounts of oxygen as it is decomposed. Solving the problem of

harmful algal blooms may lead to a decrease in the dead zone.

AQUATIC INVASIVE SPECIES

More than 185 aquatic invasive species can be found in the Great Lakes, with about 75 percent of these arriving since the St. Lawrence Seaway opened in 1959, pointing to ballast water in cargo ships as one major cause. As the shallowest, warmest and biologically most productive of the lakes, Lake Erie is often the most hospitable to these foreign invaders. It's a fact that has undeniably changed its ecosystem in the last 50 years, pushing out native species and circulating toxins such as mercury in the environment that otherwise would have settled into the sediment. The first zebra mussel in Lake Erie was found on October 15, 1988 at Stone Laboratory. The population of this filter-feeding, clam-like creature exploded, reaching 30,000 per square meter within a year and causing millions of dollars of damage to water treatment facilities all along the Lake Erie shore. More recently, Round Gobies have entered the landscape, competing with bottom-dwelling native fish and creating a new path for contaminants such as mercury and PCBs to be passed up the food web and into the fish humans like to eat. At this moment, two species of Asian Carp are threatening the Great Lakes with new invasions from the Chicago area. Only improved management programs and



public education will keep additional species from reaching the Great Lakes in the future.

CLIMATE CHANGE

The details may still be debated but most scientists agree: climate change is occurring, and human activity has contributed to the problem. As the earth's atmosphere continues to warm, many of the above problems will worsen. Storms will intensify and become more frequent, increasing the amount of sediment and nutrients in Lake Erie. These additional nutrients, as well as warmer water temperatures, will benefit harmful algal blooms and exacerbate the dead zone. Milder winters could usher in new invasive species that may not have survived in colder temperatures, and native species populations may decrease without benefit of ice cover. In its research, education and outreach efforts, Ohio Sea Grant is working to better understand these critical issues and developing strategies to improve the forecast for Lake Erie for future generations.



COASTAL COMMUNITY AND ECONOMIC DEVELOPMENT

A key element of Ohio Sea Grant's past success has always been its focus on coastal community and economic development efforts. A strong local economy built upon a healthy ecosystem will value stewardship of its natural world. In addition, a weaker economy diverts funding away from ecological projects when attention is focused on emergency needs. Diversifying local community economies becomes a way to protect tax revenues and personal income during downturns in particular niche markets, and it can build awareness and increased protection of local resources if new diversifications are based on the resources themselves. Ohio Sea Grant will continue to emphasize projects that foster economic development, solve societal problems, enhance the value of Lake Erie to the state and region and address important societal issues.

TOXIC SUBSTANCES AND PHARMACEUTICAL POLLUTION

Pharmaceuticals and toxin pollution in the region's waterways pose a serious threat to the Lake Erie food web and public. Prescription and over-the-counter drugs enter waterways when medicines are disposed of incorrectly or excreted after use and introduced to surface waters through effluent from treatment plants, septic systems, industrial discharges, and commercial animal feeding operations¹². Once in the environment, pharmaceuticals normally have no immediate impact. However, long-term exposure can disrupt organ and body systems such as reproductive organs in wildlife and humans. Toxins have a more immediate impact on wildlife and human welfare, explaining why many were banned in the 1970s. Regardless, Lake Erie had been a dumping ground for centuries, and restoration efforts have not eradicated toxin pollution. Ohio Sea Grant is working to better understand short- and long-term effects of these pollutants on wildlife and human health and what can be done to prevent future exposure.



¹²"Protecting the Great Lakes from Pharmaceutical Pollution." Alliance for the Great Lakes. 2010. <http://www.greatlakes.org/Document.Doc?id=810>



OHIO SEA GRANT College Program

STRATEGIC PLAN



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Program's Mission and Goals

The mission of the Ohio Sea Grant College Program (Ohio Sea Grant) is to increase the public's understanding of Lake Erie issues and to improve development and conservation of Lake Erie's resources. Within this mission, the program has several overarching goals:

- › Promote sustainable economic development on the Lake Erie coast and within the watershed by applying scientific knowledge to solve resource concerns;
- › Develop the critical knowledge and technology to help coastal industries in Ohio as they work to enhance revenue while protecting ecosystem function;
- › Identify, protect and conserve valuable coastal habitats and strive to improve environmental conditions in Lake Erie and Great Lakes ecosystems;
- › Enable coastal and Great Lakes communities to successfully adapt to a variable climate, and stochastic social and economic conditions;
- › Improve the quality of aquatic education in Ohio to foster a more informed citizenry with a higher quality of life.



Ohio Sea Grant Core Values

The Ohio Sea Grant's core values are essential and enduring tenets that influence the organization and support its mission. These core values support a culture of integrity within an organization that is known as an honest broker. The Ohio Sea Grant Program will be:

- › **Visionary** – Advance innovative solutions that address emerging challenges (science and stewardship) and encourage creativity, initiative and innovation.
- › **Collaborative** – Seek partnerships that leverage our strengths. Be responsive and accessible, respect partners, maintain scientific neutrality, integrate diverse expertise and provide the science and knowledge needed to inform stakeholders.
- › **Dedicated to Sustainability** – Communicate the importance of good stewardship and the value of the services that the coastland Great Lakes' ecosystems provide to the Nation.
- › **Accountable** – Operate with integrity and transparency; maintain quality and relevance in administration, management and oversight.

Ohio Sea Grant College Program's Cross-Cutting Principles

Ohio Sea Grant will strive to address two specific areas that deserve our attention to enhance the Program's capabilities to meet future national needs. In the course of implementing the 2018-2021 Ohio Sea Grant Strategic Plan, the Ohio Sea Grant College Program will:

Cultivate partnerships

by integrating the expertise and capabilities of partners from the international, federal, tribal, and state communities as well as from academia, non-governmental organizations, and industry.



Enhance diversity and inclusion

by seeking and welcoming diverse perspectives to enhance cultural understanding and enable the network to pursue its vision and mission effectively and efficiently.





Overview of the Ohio Sea Grant College Program's Focus Areas, Goals, Actions and Desired Outcomes

For more than 30 years, Ohio Sea Grant has worked to help restore and rejuvenate Lake Erie and its regional economy. With its unique combination of research, education and outreach efforts, Ohio Sea Grant has become a program of action, working with stakeholders and various partners (e.g., agencies, NGOs, academics) to solve the lake's most pressing environmental issues.

It is the integration of research, education and outreach that allows Ohio Sea Grant to investigate issues and problems and share the solutions with those likely to shape our future. Research alone seldom solves problems, but when it is translated and delivered through innovative tools and training, new opportunities arise. Through its affiliation with The Ohio State University, Ohio Sea Grant's access to leading scientists and educators enables the program to share research findings with decision makers, citizens, business owners, and future leaders.

To best evaluate the successes of the Ohio Sea Grant College Program, below are our four focus areas and goals, actions, and desired outcomes within each.

It is the integration of research, education and outreach that allows Ohio Sea Grant to investigate issues and problems and share the solutions with those likely to shape our future.

Focus Area: Healthy Coastal Ecosystems



GOAL

Lake Erie and Great Lakes habitats, ecosystems, and the services they provide are protected, enhanced, and/or restored.

ACTION	DESIRED OUTCOME
Develop and share scientific understanding, decision-support tools, technologies and approaches to protect and restore ecosystems.	<ul style="list-style-type: none"> • Scientific understanding and technological solutions inform and improve the management and conservation of natural resources. • Ecosystem science and conservation priorities developed through stakeholder participation are addressed. • Greater awareness and understanding of ecosystem function and ecosystem services improve and guide stewardship efforts.
Sustain the habitat, the biodiversity and the abundance of coastal ecosystems, fish, wildlife and plants.	<ul style="list-style-type: none"> • Improved collaborative planning and decision-making to enhance effective stewardship.



GOAL

Land, water and living resources are managed by applying sound science, tools and services to sustain ecosystems that support communities and economies.

ACTION	DESIRED OUTCOME
Support a sound science and management driven framework that integrates observations, monitoring, research and modeling to provide a scientific basis for informed decision-making.	<ul style="list-style-type: none"> • Collaborations with partners and stakeholders supports planning, research and technological solutions to address resource management needs. • Citizen Science initiatives are engaged and contribute to improving our knowledge with respect to coastal communities, economies and ecosystems. • Communities have access to sound science, data, tools and training to be effective in planning and decision-making processes. • Resource managers understand the risks, options, trade-offs and impacts of their decisions.
Identify and promote case studies and strategies that enhance resilient ecosystems and watersheds in the context of changing conditions.	<ul style="list-style-type: none"> • Communities have access to information and understand projected changes within coastal ecosystems, and how changes will impact coastal ecosystems. • Communities can access case studies, training and tools to improve their ability to plan, prepare and adapt to future ecosystem conditions.

Focus Area: Sustainable Fisheries and Aquaculture



GOAL

Fisheries and other fresh-water natural resources supply food, jobs, and both economic and cultural benefits.

ACTION	DESIRED OUTCOME
Develop a trained workforce and enhance knowledge transfer in domestic aquaculture.	<ul style="list-style-type: none"> Comprehensive needs assessment to evaluate likely success of domestic aquaculture industry in the Great Lakes.
Promote and support harvest and processing techniques that lead to safe, sustainable and high-quality food and economic and ecosystem benefits.	<ul style="list-style-type: none"> Consumers understand the health benefits of seafood and purchase safe and sustainable products.



GOAL

Natural resources are sustained to support fishing communities and industries.

ACTION	DESIRED OUTCOME
Ensure sound science, services and tools are available and accessible to resource managers, the fishing and aquaculture communities, and consumers.	<ul style="list-style-type: none"> Commercial and recreational fishermen are knowledgeable about efficient, sustainable, and responsible tools, techniques, and uses of coastal and freshwater resources. Resource managers and fishing communities have access to science and tools to increase their capability to adapt to future resource management needs.

Focus Area: Resilient Communities and Economies



GOAL

Lake Erie’s coastal communities use their knowledge of changing conditions and risk to become resilient to extreme events, economic disruptions, and other threats to community well-being.

ACTION	DESIRED OUTCOME
<p>Use innovative tools to increase the public’s awareness of changing conditions and the potential impacts their communities, economies and ecosystems may encounter.</p>	<ul style="list-style-type: none"> • Members of the community, including the underserved, are aware of and understand changing conditions and hazards, and are prepared to respond and adapt. • Existing and innovative training programs improve community leaders’ understanding of changing conditions in their communities and implement adaptive strategies.
<p>Utilize comprehensive planning and adaptive management strategies to enhance community resilience to hazards, changing environmental conditions, and changing socioeconomic conditions.</p>	<ul style="list-style-type: none"> • Communities have access to information needed to understand the factors impacting ecosystems and participate in adaptive management planning. • Communities employ adaptive management strategies and apply tools to engage diverse members of the community to improve resilience and community sustainability.
<p>Increase the resilience of coastal communities through diversification, growth, and strengthening of coastal economic sectors.</p>	<ul style="list-style-type: none"> • Members of the community, including the underserved, have access to information needed to understand how coastal economic activities and trends will impact environmental and community well-being. • Communities have access to tools, services, and technologies to adapt and grow resilient economies. • Leaders in coastal economic sectors understand how the community can become more resilient through diversification and through conservation of ecosystem resources and the services they provide.

Focus Area: Resilient Communities and Economies



GOAL

Lake Erie’s water resources are sustained and protected to meet emerging needs of the communities, economies, and ecosystems that depend on them.

ACTION	DESIRED OUTCOME
<p>Inform community members about how actions impact water quality and availability.</p>	<ul style="list-style-type: none"> • Community members understand watershed function and the services the watershed provides to support communities and economies. • Community members understand how actions will impact water quality and quantity and are able to make informed decisions.
<p>Collaborate with stakeholders to develop and share best management practices (BMPs) to protect and manage water resources.</p>	<ul style="list-style-type: none"> • Communities have access to sound science, data, tools, and services to understand and anticipate changes in water quality and quantity. • Communities have diverse, sustainable economies and industries that support the existing and emerging water needs. • Communities have access to science, tools, and technologies to protect and sustain water resources and make informed decisions.

Focus Area: Environmental Literacy and Workforce Development



GOAL

An environmentally literate public that is informed by formal and informal education programming.

ACTION	DESIRED OUTCOME
<p>Enable the public to engage in community planning processes with respect to adaptive management to changing conditions by providing the best available information.</p>	<ul style="list-style-type: none"> • Communities are knowledgeable and equipped with the best available science and technology in order to contribute to adaptive management planning processes and stewardship.
<p>Increase effective environmental literacy instruction for K-12 students by formal and informal educators.</p>	<ul style="list-style-type: none"> • Teachers and students are better informed in science, technology, engineering, and mathematics fields and can employ their knowledge to support sustainable practices within their communities.
<p>Increase effective environmental literacy communication to stakeholders, including how ecosystem change affects economic, social, and cultural values, as well as implications for conservation and management.</p>	<ul style="list-style-type: none"> • Stakeholders develop a sense of awareness, understanding and stewardship in order to sustain watershed, coastal, and marine ecosystems and resources. • Communities implement sustainable strategies when managing natural resources and make decisions based on information acquired through informal science education.

Focus Area: Environmental Literacy and Workforce Development



GOAL

A diverse and skilled workforce is engaged and enabled to address critical local, regional, and national needs.

ACTION	DESIRED OUTCOME
<p>Grow awareness among the nation's diverse population to the career paths available that support the needs of the nation's coastal communities.</p>	<ul style="list-style-type: none"> • All members of a community are enabled to explore and pursue the variety of occupations that are essential to sustain the nation's coastal communities, economies, and ecosystems.
<p>Increase opportunities for undergraduate and graduate students to gain knowledge and experience in the science and management of watershed, coastal, and marine resources.</p>	<ul style="list-style-type: none"> • College level courses and internships provide increased literacy, experience, and preparedness in areas of watershed, coastal, and marine ecosystems for all students including those from underrepresented groups. • Undergraduate and graduate students including those from underrepresented groups, are supported and have access to formal and experiential learning, training, and research experiences.
<p>Prepare a responsive and diverse workforce to advance and benefit from sectors that support the needs of the nation's coastal communities and ecosystems (e.g. industry, research, government, etc.), and to adapt and thrive in changing conditions.</p>	<ul style="list-style-type: none"> • Employment in all sectors of the U.S. coastal resource enterprise expands and diversifies. • The existing and future workforce is able to adapt and thrive in changing environmental, social, and economic conditions.



Outline of Ohio Sea Grant's 2018–2021 Strategic Planning Process

OHIO SEA GRANT DIRECTOR EFFORTS

1 Director is currently a member of numerous boards, committees, and task teams that keep the program well-informed of both Lake Erie efforts and Great Lakes regional efforts. This involvement ensures that the research, education, and outreach we develop meet the needs of our stakeholders. A few examples of this involvement include:

- › Co-Director of Lake Erie Millennium Network (2016-present)
- › Committee member of Annex IV (Nutrient Annex) of the Great Lakes Water Quality Agreement; currently active member of the Objectives and Targets Task (2016-present)
- › Committee member of Annex II (Lakewide Management) of the Great Lakes Water Quality Agreement (2016-present); responsible for issuing Lakewide Action and Management Plan (LAMP) for Lake Erie
- › Committee Member International Joint Commission's Research Coordinating Committee of Science Advisory Board (2014-present)
- › Advisory Board of the Cleveland Water Alliance (2016-present); previously Ex-officio member, 2014 to present, Program Committee of Cleveland Water Alliance
- › Agency Partner for Ohio Lake Erie Commission (2015-present)
- › Advisory Board of Ohio State's Global Water Institute (2015-present)
- › Working group for the Blue Accounting – ErieStat Workgroup (Great Lakes Commission)
- › Working group for the Fertilizer Research Workgroup (Michigan Department of Agriculture and Rural Development)
- › Member of the Advisory Council for the Ohio Water Trust

OHIO SEA GRANT DIRECTOR EFFORTS (CONTINUED)

2 Ohio Sea Grant and Stone Lab are currently managing 55 projects related to Lake Erie issues; ~\$7,000,000 in research effort (only \$1,800,000 is Sea Grant supported). The bulk of this work is overseen by an Agency advisory board that is made up of the Ohio Environmental Protection Agency, the Ohio Department of Natural Resources, the Ohio Department of Health, and the Ohio Department of Agriculture. This agency advisory board puts Dr. Winslow in regular contact with state agencies.

3 Director gives an invited update at each Great Lakes Commission meeting (quarterly; “Agency Partner Report”). These reports ensure that all agencies within Ohio know about Ohio Sea Grant and Stone Lab’s research, outreach, and education efforts. The commission is made up of the directors of the Ohio Environmental Protection Agency, the Ohio Department of Transportation, the Ohio Department of Natural Resources, the Ohio Development Services Agency, the Ohio Department of Health, and the Ohio Department of Agriculture. The role of the Ohio Lake Erie Commission (OLEC) is outlined below:

The role of the OLEC is to preserve Lake Erie’s natural resources, to protect the quality of its waters and ecosystem, and to promote economic development of the region by ensuring the coordination of policies and programs of state government pertaining to water quality, toxic substances, and coastal resource management. The Ohio Lake Erie Commission staff advises the Governor and the Commission on the development, implementation, and coordination of Lake Erie programs and policies; provides representation of the interests of Ohio in regional, national, and international forums pertaining to the resources of the Great Lakes; assists in the implementation of the Coastal Zone Management Program and the Great Lakes Restoration Initiative; facilitates compliance with the Great Lakes Water Quality Agreement and the Great Lakes Toxic Substances Control Agreement; and manages the distribution of money from the Lake Erie Protection Fund.

4 Director regularly encourages the staff to sit on as many advisory boards, committees, and working groups as possible and to regularly update leadership on the efforts of these groups.



The role of the OLEC is to preserve Lake Erie’s natural resources, to protect the quality of its waters and ecosystem, and to promote economic development of the region by ensuring the coordination of policies and programs of state government pertaining to water quality, toxic substances, and coastal resource management.



EXTENSION EDUCATOR EFFORTS

- 1** All extension educators scheduled meetings with their respective advisory boards. Extension educator expertise includes: (1) Fisheries Specialist; (2) Community and Economic Development Specialist; (3) Clean Marinas/Boaters Specialist; and (4) Human Dimensions of Natural Resources Specialist.
- 2** Reviewed all surveys given at Sea Grant sponsored and organized events. These highlight areas/topics/issues that our stakeholders would like our research and outreach focus on. Events include but are not limited to County Commissioner, Mayor and Decision Makers Day (x2), two-day Science Writers Workshop, boat shows, charter captain conference, etc.

ENTIRE PROGRAM EFFORTS

- 1** Reviewing the previous four years of annual reports, the 2014 Site visit, and the 2016 Performance Review Panel report.
- 2** On January 4, 2017, all primary Ohio Sea Grant personnel met to discuss upcoming initiatives and goals for the 2018-2021 strategic plans. At this meeting, target goals were set for all performance measures.

STONE LAB EFFORTS

Looking through last summer's evaluations:

- › Events hosted (e.g., outreach events and workshops)
- › Student evaluations of courses and workshops
- › Teacher evaluations associated with our grades 5-12 fieldtrip program
- › Visitors comments related to the Aquatic Visitors Center

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OHIO SEA GRANT *College Program*

STRATEGIC PLAN > APPENDIX



Appendix A

DEFINITIONS FOR THE PURPOSES OF DEVELOPING THE OHIO SEA GRANT COLLEGE PROGRAM STRATEGIC PLAN

Adaptive Management: A systematic approach for improving resource management by monitoring and learning from management outcomes. An adaptive approach provides a framework for making good decisions in the face of critical uncertainties, and a formal process for reducing uncertainties so that management can improve over time.

Action: The tactic or means used to achieve the desired outcomes.

Coastal Communities: Coastal and Great Lakes communities that represent a variety interests (e.g. government, business, education, industry, research, non-governmental organizations, etc.) served by the Ohio Sea Grant College Program.

Core Values: Values that guide behavior and actions of Ohio Sea Grant College Program.

Cross-Cutting Principles: Main beliefs or ideologies embraced by the Ohio Sea Grant College Program that will strengthen the organization as it strives to implement the strategic plan.

Focus Areas: Areas of emphasis that are shaped to address the nation's most urgent coastal and Great Lakes' needs.

Diversity: A collection of individual attributes that together help an organization pursue objectives effectively and efficiently.

Ecosystem: A dynamic and complex association of plant, animal, and human communities and the non- living physical components interacting as a functional unit.

Goal: An aspirational concept that inspires a level of success in a focus area and describes the desired long-term outcome.

Inclusion: An organizational culture that aims to connect all individuals to the organization. Mission: Communicates the purpose of the organization.

Outcome: An intended result or consequence.

Performance Measure: A quantitative way of measuring the achievement of a result.

Resilience: The ability to prepare and plan for, absorb, recover from and more successfully adapt to adverse events and changing conditions (e.g. severe storms, economic conditions, demographic shifts, or ecosystem changes).

Vision: A description of a future state that explains the basis for developing a strategic plan.

Appendix B

2018-2021 OHIO SEA GRANT PERFORMANCE MEASURES AND METRICS

The current list of national performance measures and metrics used in the NOAA Ohio Sea Grant College Program 2014-2017 Strategic Plan will continue to be used for the NOAA Ohio Sea Grant College Program 2018-2021 Strategic Plan.

PIER is designed to facilitate communication between NOAA and the partner Sea Grant programs. Through the system, programs integrate strategic plans, projects and funding, and project results. It is a resource for sharing Planning, Implementation, and Evaluation (PIE) information on a program scale and can be rolled up to tell a national story.

Healthy Coastal Ecosystems

- › Number of resource managers who use ecosystem-based approaches in the management of land, water, and living resources as a result of Sea Grant activities
- › Number of acres of coastal habitat protected, enhanced, or restored as a result of Sea Grant activities

Sustainable Fisheries and Aquaculture

- › Number of fishermen, seafood processing or aquaculture industry personnel who modify their practices using knowledge gained in fisheries sustainability and seafood safety as a result of Sea Grant activities

Resilient Communities and Economies

- › Number of communities that adopt/ implement sustainable economic and environmental development practices and policies as a result of Sea Grant activities
- › Annual number of communities that adopt/ implement hazard resiliency practices to prepare for and respond to/ minimize coastal hazardous events

Environmental Literacy and Workforce Development

- › Number of Sea Grant products that are used to advance environmental literacy and workforce development
- › Number of people engaged in Sea Grant-supported informal education programs
- › Number of Sea Grant-supported graduates who become employed in a job related to their degree within two years of graduation

Cross Cutting

- › Number of Sea Grant tools, technologies and information services that are used by our partners/customers to improve ecosystem-based management
- › Economic and societal impacts derived from Sea Grant activities (market and non-market; jobs and businesses created or sustained)

Cross Cutting Output Metrics

- › Clean Marina certifications
- › HACCP certifications: Number of individuals certified in Hazard Analysis Critical Control Point (HACCP) due to Sea Grant efforts (a systematic preventive approach to seafood safety)
- › Number of peer-reviewed publications produced by the Sea Grant network Sea Grant Staffing
- › Number of Postsecondary Students and Degrees Financially-Supported by Sea Grant in Higher Education Programs (Undergraduate, Graduate)
- › Number of P-12 Students Reached Through Sea Grant-Trained Educators or Directly through Sea Grant Education Programs
- › Number of P-12 Educators who participated in Sea Grant education programs Volunteer Hours
- › Sea Grant-Sponsored/Organized Events
- › Attendees at Sea Grant-Sponsored/Organized Events Public or Professional Presentations
- › Attendees at Public or Professional Presentations

OHIO SEA GRANT COLLEGE PROGRAM

Strategic Plan 2018–2021

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