2008-2011 Ohio Sea Grant College Program Performance Review Panel Report

Program Summary

For more than 30 years, Ohio Sea Grant has worked to help restore Lake Erie and rejuvenate 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 Lake Erie's most pressing environmental and economic issues. The program itself began in 1978 and was designated this country's 24th Sea Grant College in 1988. Over its 34 years, Ohio Sea Grant has led research and outreach efforts to help decrease the frequency of Lake Erie's harmful algal blooms, track and respond to the spread of the invasive species, and evaluate and respond to the reoccurrence of the Dead Zone and continued sediment/nutrient loading.

Through its educational arm, Stone Laboratory field station, Ohio Sea Grant has offered since 1978 approximately 25 college courses annually to 6,000 advanced high school students, teachers, and college students from over 110 colleges and 360 high schools and has provided nearly 1,150 students with $450,000 in scholarships from private sector donations. As a cutting-edge way to introduce STEM education to youths every year, Stone Laboratory's unique field trip has provided 170,000 students of all ages with a hands-on opportunity to be Lake Erie scientists for a day. Thanks to three of Sea Grant's 18 endowments, Stone Lab's Research Experience for Undergraduates Scholarship Program can annually provide 10 students with one-on-one supervised research projects led by key Great Lakes researchers.

Investment Per Focus Area

Focus Area	Percentage	Federal (+ Match + pass thru)	Leveraged
Healthy Ecosystems	39%	$1.40 Million	$1.75 Million
Sustainable Coastal Development	23%	$1.04 Million	$828,000
Hazard Resilience	24%	$919,000	$1.01 Million
Safe and Sustainable Seafood	14%	$365,000	$783,000

Addressing Lake Erie issues is most effective when coordination of efforts throughout the Great Lakes is achieved. In 2006, Ohio Sea Grant led the creation of the Great Lakes Research and Outreach Consortium (GLROC), a consortium of the seven programs in the Great Lakes Sea Grant Network that allows anyone of the programs to accept a grant for the region and subcontract projects to the other programs without charging indirect costs. Ohio Sea Grant created and continues to lead the Great Lakes Regional Research Information Network (GLRRIN), which started with regional funding to Ohio Sea Grant through GLROC from the National Sea Grant College Program in 2006. Ohio Sea Grant is an active leader and participant in several regional projects for the Great Lakes Sea Grant Network and hosted Sea Grant Extension Program Leaders and Sea Grant Communicators for three days at Put-in-Bay for their biannual conference and in-service training in 2011.

Ohio Sea Grant has funded more than 420 researchers from 20 different colleges and universities. The program's researchers work on cutting-edge projects such as: assessing the impact of birding on Lake Erie tourism, determining if amenity led growth is driving economies in the Great Lakes region, modeling sediment movements in the lake and the erosion of shoreline, and the development of techniques to track sportfish movements, increase the growth of important aquaculture species, and track the presence of a potentially devastating fish virus (VHS). Ohio Sea Grant also facilitates collaboration among scientists and has led the way in addressing excessive nutrient loading problems, harmful algal blooms, and Dead Zones in Lake Erie. This leadership has resulted in the funding of more than 40 projects valued at more than $10 million in the past four years and research synthesis reports that are being used by three leading state agencies.

Because engagement with the public is equally as important as its research and education programs, Ohio Sea Grant's communications program has continued to find innovative ways to inform its stakeholders. The program's award-winning magazine, *Twine Line*, reaches more than 25,000 people every issue, while its website, with its hundreds of online publications, reaches more than 250,000 unique visitors every year. Partnerships within one of the largest universities in the country have helped Ohio Sea Grant expand its campus outreach to influence more students by educating through unique venues such as ticker boards at OSU's football stadium and outreach displays at key student venues.

To ensure Lake Erie messages are consistent through K-12, as well as through place-based settings and regional communications strategies, Ohio Sea Grant with four state and regional partners developed the Lake Erie Literacy Principles. In 2011, Lake Erie Literacy Principles were finalized and are consistent with NOAA Ocean Literacy Principles. Aligned to Ohio education standards, these principles motivated development of, and were used as a model for COSEE's Great Lakes Literacy Principles which resulted in teacher education courses at more than 10 Great Lakes universities and used as a foundation for exhibit and program development at multiple regional museums.

What has made Ohio Sea Grant unique over the years is its ability to find ways to broaden its reach and educate more of Ohio's citizens about Lake Erie issues. Through its tourism initiatives like the Tourism Leadership Academy, Ohio Sea Grant has armed tourism industry leaders with the necessary tools, contacts, and knowledge about the industry to become more informed advocates of the lake. Ohio Sea Grant's on-site educational programs at the Aquatic Visitors Center, South Bass Island Lighthouse, and Stone Laboratory convey the complexities of the Great Lakes ecosystem and the importance of this aquatic resource. Ultimately, the goal of these programs is to instill an appreciation and desire to become better stewards of our Great Lakes. Since 2008 the three facilities have educated more than 100,000. Further, partners like the Lake Erie Nature and Science Center have continued to help relay Ohio Sea Grant's messages through its educational displays and programming to nearly 100,000 annually. Ohio Sea Grant was named the top outreach program within Ohio State University in 2009.

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Healthy Coastal Ecosystems

Ohio Sea Grant Healthy Coastal Ecosystems Goals

- Restored function and productivity of Lake Erie degraded ecosystems.
- Sound scientific information to support ecosystem-based approaches to managing the Lake Erie coastal environment.
- Widespread use of ecosystem-based approaches to managing land, water, and living resources in the Lake Erie coastal area.

Healthy Coastal Ecosystems represents 39% of Ohio Sea Grant's efforts. Actual accomplishments far exceed expectations due to several new partnership opportunities to reach additional stakeholders. The partnership with Ohio Department of Natural Resources to manage the Aquatic Visitors Center expands our reach by more than 12,000 per year. Through a partnership with multiple agencies, the Ohio Coastal Training Program targets planners and water resource managers. In addition, increased saliency of coastal issues, such as harmful algal blooms and Asian carp, have increased overall demand for Ohio Sea Grant expertise.

Addressing Seven Critical Issues

Lake Erie has been called the most important lake in the world. It provides shelter and nourishment to countless living things, including 11 million people who rely on it for drinking water. It is the southernmost, shallowest, warmest, and most biologically productive of the Great Lakes, often producing more fish for human consumption than the other four lakes combined. But Lake Erie also faces a number of challenges that Ohio Sea Grant and its partners are working to address. Ohio Sea Grant has identified seven critical issues whose resolutions form the basis for ensuring a healthy Lake Erie ecosystem. These include sedimentation and dredging, nutrient loading and phosphorus, harmful algal blooms, the Dead Zone, aquatic invasive species, climate change, and sustainable coastal community and economic development. These issues are interdependent and related, so we have combined some issues below for better understanding. Solving these issues through effective decision making is also interdisplinary, and Ohio Sea Grant takes such an approach in funding and supporting research for the lake's most pressing issues. Beyond Sea Grant's efforts to address the 7 critical issues, we will also highlight other Sea Grant accomplishments that fall into the following categories (1) Developing Decision-making Tools and Research Ecosystem-Based Approaches, (2) Restoring Critical Habitat, (3) Reaching Stormwater Management Decision Makers, (4) Creating an Educated Workforce, Now and in the Future, and (5) Lifelong Learning about the Lake Erie Ecosystem and Importance of Stewardship. These sections will also highlight the numerous research endeavors Ohio Sea Grant has supported, partnerships that Ohio Sea Grant has been associated with, and outreach opportunities Ohio Sea Grant has initiated.

Due to report constraints, Ohio Sea Grant accomplishments and impacts related to aquatic invasive species are presented in the PRP report for Safe and Sustainable Seafood, those most associated with climate change are included in the PRP report for Hazard Resilient Communities, and those targeting sustainable coastal development are included in the PRP report for Sustainable Coastal Communities.

Sedimentation and Dredging

An Ohio Sea Grant researcher from OSU has developed a wastewater treatment method that uses ultrasound waves to break down pharmaceuticals and personal care products (PPCPs) that are otherwise not removed during wastewater treatment. These PPCPs, which include substances like anti-inflammatories, birth control hormones, and antibiotics, can have profound effects on aquatic ecosystems, and their impact on human health is still unknown. While the ultrasound treatment is not ready for commercial use, engineers are using the findings to develop larger-scale models for continued testing.

Nanosilver is a byproduct of many everyday consumer goods, such as shoes, health and beauty products, and clothing. By understanding how these tiny particles behave

as sediment within a freshwater system, Ohio Sea Grant researchers are now evaluating their toxicology and potential contamination consequences in drinking water for 33 million Great Lakes residents.

Natural processes in wetland sediments can break down harmful chemicals like PCNB, an antifungal agent now banned for its carcinogenic properties, through a reaction with iron. Ohio Sea Grant researchers have discovered that while wetlands do not break down this contaminant as quickly as previously thought, wetlands are still an essential part of environmental protection. These research findings are providing leverage to encourage planners to maintain and restore wetland areas.

Removal and upland disposal of all contaminated sediments in the U.S. would cost trillions of dollars. The translocation of contaminants from one medium to another is not sustainable. Furthermore, reliance on one technology alone is not cost-effective. The aforementioned facts encouraged Ohio Sea Grant to support research that emphasizes *in situ* sediment management to provide a viable alternative for areas where sediment removal technologies are cost prohibitive yet remediation is warranted. The specific project was focused on active capping technology. This research was conducted to analyze the sorption performance of active materials amended to clay minerals for the sequestration of contaminants within sediments. The results indicate that the amendments enhance the performance of a sediment cap. Ongoing experiments are investigating whether or not these amendments are still effective when sediments contain both heavy metals and PAHs.

Healthy Coastal Ecosystem Performance Measures
Number of acres of degraded ecosystems have been restored with significant Ohio Sea Grant facilitation, research or other support

Most Lake Erie ports require regular dredging to stay operational, but disposal of the removed sediment can present a problem, especially in large ports like Toledo, where more than 850,000 cubic yards of sediment need to be dredged each year. Ohio Sea Grant researchers are working with Ohio soil blenders to develop "recipes" for beneficial reuse of this sediment, and are analyzing the economic feasibility of reuse compared to on-land impoundment, which takes up valuable space on port property, or open lake dumping, which can worsen algal blooms by adding nutrients back into the water column.

Nutrient Loading and Phosphorus that Leads to Harmful Algal Blooms (HABs) and the Dead Zone

Nutrients provide the foundation of Lake Erie's food web and the right balance of nutrients is essential in ensuring a healthy Lake Erie. When nutrient levels become too high, harmful algal blooms emerge and can contribute to an expanded Dead Zone. This results in public health risks, tainted drinking water, and economic losses. Phosphorus, a key ingredient in many fertilizers and weed killers, has been targeted as a leading contributor to HABs. Ohio Sea Grant has been a leader in identifying causes and solutions for the nutrient loading problem. Its director, Dr. Jeff Reutter, led a team of 25 investigators from 14 institutions to find funding and coordinate seven research projects dealing with excessive nutrient loading, HABs, and the Dead Zone. Through this effort, Ohio Sea Grant is providing knowledge and technical expertise to policymakers and community officials. Major findings include 30% of farmland already has too much phosphorus, fertilizer should be incorporated into soil, winter application should end, and other key science-based facts to guide decision making.

Ohio Sea Grant researchers determined that algae growing on the underside of lake ice contribute to the development of the Dead Zone in the summer and early fall. Keeping track of this algal growth could help natural resource managers better predict and prepare for the extent of the year's Dead Zone.

A four-year interdisciplinary project by researchers from Ohio State University and Case Western Reserve University is developing models to illustrate the decision-making processes in the Maumee River watershed, which flows into western Lake Erie and is often the starting point of harmful algal blooms in the lake. The models will include climate change scenarios along with hydrological data and decision-making consequences, allowing ecosystem managers to develop better strategies for mitigating nutrient runoff into Lake Erie in the face of more severe precipitation, one of the climate change impacts predicted for the Great Lakes region.

Another Case Western Reserve University researcher has developed a computer model that combines chemical profiles of Lake Erie sediment to determine reactions involved in internal nutrient loading, the process in which natural reactions at the lake bottom (algal decomposition, for example) add nutrients to the lake that can fuel harmful algal blooms. Funded in part by Ohio Sea Grant, the model is anticipated to predict when ecosystem managers can expect to see an improvement in the lake ecosystem based on changes in external nutrient management. Currently, the impact of such changes is difficult to determine, as internal loading can contribute nutrients even after external changes take effect.

The finding by various researchers that phosphonates can be readily utilized by the Lake Erie microbial community warrants attention because phosphonates are being added to the Lake Erie watershed in increasing amounts due to the planting of herbicide-resistant Roundup-Ready crops. Whereas this is a productive agricultural practice, the contribution of these compounds to P loadings has not been widely considered. To address this question, Ohio Sea Grant funded research to assess the phosphonate vs. phosphate concentration

in lake water. This work showed that phosphonate herbicides can be readily assimilated by bacteria and cyanobacteria in the Lake Erie watershed, and that diverse microbes have the genetic capability to use phosphonates as a P source. Once assimilated, phosphonates are converted to phosphates that can be utilized by all aquatic taxa and therefore should be taken into consideration when calculating P budgets for Lake Erie.

Using NOAA Ship Time Support for vessels and donations from the Friends of Stone Laboratory, Ohio Sea Grant assists the Lake Erie Commission and USEPA's Great Lakes National Program Office to link research efforts on the Dead Zone with our endowment-funded education program of Research Experiences for Undergraduates (REU) and outreach efforts on the causes of the Dead Zone (including HABs). From 2008-11 OSG made over 35 trips into the Sandusky Sub-Basin and beyond and over 100 trips into the Western Basin to support research, education, and outreach efforts related to the Dead Zone, its causes, and solutions. Through collaborations with Ohio State University, NOAA, Defiance College, Kent State University, and Kutztown University, Ohio Sea Grant is also linking the REU program to other water quality issues. Their results are shared annually with elected officials and decision makers during our special events for congressional delegations, the state legislature, coastal county commissioners, and mayors, among others.

Monitoring and Identifying Future Threats

Focusing only on emergent threats may diminish our ability to address new threats early, so part of Ohio Sea Grant's focus continues to target research to prevent future issues.

Monitoring and preventing infectious diseases impacting the lake's wildlife improves the health of the lake, and Ohio Sea Grant researchers have developed a test for viral hemorrhagic septicemia (VHS) that provides results in a matter of hours instead of weeks, at a fraction of the cost. The new test also determines the viral strain, how much virus is present, and whether it is actively replicating, an important determinant of infectiousness. Other Ohio Sea Grant researchers are protecting human health at the same time they are studying wildlife ailments. By assessing survival rates of avian influenza in coastal wetlands, important stopovers for migratory birds, researchers help public health officials, resource managers and animal caretakers better prepare for (and prevent) such an event.

Healthy Coastal Ecosystem Performance Measures
Number of stakeholders that have used ecosystem-based approaches in resource management of Lake Erie as a result of Ohio Sea Grant and partnership activities

Target 25
Actual 681

Aquatic Invasive Species (AIS) threaten our nation's inland lakes, rivers, wetlands, estuaries, and oceans. To address AIS within the Lake Erie watershed involves a multi-pronged approach with various audiences to stop the transport of AIS. Working with the Ohio Division of Wildlife, Ohio Sea Grant

updated and rewrote the Ohio AIS Management and Rapid Response Plan to direct action.

In addition to our involvement with the Ohio AIS Management and Rapid Response Plan, we have also collaborated with the University of Minnesota to educate professional tournament anglers about AIS. This education includes Ohio Sea Grant teaching "Best Management Practices" devised to prevent the spread of AIS. Evaluation results from this educational event have led to additional education and outreach strategies that will be included in our Ohio Clean Marinas and Ohio Clean Boater programs, as well as programs for launch ramp users and others who can use best practices to reduce fishery risks.

Developing Decision-Making Tools and Researching Ecosystem-Based Approaches

An Ohio Sea Grant researcher at Kent State University found that public outreach is an important part of protecting an ecosystem through Ecosystem-Based Management. Engaging residents in protecting their surroundings increases the emotional connection people have to the environment, which in turn makes them more likely to want to protect it. A survey covering ecosystems in a variety of geographic locations in the U.S. underscored the need for (1) more public outreach around Lake Erie, which has been struggling with environmental problems for the past decade, and (2) a management model that provides suggestions on how to improve collaboration between public officials and residents to better protect the lake's future.

Erosion along the Ohio shore of Lake Erie is a serious problem; approximately 95 percent of the Ohio lakeshore is affected. Each year, nearly 1.6 million tons of material are eroded along Ohio's lakeshore, threatening public safety, health, and welfare. Further, the Ohio Department of Natural Resources (ODNR) identifies coastal erosion and flooding as one of several priority coastal management issues. To

minimize damage from coastal erosion, ODNR was directed to identify areas of coastal erosion along the Lake Erie shore, and is currently updating maps of the Lake Erie Coastal Erosion Areas using 2004 orthoimagery. Accurate shoreline positions and variation information are crucial to the identification of eroded areas as well as to many other coastal applications, including coastal development, coastal environmental protection, and coastal resource management and decision making. A project funded by Ohio Sea Grant has investigated an algorithm and procedure to map the Lake Erie shorelines by integrating airborne LiDAR data with the newly available 0.4-m-resolution World View 2 satellite images. This technique will improve cost effectiveness, accuracy, and efficiency of shoreline mapping. Due to the rapidity of the procedure's generation process, it can directly benefit ODNR in achieving its goal for designation of Lake Erie Coastal Erosion Areas (CEA) in a timely and cost-effective manner. The developed shoreline mapping techniques will also provide useful information for monitoring and research programs at the Old Woman Creek National Estuarine Research Reserve. The mapping results of this project will support the Lake County Planning Commission and its GIS department in their regulatory coastal management activities.

Improving the predictive capability of existing forecasting models for Lake Erie, especially in the near-shore zone, in order to provide more accurate water level and current forecasts to user communities of the Lake, e.g., recreational, commercial, and emergency response, is critical. For this reason, Ohio Sea Grant supported research to develop a high-resolution computational model of Lake Erie using the latest shoreline and bathymetric data available. This provides unprecedented levels of resolution and accuracy. Simulations are currently being performed in order to validate the models versus historical records of water levels.

The Great Lakes Observing System (GLOS) must work with limited resources to achieve its mission to increase the availability of environmental data to resource managers, researchers, policy makers and educators. Understanding the needs of key GLOS user groups is essential if appropriate products and services are to be efficiently provided. In 2010, GLOS contracted with Ohio Sea Grant to lead the Great Lakes Sea Grant Network (GLSGN) in a needs assessment of Great Lakes Lakewide Management Plan/Area of Concern (LaMP/AOC), public health and fishery managers. GLOS now has a better idea of the needs of key potential clientele and is better situated to focus scarce resources on developing tools and products for use by Great Lakes LaMP/AOC, public health and fishery managers.

Restoring Critical Habitat

Ohio Sea Grant creates clean and healthy watersheds through participation on Areas of Concern projects, as well as with watershed committees and universities throughout the region. Collaboration reduces duplication and leverages resources and expertise. Great Lakes collaboration includes GLISA, GLOS, SARP, and the Great Lakes Sea Grant Network, to name just a few.

Following extensive phosphorus reduction efforts initiated in the 1970s, algal blooms in Lake Erie have been largely absent. However, blue-green algae (cyanobacteria) blooms in Lake Erie's Western Basin and dead zones in the Central Basin began to reappear in the mid-1990s. The return of the symptoms of anthropogenic eutrophication of Lake Erie continuously proves to be among the lake's most pressing problems and threatens a multi-billion dollar regional economy. Based on the success of past synthesis and summary efforts for Lake Erie and Ohio, Ohio Sea Grant is serving on Ohio's Phosphorus Task Force II and the Agriculture Nutrient Task Force. Based on our success in helping Ohio receive over $11 million dollars from USEPA to support more than 30 projects to restore Lake Erie, we were also asked to co-lead Ohio's Synthesis Team to summarize the results of these projects.

The Black River Area of Concern (AOC) is restoring wetlands, building fish shelves, and reclaiming floodplain areas thanks to Ohio Sea Grant expertise and assistance. As a partner in the project and master plan, Ohio Sea Grant has helped secure funding and provided recommendations for restoring this important area. Great Lakes AOCs are severely degraded water systems, and the Black River is the only river system in Ohio where the entire watershed has been designated as an Area of Concern. In addition to providing drinking water for two communities, the river is home to four state-listed endangered, threatened or special concern aquatic animal species, including the recently sighted river otter, and more than 12 state-threatened and/or protected plant species. The City of Lorain is now building underwater rocky fish habitat shelves, totaling more than 1,600 feet of new prime vegetated fish habitat for walleye, smallmouth bass, northern pike and longnose gar. This project, once implemented, will also restore up to seven acres of riparian habitat from a former industrial area back to its original natural forested state.

Ohio Sea Grant has contributed toward the potential delisting of the Ashtabula River AOC through involvement as a leader in the community effort. Ohio Sea Grant research, information transfer, and staff have supported community and governmental efforts to identify the contaminated

sediments, seek financial resources, design the remediation and implement remedial actions to restore the local ecosystem. A $75 million dredging effort removed over 600,000 cubic yards of contaminated material from the lower two miles of the Ashtabula River and placed it in a specifically designed landfill that was capped in 2009. This significantly reduced the contamination threat to the Lake Erie ecosystem and resulted in the construction of over 1,000 feet of fish habitat and about two acres of wetlands on the lower Ashtabula River. An additional $1.5 million was received by the OEPA in 2011 for additional habitat restoration work in the Ashtabula AOC. These Ohio Sea Grant efforts helped one local community significantly reduce the risk of a serious environmental threat to the Lake Erie ecosystem and restore two acres of wetlands. Restoration of an additional 8 acres of habitat is ongoing.

After an intensive 10-year effort, the Lake Erie Watersnake has been removed from the list of federally threatened species. It is found only on and around the Western Basin islands of Lake Erie, and human and snake interactions too often resulted in the demise of the rare reptile. The US Fish and Wildlife Service (USFWS) listed the Lake Erie Watersnake as a federally threatened species as the population dropped to about 2,000 animals. Using Ohio State's Stone Lab as home base for three summers, Ohio Sea Grant supported researchers studied the habits of the rare snake. During this time, these researchers also developed an intensive outreach campaign to educate local residents and transient boaters about the need to protect the snake. The nation learned about the snake in 2006 as the research was featured on the Discovery Channel's "Dirty Jobs with Mike Rowe" program. In 2011, the snake rebounded to almost 12,000 individuals. Surveys say public opinion about the snake is friendlier toward the reptile and human-caused deaths are decreasing. Working with private landowners and the Lake Erie chapter of the Black Swamp Conservancy helped to permanently protect almost 11 miles of shoreline and 300 acres of snake habitat.

Reaching Stormwater Management Decision Makers

By collaborating with other state and federal agencies, Ohio Sea Grant trains coastal officials and planners on balanced growth, best land use practices, and geospatial tools to evaluate watershed land use options for impacts on water quality.

The Ohio Coastal Training Program is a partnership of Ohio Sea Grant, the ODNR Office of Coastal Management, Old Woman Creek National Estuarine Research Reserve, and the Ohio Lake Erie Commission and is aligned with NOAA's national education and outreach strategic plan. Ohio Sea Grant contributed funding or in-kind support to four workshops reaching 1,132 individuals to increase their understanding of land use impacts on the lake and to build capacity of local planners. Quarterly workshops engage stormwater professionals and offer incentives for innovative stormwater management. Fourteen additional courses have been offered by the Ohio Coastal Training Program, as well as a climate adaptation resource webpage and curriculum for natural resource managers and coastal community officials. Case studies and expertise have been shared throughout the Great Lakes region and throughout NOAA.

Recognizing the importance of collaboration in achieving ecosystem goals, a workshop entitled "Working Together to Get Things Done" builds capacity to work with people who have different priorities, viewpoints, and knowledge in order to achieve resource management goals for Lake Erie watershed coordinators and conservation professionals. Following a needs assessment, the Ohio Coastal Training Program also offered Green Grants, a workshop providing skill-building and networking opportunities for nearly100 participants from communities and nonprofit organizations.

The Ohio Coastal Training Program Coordinator at Old Woman Creek NERR is Co-Investigator and Collaboration Lead on a NERRS Science Collaborative grant awarded in November 2011. The project team was awarded $821,000 to conduct collaborative research focused on performance of stormwater systems and produce technical guidance, tools, and training for stormwater professionals in Ohio's Lake Erie basin. The program coordinator also planned and co-facilitated a collaborative research work session for Ohio Division of Wildlife staff and other conservation professionals to provide input on priorities for a regional climate vulnerability assessment funded by the U.S. Fish and Wildlife Service.

Creating an Educated Workforce

The mission of the Franz Theodore Stone Laboratory is to serve 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. Its programming addresses the needs of students 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.

Since 2008, Ohio Sea Grant's Stone Laboratory has offered 91 courses for college credit available to high school, college, and graduate students and professionals. In addition, we offered 18 workshops for college students and aquatic science professionals. These efforts reached 839 students: 400 college-level students from numerous universities/colleges, 256 advanced high school students from across the country, 183 in non-credit workshops, and 48 taking regular courses as a non-credit workshop option.

With Ohio Sea Grant funding and support, more than 1,200 teachers carry knowledge about the Great Lakes back to the classroom. COSEE Great Lakes was able to introduce lesson materials specific to the Great Lakes to teachers, who often are not provided with adequate materials to teach students about the lakes and their importance to the region. Working with Ohio Sea Grant and Stone Laboratory, this program also connects schoolteachers with working Great Lakes scientists, allowing them to experience the Great Lakes ecosystem first-hand.

The Research Experience for Undergraduates (REU) Scholarship Program was developed to provide educational and training opportunities for undergraduate students to assist in the work of scientists and address real-world problems. Immersion in a research project allows students to apply science, technology, engineering and math (STEM) skills to a current Lake Erie issue. Since 2008, a total of 126 REU credits were earned by 40 undergraduate students studying at Stone Laboratory.

Lifelong Learning About the Lake Erie Ecosystem and Importance of Stewardship

In 2009, Ohio Sea Grant and the ODNR - Division of Wildlife (ODNR-DOW) worked to reopen the old state fish hatchery/museum at Put-in-Bay. In a relatively short time Ohio Sea Grant turned the hatchery/museum into an environmental science museum (Aquatic Visitors Center; AVC). More than 12,000 people every year learn about the lake and their role in protecting the ecosystem during visits. In addition to reaching people at the AVC, Ohio Sea Grant also introduces them to Lake Erie while they are visiting the South Bass Island Lighthouse. Since 2008, nearly 30,059 have visited this Ohio Sea Grant landmark overlooking the lake.

Stone Lab offers youth the chance to be a scientist for a day, participate in a science cruise, get wet seining for fish, view Lake Erie water samples under a microscope, and much more. Living on an island offers a unique perspective for students. Since 2008, over 28,000 youth through adult students participated in 800 organized workshops, conferences, tours and educational programs at OSU's Stone Laboratory.

Ohio Sea Grant is also involved in awareness campaigns. For example, traces of chemicals from pharmaceutical and personal care products (PPCPs) have been found in many waters tested in the United States. Proper disposal of these chemical-laden products will avoid harm to fish and other aquatic wildlife, as well as drug misuse or accidental poisoning in humans. Displays developed by Ohio Sea Grant have been used by other Great Lakes Sea Grant Network team members, Southwest General Hospital in Cleveland, and are on permanent display at the aforementioned Aquatic Visitors Center. Ohio Sea Grant has also worked with the Lorain County Sheriff's Department Drug Enforcement Task Force on a county-wide unwanted pharmaceuticals collection event. Although still in its early stages, the entire Great Lakes project team has collected 2,473,154 pills and contacted approximately 795,932 people. A Great Lakes wide website has been developed at ***www.unwantedmeds.org***.

Ohio Sea Grant created social media opportunities before these platforms became routine and readily accessible. Since July 2009, 1,374,375 posts have been read on the Lake Erie Discussion Board and there are 407 registered users. Most of these posts are related to fishery regulations, practices, and issues. With the explosion of social media usage and platforms, a comprehensive social media strategy has been developed to continue to provide a forum for questions and answers; however, the Lake Erie Discussion Board provides a valuable way to monitor concerns and to participate in in-depth conversations related to Lake Erie fishery issues.

Healthy Coastal Ecosystem Performance Measures
Ohio Sea Grant will solicit applied ecosystem research and seek to support at least one research project to assist ecosystem managers
Target 4
Actual 5

Harmful algal blooms (HABs) occur all too frequently in Lake Erie and other freshwater ecosystems. These HABs may produce toxins that have the potential to harm people, pets and wild animals. HABs have caused taste and odor problems in drinking water, reduced recreational beach use, and adversely impacted tourism. Ohio Sea Grant partnered with Ohio State University Extension, the Ohio Department of Health, Ohio Department of Natural Resources and the Ohio EPA to develop an informational fact sheet on HABs. Thoroughly researched and documented, the fact sheet discusses key questions citizens need to know about HABs. Citizens now have accurate, easy to understand information on HABs and are better prepared to address this growing issue and protect their families and pets.

Aquatic Invasive Species (AIS) threaten our nation's inland lakes, rivers, wetlands, estuaries and oceans. The Great Lakes Sea Grant Network, led by Minnesota, developed a two-year, comprehensive AIS public outreach initiative as one strategy to help stop new AIS introductions. An estimated 26,554 individuals, including professional tournament anglers, have been reached with information on AIS, Asian carp, AIS impacts and methods to stop the transport of AIS.

Ohio Sea Grant's Clean Marinas Program is providing an opportunity for Ohio marinas to voluntarily implement best management practices that reduce their nonpoint source pollution. A total of 37 Ohio Marinas are verified Clean Marinas and another 32 have pledged to become Clean Marinas. One of the primary benefits of the Clean Marina program for marinas is an enhanced image. Nationwide 30% of Clean Marina operators attribute an increase in dock sales to their participation in the program.

Sustainable Coastal Development

Ohio Sea Grant Sustainable Coastal Development Goals

- Coastal communities that make efficient use of land, energy, and water resources and protect the resources needed to sustain coastal ecosystems and quality of life.
- Healthy coastal economies that include working waterfronts, an abundance of recreation and tourism opportunities, and coastal access for all citizens.
- Lake Erie coastal citizens, community leaders, and industries that recognize the complex inter-relationships between social, economic, and environmental values in coastal areas and who work together to balance multiple uses and optimize environmental sustainability.

Sustainable Coastal Development represents 23% of Ohio Sea Grant's efforts. This focus area has increased in importance since the Ohio Sea Grant Strategic Plan was developed due to the increased saliency of overall sustainability related to land use decisions.

Building sustainable coastal communities means increasing awareness of the resources upon which these communities' economies are built, as well as sharing the importance of ecosystem health to long-term economic vibrancy. Ohio Sea Grant does this through (1) research evaluating the resources and resource-based industries and by (2) providing assistance to communities seeking to retain, expand, or develop businesses and markets. Ohio Sea Grant sustainability activities also involve leveraging smart decisions for energy and recycling, as well as making sure policy leaders at all levels make balanced decisions.

Given the $11 billion impact of Lake Erie tourism within Ohio's eight coastal counties, the Ohio Sea Grant Program recognizes the importance of developing strategies to boost local economies while protecting those intrinsic qualities which attract visitors and their dollars. This means working with local communities and the tourism industry to develop new products, as well as assisting in reaching markets and generate higher returns on investment. In 2011, the Ohio Sea Grant Extension Tourism Program Director was awarded the top tourism industry award in the State of Ohio. Efforts transcend all four focus areas as defined by the National Sea Grant Program, with strategic tourism actions serving as both the ends and the means for achieving outcomes. The following sections will highlight our efforts to promote and support sustainable Coastal Development: (1) Assessing the Value of Our Resources, (2) Creating Economic Development Opportunities and Awareness of Coastal Resources, (3) Increasing Capacity of Local Communities to Live and Work Sustainably, (4) Creating Strong Leaders, and (5) Living and Working Sustainably Through Green Energy and Recycling. These sections will also highlight the numerous research endeavors Ohio Sea Grant has supported, outreach opportunities Ohio Sea Grant has initiated, and partnerships that Ohio Sea Grant has been associated with to help us reach our sustainable coastal development goals.

Assessing the Value of our Resources

Sea Grant supported research at Bowling Green State University (BGSU) found that bird watching contributes $30 million and 283 jobs to northern Ohio's economy each year. By surveying 1,100 birders at six of Ohio's most popular birding sites, BGSU was able to determine that about 2.4 million visitors come to Ohio for birding opportunities, paying for food, gas and lodging along the way. Through continued Ohio Sea Grant collaboration, BGSU is now working with local communities to educate government leaders and businesses about the value of birding, and about how attracting more birders to an area—through advertising campaigns as well as through establishing and maintaining birding sites—can improve the region's economy.

Another Sea Grant project associated with assessing

resource value is investigating the evidence for amenity-led growth in the Great Lakes and Lake Erie regions. To date, regional analysis verifies that there are some differences in growth and economic structure in the eastern and western Great Lakes. Descriptive analysis points to higher rates of employment, population, and wage growth in the western Great Lakes, compared to the eastern Great Lakes, between 1990 and 2008. Sea Grant researchers also found some initial evidence that industrial disamenities appear to be hindering economic vitality and that some natural amenities may be helping. Specifically, they found a positive relationship between population growth, forest cover and being closer to one of the Great Lakes, and a negative association with air emissions.

Creating Economic Development Opportunities and Awareness of Coastal Resources

Ohio Sea Grant and the Ohio Department of Natural Resources created the Lake Erie Ohio Birding Trail, which connects some of the state's most popular birding sites, and an accompanying website (***lakeerieohiobirding.info***). This project involved facilitating planning sessions for natural site managers. Ohio Sea Grant has also worked with site managers and county planners on managing visitation to prevent habitat impairment, as well as ways to improve the guest experience. In Conneaut, Sea Grant worked with the port authority to raise their awareness of birders who were visiting a mudflat for shorebird sightings. Once the port authority recognized that the mudflat was indeed attracting additional spending, they constructed a viewing platform and boardwalk.

As natural areas become more important to a community's ability to attract visitors, local businesses and decision makers begin to better understand their economic value, in addition to their ecological significance. More people are also seeking ways to experience the outdoors while on vacation, resulting in increased local spending. Because of this, Ohio Sea Grant produced *Explore the Lake Erie Islands: A Guide to Nature and History Along the Lake Erie Coastal Ohio Trail*, an award-winning guidebook highlighting parks, preserves, stories, and historical sites on U.S. and Canadian Lake Erie islands. The guide involved bi-national collaboration with more than 30 partners.

Ohio Sea Grant partnered with six historical, recreational diving, and research organizations to develop the website 'Shipwrecks and Maritime Tales of the Lake Erie Coastal Ohio Trail' (***ohioshipwrecks.org***) and created an accompanying publication to encourage visitor spending and increase awareness of the region's rich maritime heritage.

Ohio has the largest charter fishing fleet on the Great Lakes. But for most Ohio charter captains, the charter business is a secondary source of income, and information relating to the business of charter fishing is needed. For more than 30 years, Ohio Sea Grant has organized the annual Ohio Charter Captains Conference to strengthen the charter industry through education in business management, updates on rules, and the latest information on Lake Erie environmental issues. Attendance at the Ohio Charter Captains Conference runs from 135 to over 220 annually. More than two-thirds of the attending captains report an increase in their bottom line as a result of information learned at one or more of the annual conferences.

Sustainable Coastal Development Performance Measures
Number of coastal communities have adopted sustainable development practices as a result of Ohio Sea Grant activities

Target	**3**
Actual	**16**

Sustainable Coastal Development Performance Measures
Statewide tourism leaders have participated in Sea Grant training to create understanding of relationship between resource health and economic potential

Target	**50**
Actual	**239**

Increasing Capacity of Local Communities to Live and Work Sustainably

Ohio Sea Grant is involved in facilitating plan developments in many different areas of the coastal region. One example includes efforts through the Ohio Coastal Training Program to help the City of Sandusky and Erie County conduct 80 stakeholder interviews over a three-day period. As a result, Sandusky will be better able to lessen the impact of development along its coastline by including the opinions of both citizens and elected officials in its planning process.

Ohio Sea Grant was sought out by the National Park Service to facilitate civic engagement after a Congressional mandate requested a feasibility assessment for a 14-county Western Reserve Heritage Area. These communities had historically not worked regionally in linking stewardship, economic development efforts, and resource assessments. More than 3,800 individuals participated in town hall gatherings or through social media discussions. An advisory board was established, consisting of more than 20 regional community leaders, and this board still meets to advance strategies.

Building the capacity of local communities to help themselves is also important. Ohio Sea Grant trained 36 statewide economic

development professionals to conduct business surveys, assemble effective local task forces, conduct business survey analyses, and finance programs focused on business retention and expansion.

Ohio Sea Grant educated 36 water professionals and college students about ways to facilitate the continued health, well-being and prosperity of Ohio communities faced with increased cyanobacteria in the water. These photosynthesizing bacteria, commonly called blue-green algae, are capable of producing toxins that affect the liver, nervous system, and/or skin. They can also cause water quality deterioration associated with excessive production. Providing tools to water professionals and municipal water supplies to deal with cyanobacteria is essential to protecting the health of Ohio's public.

Since 2007, Ohio Sea Grant has been a leader in the designation and continued management of the Lake Erie Coastal Ohio Trail, a 200-plus mile national scenic byway. This project involves programs, speakers, and activities that have reached more than 12,000 residents and business owners. The project has been able to increase the recognition of the importance of balanced growth. Further, nearly $5 million has been leveraged for public access and other projects through Ohio Sea Grant grant-writing assistance, technical expertise, and facilitation.

The Ohio Sea Grant Program played a role in launching the Ohio portion of the Great Lakes Small Harbor Coalition to maintain small harbor infrastructure on Lake Erie. The Ohio boating industry employs almost 19,500 people and is responsible for more than $1 billion in annual economic impact. Until 2009, Ohio communities were not organized to work for the maintenance of Ohio's small recreational harbors. Ohio Sea Grant worked with the Michigan Small Harbor Coalition, the Lake Erie Marine Trades Association and coastal marine interests to organize and form the Ohio Chapter of the Great Lakes Small Harbor Coalition, as well as its website, to keep Ohioans informed of small harbor dredging and maintenance issues. Ohio Sea Grant data and technical information has informed ongoing discussions on maintaining small recreational harbors and updating US Army Corps of Engineers fact sheets.

From 2010-11, Ohio Sea Grant partnered with the Ohio State University Extension's Sustainable Development Initiative, the Village of Edgerton and its business community in Williams County to plan and organize ten community-wide sustainable visioning trainings and information gathering sessions based on

what citizens currently value and what their hopes for the future are. 225 participants provided the overall vision and developed a planning document complete with goals, objectives and strategies on how to achieve them. This document will guide the Village of Edgerton in future growth and conservation.

Nature-based tourism is emerging as a key market for the state's tourism industry; however, few natural resource managers or tourism industry professionals understand the market's complexities and needs. Understanding the nature tourist's needs is critical to creating and promoting a nature-based experience that will increase a local community's economy while not damaging its resources. In 2011, Ohio Sea Grant worked on five different projects related to building sustainable resource-based tourism strategies, including those led by municipalities, a county metropark, a visitors bureau, and a local grassroots preservation organization. Ohio Sea Grant helped resource managers and tourism professionals identify the market characteristics of recreational users best suited for their local resources and products. Ohio Sea Grant helps these users understand the information and infrastructure needs of these travelers. Ohio Sea Grant accomplished these tasks through one-on-one consultations, presentations, development of educational materials, and workshops.

Sustainable Coastal Development Performance Measures
New research projects focus on socio-economic research/outreach cost-benefits for local communities

Target 2
Actual 4

Sustainable Coastal Development Performance Measures
Ohio Sea Grant has assisted 5 public access projects along Lake Erie, resulting in 20 additional acres for recreational use

Target 5
Actual 8

To encourage further coastal development, Ohio Sea Grant has recognized the need to restore ecologically degraded sites so that they can attract development and recreation in the future. One such example is the Lower Black River. The Black River is the only river system in Ohio where the entire watershed has been designated as an Area of Concern. The Black River watershed AOC river system provides a source of drinking water for two communities (Oberlin and Wellington). It is estimated that approximately 180,000 citizens reside in the watershed. To help restore and then develop this region for tourism and recreation, Ohio Sea Grant helped the Black River RAP committee and the Lower Black River Restoration Sub-Committee to develop the necessary studies of and assisted in developing recommendations for improvements.

Creating Strong Leaders

Ohio Sea Grant provides information and resources to develop the leadership capacity of elected and appointed leaders, while increasing their understanding of how their decisions affect the Lake Erie watershed and coastal communities. At the local level, more than 60 mayors and county commissioners, as well as their planners, managers, and others who work directly in implementing policy, have sampled water quality from research vessels, viewed microorganisms under a Stone Lab microscope, and learned about the lake directly from scientists during Ohio Sea Grant's annual Mayors and County Commissioners Day.

Since 2009, more than 200 elected and appointed officials have participated in a ten-week local government leadership academy with a curriculum focused on public officials and public service, leadership skills and styles, building sustainable communities, team building, technology in local government, intergovernmental relations, ethics, communicating and working with citizens and the media, and conflict management and dispute resolution. Ohio Sea Grant worked with Ohio State University Extension, the Toledo Area Chamber of Commerce, the Ohio County Commissioners Association, the Ohio Township Trustees Association, and the John Glenn Institute for Public Policy at Ohio State University to develop a core curriculum for local government leadership training for elected and appointed officials.

With term limits reducing the institutional memory of the Ohio State House and Senate, it is more important than ever to provide Lake Erie educational opportunities to key legislative and administrative decision makers. Ohio Sea Grant partners with local agencies, private industry, non-governmental organizations and key state legislators to plan, develop and conduct legislative events at Stone Laboratory that include field trips, tours, educational exhibits, and a science discovery trip on a university research vessel. Since 2009, more than 200 key decision makers (state & federal legislators and their legislative aides, agency officials and Ohio State University administrators) have participated in at least one of these Ohio Sea Grant events, and nearly 100% said they intend to use the learned information in future decision making.

The health of Lake Erie's tourism industry is vital for Ohio, as it represents nearly one-third of total tourism economic impact. Policy decisions made by state tourism industry leaders contribute to the health of the industry, yet these leaders are often not prepared to take on the task. Recognizing the powerful role tourism industry leaders could play if they were armed with the necessary tools, contacts, and knowledge to make informed decisions, Ohio Sea Grant helped the Ohio Travel Association launch the Ohio Tourism Leadership Academy (OTLA) in 2008. Fifty-two tourism industry members have completed the year-long curriculum, the first of its kind in the nation. Nearly 80% of graduates have gone on to leadership positions in state or regional organizations.

Living and Working Sustainably Through Green Energy and Recycling

Making Stone Laboratory an example of sustainability creates a living laboratory for Ohio Sea Grant. Through grant funding provided by Ohio State University, the Friends of Stone Lab, the Royal Bank of Canada, and the Joyce Foundation, Ohio Sea Grant replaced approximately 40 toilets and shower heads with low-flow units. Solar thermal was added to the dining

hall roof to supply all kitchen needs, and 50 (12-Kilowatt) solar panels mounted on a pavilion create an outdoor classroom and lecture site. All 50 solar panels have individual readouts on a website, allowing the program to compare monocrystalline panels to polycrystalline panels and assess various angles to the sun's rays. The panels on top of the pavilion are viewable by more than 800,000 tourists annually and will be used within sustainable energy courses offered by Ohio Sea Grant at Stone Lab. All power is diverted through a mechanical room to allow future research on battery storage.

Every winter, boats kept in cooler climates are wrapped with a protective plastic shrink wrap cover. In the spring, the shrink wrap is removed and discarded. Historically, most of this material ended up in landfills. Since 2006, Ohio Sea Grant has helped coordinate a shrink wrap recycling collection with a plastics company located in the Appalachian region of Ohio. Since 2009, more than 1,225,000 pounds of boat shrink wrap has been recycled, saving each participating marina an average of $700 per year in waste disposal costs. The recycled plastic was made into more than 177,000 highway guardrail spacer blocks (over 220 miles worth) that cost taxpayers less than the traditional wooden spacer blocks.

Ohio Sea Grant, in partnership with the Ohio Lake Erie Commission, Ohio Coastal Training Program and Cleveland State University, conducted three workshops in Columbus, Cleveland and Toledo entitled "Planning for Renewable Energy in Your Community." Nearly 200 planners, economic development officials and elected and appointed officials learned about current renewable energy options and their impact on Lake Erie coastal communities.

Sustainable Coastal Development Performance Measures
Coastal communities and citizens have adopted hazard resiliency practices to prepare for and minimize coastal hazardous events

Target	**200**
Actual	**2,290**

A team of state-wide renewable energy and land use experts was gathered by Ohio Sea Grant to conduct a roundtable about how Ohio needs to respond to its communities about potential land use planning problems related to the future of renewable energy. As a result, the analysis and data was shared at three state-wide land use conferences. These annual conferences average over 100 attendees each and focus on the cornerstones of sustainability: community, economy and environment. Ohio Sea Grant also partnered with the Ohio Lake Erie Commission to promote the Ohio Balanced Growth Program that incorporates regional cooperation on growth and development in Ohio's communities.

Marinas are not substantial pollution generators, but because of their on-the-water location, their activities impact Lake Erie. Ohio Sea Grant's Clean Marinas Program provides an opportunity for marinas to voluntarily adopt EPA-approved pollution control practices that help minimize the potential for water pollution. Workshops, certifications and site reviews, and incentives are used to increase the sustainability of coastal marinas. A total of 37 Ohio Marinas are certified Clean Marinas and another 32 have pledged to become Clean Marinas.

Expanding upon the success of the Clean Marinas Program, Ohio joined forces with Michigan and Wisconsin Sea Grant through a Green Marinas Education and Outreach project supported by USEPA's Great Lakes Restoration Initiative. By working together, these programs are developing regional and consistent best management practices and bolstering educational offerings to marinas.

Safe and Sustainable Seafood Supply

Ohio Sea Grant Safe and Sustainable Seafood Goals

- Healthy Lake Erie fisheries that harvest, produce, process, and/or market fish products responsibly and efficiently.
- Informed consumers who understand the importance of ecosystem health and sustainable harvesting practices to the future of our Lake Erie fisheries, who appreciate the health benefits of fish consumption, and who understand how to evaluate the safety of the fish they catch.
- Sustainable fisheries to meet public demand.

Safe and Sustainable Seafood represents 14% of Ohio Sea Grant's efforts. Most seafood activity within the Ohio portion of Lake Erie is generated by the lake's fishery, including its abundant sportfishing and limited commercial activity. Aquaculture within Ohio is not a huge business and is limited in scope and size. In recent years, emerging threats and issues to the lake's overall vitality, which also impact the fishery, have increased in saliency and importance. Despite the diminished focal effort, however, Ohio Sea Grant has made substantial impacts to create an enhanced and healthy fishery, generating leaders aware of fishery issues, increasing productivity and profitability of the fishery, mitigating aquatic invasive species, reaching the public about fishery issues, and increasing productivity and profitability of aquaculture efforts.

Lake Erie's fishery is part of the fabric of Ohio's coastal communities. It contributes to community economics, cultural traditions, and pride. In particular, sport fishing is a major component of Lake Erie tourism, contributing more than $850 million annually to local businesses. Generations of residents have earned a living through the fishery, and Friday Night Fish Fries are a common venue for bringing communities together. Protecting this cultural tradition and economic force is important for preserving jobs, income, and tax revenues at the federal, state, and local levels.

The last few years have introduced new Lake Erie threats that endanger a healthy fishery, as well as increased media and public awareness of these emerging issues and long-term pressures to a healthy fishery and ecosystem. Perhaps the greatest example is the threat of Asian carp and other aquatic invasive species that alter ecosystems. The increased saliency of Lake Erie issues has created greater demand for Ohio Sea Grant research, education programming, and information. Combined with the 2009 opening of the Aquatic Visitors Center (a former fish hatchery at the popular Put-in-Bay tourism destination), Ohio Sea Grant has far exceeded projections for reaching the public with information about the fishery. The following sections will highlight our efforts to promote and support safe and sustainable seafood: (1) enhanced, healthy wild fishery, (2) leadership for Lake Erie's fishery, (3) improved productivity and profitability, (4) mitigation of aquatic invasive species, (5) new ways to reach visitors with fishery information, and (6) improved productivity and enhancement of aquaculture. These sections will also highlight the numerous research endeavors Ohio Sea Grant has supported, outreach opportunities Ohio Sea Grant has initiated, and partnerships Ohio Sea Grant has been associated with to help us reach our safe and sustainable seafood goals.

Due to report constraints, Ohio Sea Grant accomplishments and impacts related to aquatic invasive species are presented in this section, those most associated with climate change are included in the PRP report for Hazard Resilient Communities, and those targeting sustainable coastal development are included in the PRP report for Sustainable Coastal Communities.

Enhanced, Healthy Wild Fishery

Walleye and yellow perch are the two most economically important fish species in the lower Great Lakes. To successfully conserve these species, the Great Lakes Fishery Commission prioritized the identification of impediments to population growth and options for rehabilitating these fish stocks. Ohio Sea Grant funded research from 2007 through 2012 that explored (1) genetic differences between the two species, particularly related to their tendencies to return to spawning grounds and (2) travel patterns so that fisheries managers can direct conservation efforts to the most important areas. Walleye spawning groups, in particular, return to their sites of origins, such as the Maumee River, Sandusky River, and Van Buren reefs. Using the results of these studies, Ohio Sea Grant is now working on an online database to provide data and an interactive resource for academics and agency fisheries managers. Greater understanding of the behaviors of these important fish has led to improved regional management and better-informed researchers and fisheries management professionals.

Lake Erie tributary steelhead fishing has grown in popularity and economic importance, and the state's $600,000 stocking program produces $12 to $14 million annually in gains related to increased angler participation and spending. At 300,000 hours per year of participation, steelhead fishing has expanded tremendously and now steelhead are the third most popular fish species in Lake Erie behind Lake Erie open water walleye and yellow perch (2.0 and 1.5 million angler hours, respectively). There has also been a considerable increase in the number of guided fishing trips for steelhead in Ohio streams. Ohio and Pennsylvania hatchery managers and state fish biologists have begun modifying their stocking strategies due to Ohio Sea Grant-funded research. Research has helped to develop a natural tag using fish otoliths to track steelhead returns to their spawning sites. Using these data, biologists have now started to stock further upstream to maximize time for steelhead to imprint on their native tributaries, thereby increasing the probability that these fish will return.

New threats to the Great Lakes fishery have occurred over the current reporting period. For example, Viral Hemorrhagic Septicemia (VHSv), which causes massive fish die-offs in the Great Lakes, threatens our fishery and economy. A monitoring program using electro-shocking equipment was conducted by Ohio Sea Grant in collaboration with the Ohio Department of Agriculture and the US Fish and Wildlife Service to help refine the regulatory proclamation on intrastate fish movement and to prevent the spread of the disease inland from Lake Erie. Ohio Sea Grant research led to greater understanding of the timing and ecological impacts of VHSv, essential for developing management controls. In addition, Ohio Sea Grant is leading the way in VHSv detection. Existing VHSv testing is labor intensive, time consuming, less sensitive, and less accurate. Working with several state and federal partners, Ohio Sea Grant researchers have developed a new rapid StaRT-PCR test that is VHSv specific and can detect a single VHSv molecule in hours at a fraction of the cost.

Another step toward a healthy wild fishery is Ohio Sea Grant's support of research related to hormones. Hormones used in agriculture, particularly growth promoters used in concentrated animal feed operations (CAFOs), find their way into our waters and impact the development of the fishery. Ohio Sea Grant funded research has helped determine the soil types that can benefit from manure application and has helped develop guidelines for timing manure application to cropland to reduce the negative impacts of CAFO hormones on the fishery. This research resulted in a National Science Foundation grant to continue developing agricultural guidelines for ensuring healthy watersheds across the nation.

Safe and Sustainable Seafood Supply Performance Measures
Ohio Sea Grant will have reached 5,000 with education and outreach related to the Lake Erie fishery

Target	**5,000**
Actual	**56,931**

Leadership for Lake Erie's Fishery

A Great Lakes Fisheries Leadership Institute has helped emerging leaders understand and consider research-based fisheries management. By providing these community and organization leaders with fishing experiences, information on its impact, and discussions regarding challenges, graduates developed a greater understanding of how their future decisions may impact the vitality of the fishery. A total of 40

new leaders have graduated from this program and are sharing what they learned with others interested in protecting and improving Lake Erie sport fishing. For many of these leaders, this institute is their first opportunity to visit Stone Lab. When this experience is coupled with in-class discussions addressing the issues and challenges, a powerful and long-lasting impression is made that contributes to making smarter and better balanced decisions.

Improved Productivity and Profitability

Ohio has the largest charter fleet in the Great Lakes, yet its vibrancy and value is at risk due to socioeconomic and environmental changes. Helping charter captains adapt to a constantly changing environment, Ohio Sea Grant works directly with captains and their networks to educate and inform. An annual Ohio Sea Grant Charter Boat Conference reaches up to 25% of the licensed captains in the state with updates on fishery resource management, business management, laws and regulations, and marine technology. Two-thirds of those who take part annually report increased profitability due to information learned at the conference, and 89% of respondents in 2011 reported improving their operation based on information presented at the conference. Ohio Sea Grant also consistently takes the pulse of this important industry through surveys. Lake Erie charter captains conducted over 21,000 paid charter trips in 2010 with 73% of the trips focusing on walleye fishing. Estimated charter industry revenues for 2010 were almost $9.7 million. For most captains fuel costs were by far the most expensive operating cost of running their business.

Budget cuts at the state level have reduced and impaired the ability of both the Ohio Environmental Protection Agency and the Ohio Division of Wildlife fisheries managers to monitor the Lake Erie fishery. Further, budget cuts also reduce the ability of these agencies to train new staff in management techniques. Rather than counting on these agencies to train new employees when they are hired, Ohio Sea Grant, since 2007, assists in training. Ohio Sea Grant and Stone Laboratory have offered fish sampling workshops to increase the competitive advantages of entry-level applicants and to ensure a better-trained workforce. Seven workshop participants have been hired by the state thanks to skills obtained in our sessions.

Mitigation of Aquatic Invasive Species

Aquatic Invasive Species (AIS) threaten our nation's inland lakes, rivers, wetlands, estuaries, and oceans. Addressing AIS within the Lake Erie watershed involves a multi-pronged approach with various audiences to stop the transport of AIS. Working with the Ohio Division of Wildlife, Ohio Sea Grant updated and rewrote the Ohio AIS Management and Rapid Response Plan to direct action.

In addition to our involvement with the Ohio AIS Management and Rapid Response Plan, we have also collaborated with the University of Minnesota to educate professional tournament anglers about AIS. This education includes Ohio Sea Grant teaching "Best Management Practices" devised to prevent the spread of AIS. Evaluation results from these education events have led to additional information strategies. Additional education and outreach strategies are being developed to reach participants in the Ohio Clean Marina and Ohio Clean Boater programs, as well as launch ramp users and others who can use best practices to reduce fishery risks.

New Ways to Reach Visitors with Fishery Information

When people experience fishing and learn about Lake Erie, they gain a deeper understanding of the importance of stewardship. In 2007, state budget cuts necessitated the closing of a former Put-in-Bay fish hatchery that had been operated by the Ohio Division of Wildlife as a museum. This facility is next to the Ohio State University research facility at Stone Laboratory. In 2009, Ohio Sea Grant entered into a management agreement with the Division to reopen and improve the site. Staffed by Ohio Sea Grant, Stone Lab student workers, and volunteers, the Aquatic Visitors Center provides an on-the-dock fishing experience for youth under 16 years old. The center allows youth and adults to view Lake Erie under a microscope, as well as to participate in hands-on activities to learn about Lake Erie, food webs, sustainable sport and commercial

Safe and Sustainable Seafood Supply Performance Measures
Ohio Sea Grant will work with Ohio Department of Natural Resources and other partners to update statewide Ohio AIS Management Plan
Target 1
Actual 1

Safe and Sustainable Seafood Supply Performance Measures
Ohio Sea Grant will investigate the feasibility of developing at least two new Lake Erie or aquaculture fish products
Target 2
Actual 3

fisheries, and aquatic science. Since 2009, more than 56,930 people have visited the center and report being more likely to pay attention to Lake Erie issues in the future. New exhibits and program development follow current issues and include aquatic invasive species, Asian carp, unwanted medications in our waters, and harmful algal blooms.

Ohio Sea Grant has developed a fishery-oriented curriculum through its Stone Lab educational program, offering more than 10 fishery-focused courses and research programs to an average of 150 high school students, college students, and teachers each summer during the 2008-2011 reporting period. The courses and research curriculum continue to emphasize how the fishery is an intricate part of a sustainable Lake Erie ecosystem.

Ohio Sea Grant created social media opportunities before these platforms became routine and readily accessible. Since July 2009, 1,374,375 posts have been read on the Lake Erie Discussion Board and there are 407 registered users. Most of these posts are related to fishery regulations, practices, and issues. With the explosion of social media usage and platforms, a comprehensive social media strategy has been developed to continue to provide a forum for questions and answers; however, the Lake Erie Discussion Board provides a valuable way to monitor concerns and to participate in in-depth conversations related to Lake Erie fishery issues.

Ohio's youth experience fishing first-hand during several Ohio Sea Grant programs, including a 4-H Sea Camp on Kelley's Island each year. This 5-day event is designed to instill a sense of stewardship to the Lake Erie resource and intertwines science and popular recreational activities. Programs on lure making, aquatic biology, and fishing techniques are led by Ohio Sea Grant. Since 2008, 72 adolescents and counselors/staff learned about casting, trawling, knot-tying, and filleting and preparing a catch, as well as field sampling techniques and identification skills.

Improved Productivity and Enhancement of Aquaculture

Ohio Sea Grant has helped the Ohio aquaculture industry work on developing golden shiner baitfish production technology. Two growers successfully cultured golden shiners from hatching to market. In addition, Ohio Sea Grant worked with the Center for Innovative Food Technology to evaluate market feasibility and uses of two underutilized fish, the freshwater drum and white perch.

Demand for yellow perch is high, as this is the traditional fish used in local restaurants and by consumers in many Great Lakes states. Ohio ranks first in pounds of yellow perch sold in the nation. Despite this economic opportunity, expansion of the yellow perch aquaculture industry has not occurred. One reason is the relatively slow growth of cultured fish populations. Ohio Sea Grant research indicated that only 60% of the fish cultured in aquaculture operations reach market size. Ohio Sea Grant researchers used genetic selection techniques and selective breeding to improve growth rates 28% to 54%, and these genetically-improved perch have been distributed to fish farmers statewide for field-testing, creating added revenues and markets.

The new test for VHSv developed by Ohio Sea Grant researchers also protects the aquaculture industry and the bait fish trade, as fish can now be tested quickly and economically before being sent to fish farms throughout and beyond the state.

Hazard Resilience in Coastal Communities

Ohio Sea Grant Hazard Resilient Communities Goals

- Community capacity to prepare for and respond to hazardous events.
- Effective response to coastal catastrophes.
- Widespread understanding of the risks associated with living, working, and doing business along the Lake Erie coast.

Hazard Resilient Coastal Communities represents 24% of Ohio Sea Grant's efforts. This focus area has increased in importance since the Ohio Sea Grant Strategic Plan was developed due to the emergence of highly visible issues, such as harmful algal blooms. This has increased local demand for Ohio Sea Grant research, education, and outreach.

In defining hazards along Lake Erie, Ohio Sea Grant considers those forces that disrupt the ecosystem or produce personal, economic, or property risk. These risks may be associated with public safety, health, property loss, and diminished revenue or increased costs. Examples of Lake Erie hazards include erosion, flooding, severe water level fluctuations, rip tides, and harmful algal blooms. Ohio Sea Grant considers climate change as a hazard as well, as a changing climate accelerates and intensifies many of the hazards identified above. For the Great Lakes, the most serious symptoms of a changing climate include more frequent and intense storm events, low water levels, and increased water temperatures. Each potential change has its own short-term risks, such as property damage, impact on access, and health risks. Each also fosters an environment for long-term hazards, such as costly infrastructure repairs, revised storm water management strategies, increased run-off of nonpoint pollution, and higher water temperatures contributing to increased harmful algal growth.

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 at greater intensity. Lake Erie's watershed is also the most populated, 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. 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. The following sections will highlight our efforts to promote and support a hazard resilient ecosystem: (1) research to assess risk, (2) safety education, (3) forecasts for the future, and (4) response to hazards. These sections will also highlight the numerous research endeavors Ohio Sea Grant has supported, outreach opportunities Ohio Sea Grant has initiated, and partnerships that Ohio Sea Grant has been associated with to help us reach our hazard resilient goals.

Due to report constraints, Ohio Sea Grant accomplishments and impacts related to aquatic invasive species are presented in the PRP report for Safe and Sustainable Seafood, those most associated with climate change are included in this section, and those targeting sustainable coastal development are included in the PRP report for Sustainable Coastal Communities.

Hazard Resilience in Coastal Communities Performance Measures
Decision makers have received information and training regarding coastal hazard risk planning

Target 100
Actual 5,134

Research to Assess Risks

Research to assess hazard risks includes both research related to mitigating hazards and research of stakeholder needs for adapting to new conditions and mitigating damage.

Biofilm, including microorganisms that grow on boat hulls, can cause major problems for Great Lakes freighters by corroding ships' hulls and increasing drag in the water. Preventative measures are estimated at more than $5.7 billion each year. Ohio Sea Grant researchers discovered an environmentally-friendly alternative to the heavy-metal based paint used to prevent biofilm build-up: a natural chemical called *rhamnolipid*, which "signals" certain biofilm organisms not to attach. A new instrument developed to test the *rhamnolipid's* properties is already being requested for use by biofilm researchers across the country.

When storms rage across Lake Erie in the spring and summer, sediment is washed from the landscape, and sediment already found at the bottom of the lake and its tributaries is stirred up and redistributed. Over time, the build-up of sediment reduces the depth of harbors, making it necessary to dredge to restore safe passage. With dredging comes an additional risk of spreading pollutants like mercury and PCBs, which often rest at the bottom of these harbors attached to sediment particles. To assist communities in determining whether managing contaminated sediment via capping or dredging is the safest way to remove sediments, Ohio Sea Grant researchers created a computer model. This model is used as a risk assessment tool to help communities deal with sediment contamination in the best possible way to minimize distribution of small sediment particles (and the attached contaminants) into the water column or into the materials used to cap contaminated sediments.

Ohio Sea Grant researchers have combined ultrasound waves and engineered algae to develop a treatment system for mercury removal in Lake Erie sediment. The ultrasound separates the mercury from the sediment particles to which it is attached, and the now patented alga binds the contaminant so it can be removed. Lab tests showed that the system can remove 30% of mercury contamination in about 30 minutes, with in-field prototype testing pending.

Ohio Sea Grant researchers are studying how well different types of avian influenza can survive in Ohio's coastal marshes. Despite the lack of recent outbreaks, avian influenza—"bird flu"—is still found in bird populations across the globe, and migrating birds could carry the virus to Ohio, where coastal marshes represent an important stopover on many major flyways. Understanding the risk of an avian flu outbreak helps public health officials, resource managers and animal caretakers better prepare for (and prevent) future events.

Much of the Lake Erie port and harbor infrastructure needed to support commercial transportation is 50 to 100 years old and needs to be repaired or replaced in the next decade. To help communities make smart future port infrastructure decisions in the face of global changing climate, Ohio Sea Grant helped lead the Great Lakes Sea Grant Network in a NOAA Sectorial Applications Research Program (SARP) project in Toledo and Duluth. Focus groups in Toledo, one of the busiest Great Lakes ports, indicated that even a few inches of lake level change

makes a big difference to commercial transportation on the Great Lakes. Port managers and planners want to learn more about the potential impacts of climate change on their work, but most respondents were not looking ahead more than one to five years. Ohio Sea Grant is working to help identify user needs and bring global climate change information to the local and regional level. Over a dozen technical products, tools and webinars have been developed since the initial focus groups, including a regional modeling effort, new data visualizations, Great Lakes Sea Grant Network fact sheets, and a harbor infrastructure economic matrix.

Following extensive phosphorus reduction efforts initiated in the 1970s, algal blooms in Lake Erie had been largely absent. However, blue-green algae (cyanobacteria) blooms in Lake Erie's Western Basin and Dead Zones in the Central Basin began to reappear in the mid-1990s and have increased in the past two years. These blue-green algal blooms and the Dead Zone warrant attention in this hazard resilient focus area because research has shown that the algal blooms plaguing the Western Basin of Lake Erie are closely tied to the nutrients released from sediments during spring runoff. Spring runoff, unfortunately, has been linked to both an increased frequency of storms and an increased volume of water associated with each storm. Together, the frequency of rain events and the volume of water discharged per event, are being linked to global climate change, clearly a hazard to community resilience. Beginning in 2009, Ohio Sea Grant led a team of 15 scientists, representing two countries and 11 institutions, agencies, and companies, in developing and conducting seven collaborative research projects, and explored strategies to reduce nutrient loading to Lake Erie and eliminate harmful algal blooms. Three state agencies are now attempting to implement the strategies, and Ohio Sea Grant has been asked to assist in that process. Ohio Sea Grant also serves on Ohio's Phosphorus Task Force II and the Agriculture Nutrient Task Force. Based on our success in helping Ohio receive over $11 million dollars from USEPA to support over 30 projects to restore Lake Erie, we were also asked to co-lead Ohio's Synthesis Team to summarize results of these projects. As a member of these teams, Ohio Sea Grant is currently developing recommendations to decrease nutrient inputs, assisting with research to understand the movement of sediments and nutrients through Lake Erie, and involved in discussions on how to effectively manage the resources of Lake Erie.

Policymakers making decisions to address the hazard-causing impact of a changing climate need viable options and a better understanding of the consequences of their actions and inactions. To identify existing policymaker priorities and needs, nearly 100 local, state and federal policymakers were surveyed by Ohio Sea Grant in 2010. Water quality, habitat, species movements, lower lake levels, droughts, and health issues topped their list of concerns. Barriers to adaptation include lack of funding, lack of staff time, lack of knowledge, and lack of public support. Resources most needed include education about impacts, financial assistance, strategies for communicating, and technical expertise and tools. Policymakers need local and real-time data, institutional coordination, technical assistance, and training in order to decrease environmental impacts and to protect quality of life for citizens. This survey has been used regionally to build tools and structure communications with policy officials.

Hazard Resilience in Coastal Communities Performance Measures
Needs assessments are conducted with at least three stakeholder groups on their needs for climate change information and tools
Target 2
Actual 3

The NOAA Great Lakes Regional Collaboration Team, Great Lakes Sea Grant Network, and Old Woman Creek National Estuarine Research Reserve worked with the Great Lakes and Saint Lawrence Cities Initiative to develop specialized training for Great Lakes coastal communities targeting adaptation to the impacts of climate change. To ensure that training met priority needs and provided accessible and applicable tools and resources, these organizations conducted a needs analysis of adaptation training and information needs of Great Lakes communities. Results are being used throughout the region to structure tool and training development, particularly for planners and storm water managers.

Ongoing studies related to risk assessment include (1) the public health impacts of harmful algal blooms and (2) collaboration with University of Michigan and Michigan State University on the Great Lakes Integrated Science and Assessment Center (GLISA). The GLISA project is assessing stakeholder needs related to climate change in three primary target groups – agriculture, water management, and outdoor recreation. This project is unique in that it is evaluating the role of boundary organizations in building trust and communicating information.

Safety Education

Ohio Sea Grant collaborated with other organizations to offer Stone Lab workshops on harmful algal blooms to 36 water management professionals and students. These workshops are critically important because Lake Erie provides drinking water for 13 million people. Enrolled professionals received contact hours toward state certification and learned how to protect the quality and safety of municipal water supplies.

Ohio Sea Grant, through Stone Laboratory, provides safety training for more than 15 divers each year and was instrumental in developing safe diving protocols for Ohio State University. Ohio Sea Grant's Diving Safety Officer has supervised university research dives throughout the world,

including Hawaii, Saipan, and the Caribbean. Safe ice fishing on Lake Erie involves knowing basic rules and being aware of dangerous conditions. Since 2008, more than 12 weekly ice fishing safety updates were provided by Ohio Sea Grant for use by the Ohio Department of Natural Resources and potential ice fishing anglers.

Working with the Cuyahoga County Health Department, Ohio Sea Grant presented at annual beach manager gatherings for all public beach managers, addressing many of these managers' information needs related to beach nuisances and issues, such as fish-kills, mayflies, and harmful algal blooms. Ohio Sea Grant also co-authored a climate change presentation in collaboration with University of Michigan and Michigan State that was presented to approximately 30 Great Lakes beach mangers at an annual conference in 2011. Ohio Sea Grant provided rip current information in both English and Spanish to better address the City of Lorain's large Hispanic community. Rip tide safety instruction was also provided at two Cleveland-area beaches.

Forecasts for the Future

Beginning in 2010 we began forecasting an almost immediate recovery from HABs if we could reduce the loading of phosphorus by two-thirds. The drought of 2012 is providing a perfect natural experiment and test of our forecast. On 5 July we joined NOAA and hosted a press conference at Stone Lab to release our prediction for the severity of blooms for the remainder on 2012.

Response to Hazards

In response to harmful algal bloom outbreaks, Ohio Sea Grant has been at the forefront of research, education, and outreach. As described in previous sections, Ohio Sea Grant is a leader in integrating and directing research from 11 universities to identify feasible solutions, and has delivered the results of this research to water managers, policymakers, and others involved in developing a strategy. As the tourism industry is on the front-line of many coastal environmental issues, Ohio Sea Grant developed a taskforce to identify communications strategies and efforts that will minimize economic losses and increase worker and guest safety. Due to Ohio Sea Grant's discussions with the industry and Ohio EPA, rapid-response and monitoring kits are being developed to detect unsafe E. coli levels in order to provide beach managers with faster results. Ohio Sea Grant is also establishing a water quality lab at Stone Laboratory to minimize the time needed to get results, again reducing economic losses and increasing safety. Working with state and federal agencies, Ohio Sea Grant also developed HABs materials that answer key questions citizens have about HABs. Through collaboration with several state agencies, informational material for display at public events, and presentations for the public, nearly 5 million citizens have information on HABs and are better prepared to address this growing issue and protect their families and pets.

To strategically plan climate outreach for the state and help localize the climate change issue, Ohio Sea Grant created the OSU Climate Change Outreach Team. The team, representing nine departments within Ohio State University, works with six other state and federal agencies, as well as local health departments and planning agencies, to coordinate climate education and outreach initiatives within the Great Lakes region. Content is based on stakeholder needs assessments, as well as monthly surveys following webinars. More than 3,300 participants representing 350 organizations from around the country have attended the monthly webinars since 2011, with 90% acknowledging they learned new information and would share it. The webinars have been used in 10 secondary

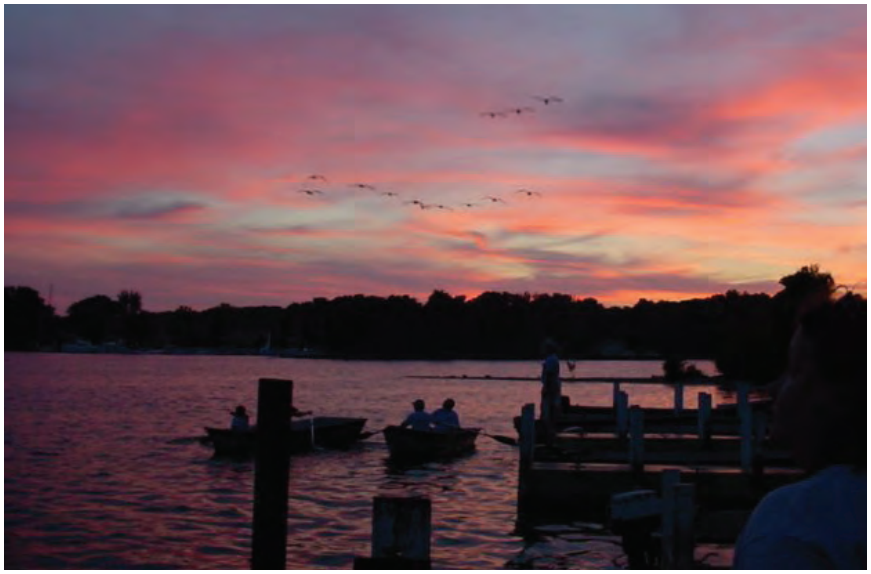
Hazard Resilience in Coastal Communities Performance Measures
Marinas within the coastal Ohio area are certified as Clean Marinas

Target	**60**
Certified	**37**
Pledged	**32**

and college courses as teaching tools, and the website is used as a regional resource for natural resources professionals with nearly 8,000 unique visitors. The partnership sparked the creation of a multi-disciplinary group of OSU researchers to tackle regional climate-related issues.

To leverage Ohio Sea Grant's ability to reach thousands with climate-related information each year, Extension agents have incorporated information about climate change into most of their programs. In addition, changes in curriculum, lectures, tours, and displays at both the Aquatic Visitors Center (which reaches 12,000 per year) and Stone Laboratory (which provides instruction for 5,673 per year) have integrated information about climate change.

A partnership with the Ohio Coastal Training Program helped introduce nearly 450 environmental professionals from around the state to climate adaptation planning at adaptation planning workshops since 2009. Four publications on climate impacts and adaptation have been developed and delivered to nearly 10,000 stakeholders through the program's magazine and e-newsletter.



Climate-related information has also reached more than 40 coastal communities through an Ohio Coastal Training Program climate module, as well as specific and targeted training provided on a consultation basis. Communities in which some of these trainings have occurred include Toledo, Cleveland, Painesville, Fairport Harbor, Ashtabula, Geneva, Geneva-on-the-Lake, North Perry, Sylvania, Oak Harbor, Columbus, Jefferson, Put-in-Bay, Lorain, Sandusky, Huron, Madison, Austinburg, Conneaut, Andover, North Kingsville, and Unionville. This is probably a conservative measure, as many trainings are held in one community, but are attended by decision makers and citizens from nearby communities.

Creating teachers who understand climate change and can introduce the topic in the classroom, Ohio Sea Grant provided support of the Great Lakes Climate Curriculum, which has taught 12 formal and informal educators from the Great Lakes region. The program also provided funding to update the curriculum and its 15 lesson plans. In addition, Ohio Sea Grant has provided at least 11 guests lectures surrounding hazard issues, reaching more than 300 individuals attending these events at Stone Laboratory.

Finally, Ohio Sea Grant has worked to restore critical habitats around Lake Erie. This clearly represents Ohio Sea Grant's commitment to return Lake Erie to a resilient ecosystem. Ohio Sea Grant creates clean, healthy, and resilient watersheds through participation on Areas of Concern (AOC) projects, as well as with watershed committees and universities throughout the region. Collaboration reduces duplication and leverages resources and expertise. Great Lakes collaboration includes GLISA, GLOS, SARP, and the Great Lakes Sea Grant Network, to name just a few. The Black River Area of Concern (AOC) is restoring wetlands, building fish shelves, and reclaiming floodplain areas thanks to Ohio Sea Grant expertise and assistance. As a partner in the project and master plan, Ohio Sea Grant has helped secure funding and provided recommendations for restoring this important area. Ohio Sea Grant has also contributed toward the potential delisting of the Ashtabula River AOC through involvement as a leader in the community effort. Ohio Sea Grant research, information transfer, and staff have supported community and governmental efforts to identify the contaminated sediments, seek financial resources, design the remediation and implement remedial actions to restore the local ecosystem. A $75 million dredging effort removed over 600,000 cubic yards of contaminated material from the lower two miles of the Ashtabula River and placed it in a specifically designed landfill that was capped in 2009. This significantly reduced the contamination threat to the Lake Erie ecosystem and resulted in the construction of over 1,000 feet of fish habitat and about two acres of wetlands on the lower Ashtabula River. An additional $1.5 million was received by the OEPA in 2011 for additional habitat restoration work in the Ashtabula AOC. These Ohio Sea Grant efforts helped one local community significantly reduce the risk of a serious environmental threat to the Lake Erie ecosystem and restore two acres of wetlands. Restoration of an additional 8 acres of habitat is ongoing.