TWINELINE

2009 SPRING/SUMMER EDITION VOL.31/NO.2

BIOCOMPLEXITY

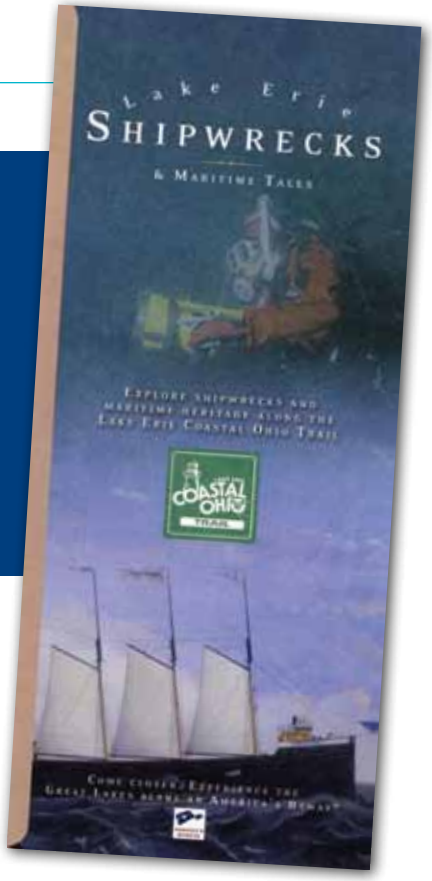
Uncovering Lake Erie's Physical, Biological, and Economic Connections

TABLE OF CONTENTS

2009 SPRING/SUMMER EDITION

Explore Lake Erie's Shipwrecks

ohioshipwrecks.org



Twine Line (ISSN 1064-6418) is published four times a year by the Ohio Sea Grant College Program at The Ohio State University, 1314 Kinnear Rd., Columbus, OH 43212-1156. Subscription price is $10.00 per year (four issues). The opinions expressed are those of the authors only. Please contact the office to obtain permission before reprinting articles or graphics. Ohio Sea Grant is a statewide program that supports greater knowledge and stewardship of Lake Erie and the Great Lakes. It is part of the NOAA Sea Grant College Program (NOAA grant NA16RG2252, project M/P-2), which includes 32 state programs. Support of Ohio Sea Grant is provided by National Sea Grant, the State of Ohio, The Ohio State University, Ohio State University Extension, and participating universities, agencies, and businesses.

Cover photo by Bob West, www.flickr.com/photos/bob_west

OHIO SEA GRANT
The Ohio State University
1314 Kinnear Rd.
Columbus, OH
43212-1156
Phone: 614.292.8949
Fax: 614.292.4364
ohioseagrant.osu.edu

OHIO SEA GRANT STAFF
Dr. Jeffrey M. Reutter, Director
reutter.1@osu.edu

Dr. Rosanne W. Fortner, Education Coordinator
fortner.2@osu.edu

Jill Jentes Banicki, Assistant Director
jentes.1@osu.edu

Eugene Braig, Assistant Director
braig.1@osu.edu

Stacy Brannan, Associate Editor
brannan.16@osu.edu

Nancy Cruickshank, Publications Manager
cruickshank.3@osu.edu

George Oommen, System Engineer
oommen.6@osu.edu

Rick Shaffer, Business Manager
shaffer.25@osu.edu

John Tripp, Fiscal Manager
tripp.3@osu.edu

Greg Aylsworth, Designer
aylsworth.2@osu.edu

EXTENSION AGENTS
Frank R. Lichtkoppler*, Lake & Ashtabula Counties
440.350.2582
lichtkoppler.1@osu.edu

Fred L. Snyder*, Ottawa County
419.635.1022
snyder.8@osu.edu
*Program Co-Coordinators

Heather Elmer, Ohio Coastal Training Program
419.433.4601
heather.elmer@dnr.state.oh.us

Tory Gabriel, Fisheries Program Coordinator
440.808.5627
gabriel.78@osu.edu

John R. Hageman, Jr., Ottawa County
614.247.6500
hageman.2@osu.edu

Melinda Huntley, Tourism Director
419.609.0399
huntley@coastalohio.com

David O. Kelch, Erie & Lorain Counties
440.326.5851
kelch.3@osu.edu

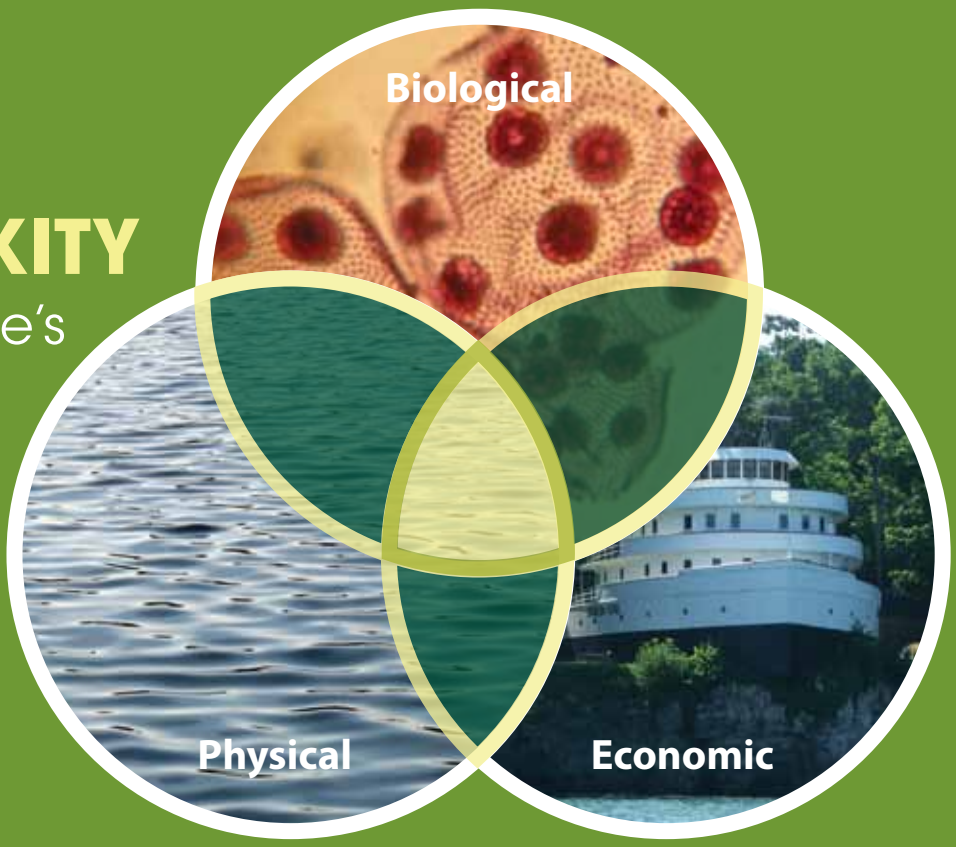
Joe Lucente, Lucas County
419.213.4254
lucente.6@osu.edu

Matt Thomas, Stone Laboratory
419.285.1846
thomas.347@osu.edu

Colleen Wellington, Ohio Clean Marinas Coordinator
419.609.4120
wellington.28@osu.edu

BIOCOMPLEXITY

Uncovering Lake Erie's Physical, Biological, and Economic Connections



by Stacy Brannan, Ohio Sea Grant Communications

Scientists tend to be a focused bunch. It isn't uncommon for them to work within a set of specialized interests, studying something very closely and then reporting the findings. But in the early 2000s, the National Science Foundation (NSF) had a different idea. The foundation sent out a call for grant proposals to study biocomplexity—the interaction between different kinds of organisms within a system and the larger environment. The projects would require significant collaboration between people with all kinds of backgrounds.

In 2004, a group of 16 researchers from Ohio State University, Kent State University, and the private sector received a $1.4 million NSF biocomplexity grant. The project, titled "Interactions among Human, Biological, and Physical Processes within Large Lake Ecosystems," brought together biologists, economists, ecological engineers, mathematicians, physicists, sociologists, and geographers, including a number of Ohio Sea Grant researchers.

"The idea behind the grant was to have an integrated look at Lake Erie," says Dr. Jay Martin, Associate Professor of Ecological Engineering in the Department of Food, Agricultural, and Biological Engineering at Ohio State. "We wanted to study the combination of how ecological processes happen and how human wants and desires overlap with them."

The project focuses on three kinds of these processes: physical, including waves, currents, and water and pollution levels; biological, encompassing the growth, feeding, reproduction, and survival of Lake Erie organisms; and human or societal, meaning the demand for lakefront property, clean water, fishing and boating access, and other similar amenities. The researchers formed collaborative teams, designed to integrate their wide-ranging expertise. The goal: to create multiple computer-based models to predict how the processes affect each other over time, using data collected by Ohio Sea Grant, the Ohio Department of Natural Resources' Division of Wildlife, the Ohio Environmental Protection Agency, and a number of other organizations.

"A traditional environmental study says, 'The people are there, and they are polluting the lake and causing it to go bad.' It's very one-way," explains Dr. David Culver, lead investigator on the project and Professor Emeritus in the Department of Evolution, Ecology, and Organismal Biology at Ohio State. "This project tries to have linkages that go both ways, with humans impacting the lake and the lake impacting the humans."

One of the greatest challenges among the collaborators has been learning to understand each other's languages and perspectives, since biologists tend to see things in short-term, often seasonal cycles, whereas economists generally take a long-term approach that may span decades.

"If I decide to build a house, I might think about it for five or ten years, picking out the spot and saving up the money," Culver relates. "But as far as the fish are concerned, there's spring, summer, fall, and winter. You'll have a total biomass turnover of plankton every week to three weeks, and algae divide once a day. These are completely different time scales."

They are, however, interconnected, so each

element of those widely varying timeframes must be integrated to create an accurate model. For instance, an increase in the amount of phosphorus running into the lake will affect water clarity and the overall health of the ecosystem, including sport fish like walleye and yellow perch. This in turn will change people's opinions of the lake and whether they want to live in the region, which will affect the overall economy. Good regional planning depends on taking everything into account.

"Instead of managing just one aspect of the ecosystem or economy, we need a more holistic approach," explains Dr. Elena Irwin, Associate Professor in the Department of Agricultural, Environmental, and Development Economics at Ohio State. That approach starts with the basic, physical framework of the lake itself.

Physical: Water, Waves, and Pollution

As the shallowest, warmest, and southernmost of the five Great Lakes, Lake Erie is unique. Its three basins—Western, Central, and Eastern—have widely different depths that make for distinct hydrodynamic behaviors, all of which have been studied and recorded extensively by Ohio Sea Grant and many other agencies. These patterns are at the foundation of all other Lake Erie research, affecting everything from the flow of pollutants to the life cycles of fish, insects, and countless other organisms, both native and invasive.

"Hydrodynamics means the things that water does and doesn't do," explains Culver. "That includes currents, temperature, and maybe most importantly, friction."

In Lake Erie, friction comes into play as water flows across the stationary lake floor, as wind blows across the lake surface, and even as pockets of water at different temperatures bump against each other. Because water is viscous, meaning it resists being moved, this bumping sets into motion turbulent mixing as warm water rises to the top and cold water sinks.

All of these things were important to take into account as the teams studied the systems' complex interactions. "The physics of the lake affects the biology and chemistry, which affects the function of the lake, which affects the people," Culver says.

In the biological portion of the study, Culver's graduate students Leon Boegman and Hongyan Zhang created two-dimensional (2-D) models that took into account Lake Erie's hydrodynamic processes before adding sport fish like walleye and yellow perch to the model. In the economic area, hydrodynamics were important as contributors to the pollution level of the lake, which changes public perception and ultimately influences whether people wish to vacation or live in the region.

The development of three-dimensional (3-D) models, currently being created by Joe DePinto at Limnotech, an environmental consulting firm involved with the project, will allow for even more accurate depictions of basic lake functions.

"Right now, the 2-D models we have just take an average across the lake, from the U.S. to Canada," Culver says. "Having 3-D models with detailed measurements that can accurately represent temperatures, currents, and the like will yield more understanding." And more understanding will lead to better management of Great Lakes resources, including the large sport fish people love to catch.

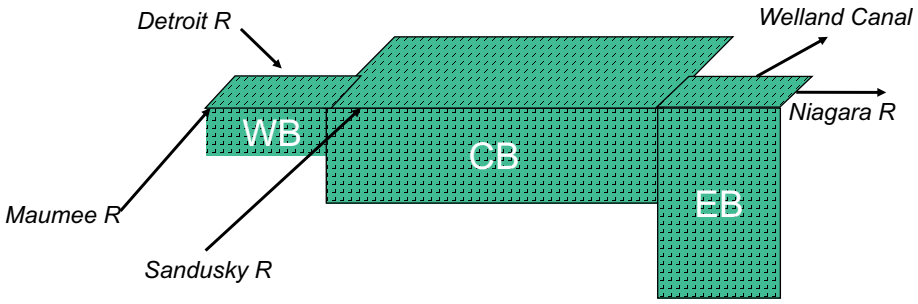
Biological: Lake Erie's Organisms

Traditional research about large inland lakes, or limnology, is very one-dimensional. Scientists go out to the open water, anchor their boats, and then sample its depth. This allows them to determine the basics: the temperature change from the surface to the lake floor, the variation in oxygen level, how much sunlight penetrates from above. It doesn't, however, take into account things like weather and pollution levels, and it can't tell you anything about the fish in the lake and how humans affect their populations.

"We needed a model that behaves more like a big lake, which has stuff happening to it," explains Culver. "With a one-dimensional limnology model, you don't have water sloshing back and forth, you ignore the wind, you ignore the waves, you ignore a lot of things."

And so Culver and his graduate students created EcoLE-FisH, an ecological model of Lake Erie constructed as part of the biocomplexity project.

Ecological Model of Lake Erie with Fish and Humans: **EcoLE-FisH**



Top Predators: Walleye and Humans

Dr. David Culver's EcoLE-FisH model sliced Lake Erie into small segments two-dimensionally, indicating with arrows where tributaries flow into the Western Basin and out of the Eastern Basin. His graduate students then added a biological component to determine the effects of zebra mussels and phosphorus on Lake Erie, as well as walleye populations to try to discern a connection between temperature and the number of fish that survive to age two–old enough to be caught.

They started with the basic 2-D model of the lake, which sliced the lake into small segments and accounted for water levels, the flow from tributaries, and temperatures. The first step for Culver's group, and specifically for grad student Zhang, was to add a biological component using data from the ODNR Division of Wildlife's Lake Erie Plankton Abundance Study.

"The original goal of the EcoLE model was to have a way to tease apart the effects of zebra mussels and phosphorus levels on the lake, taking them out and putting them back to see what happens," Culver says. "Mathematical models help you experiment with those sorts of things you can't do in reality."

Once Culver's team created the model, the next step was to incorporate the interaction between fish and humans—the FisH aspect of EcoLE-FisH—and to perhaps shed some light on one of the biggest mysteries of Lake Erie: the factors that determine how many baby fish survive to become big enough to catch, which is also called "recruitment."

In the last two decades, the recruitment class nearly every year has been very low, resulting in a limited number of adult sport fish. However, in 1996 and 2003 the number of young of year spiked significantly, allowing for a reliable recruitment class beginning two to three years later and lasting another decade. Unfortunately, no one knows why there is so much variability, and Culver hoped the model might provide a few explanations. He decided to start with walleye, the most popular sport fish in the lake.

Using weather data for three full years, including air temperature, cloud cover, ice cover, and wind speeds, graduate student Aparna Sathyanarayan modeled water quality dynamics and followed walleye eggs, larvae, juveniles, and adults over time. She also included the total number of walleye caught by sport fishermen each year.

Ultimately, Sathyanarayan and Culver saw a pattern: if the water was cold—around 34°F—at the beginning of spawning season in March, 66% more fish lived to be two years old and 23% more lived to be three years old. Conversely, if the temperature started out warmer, at 44°F, recruitment decreased by 2% two years later and 18% three years later.

This year, the Great Lakes Fishery Commission has reduced the number of walleye that can be caught in 2009 to 2.45 million—a 32% reduction from 2008 levels. Without colder winters in the coming years—a concern, given the expected effects of climate change—the number of available game fish will continue to dwindle, which could severely hamper the Lake Erie economy. EcoLE-FisH, however, will continue to provide some answers.

"The fish from those high recruitment years are now getting larger and larger, which is great, but there are fewer and fewer of them," says current Master's student Jon Horn, who will be using the model to study yellow perch in the coming year. "The model helps to see if there are any management decisions that could help maintain the population." It's an important goal, since fish draw people, who have their own impact on Lake Erie.

Economic: Human Wants and Needs

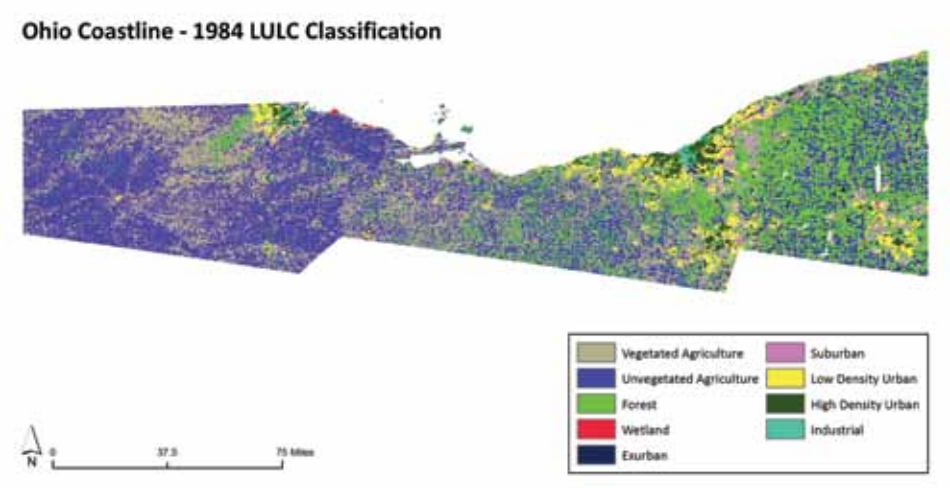
Balancing the ecological health and economic needs of the Lake Erie region is a tricky feat, and one that is often cyclical. A clean lake with plenty of fish to catch and beautiful vistas to enjoy draws people who want to live and work in an area with many natural amenities. In fact, Irwin has shown that average property values increase by nearly $12,000 when a waterfront home is within 10 miles of a Lake Erie beach.

This attraction brings businesses and a much-needed infusion of money to the state and local economies, but the presence of so many people often means higher levels of pollution, causing an ecological decline in the lake that can happen so slowly that it often goes unnoticed until it passes a certain point.

"It's not any one individual who has any impact on the lake," says Irwin. "It's the accumulative impact of many people over a longer period of time. You get to this critical threshold and suddenly the lake changes, which then changes what people think about living there."

Irwin's goal was to use computer modeling to see if there might be a balance point at which the push and pull between people and the environment stops, reaching equilibrium. She used the population size to measure the health of the economy, and phosphorus levels served as a reflection of the lake's environmental integrity.

"What we found is that there are two balanced points, or stable states," she says. "One is a point where there are no people and very little phosphorus. The ecology is very good, but it isn't economically viable.



The way land is used—whether as wetland, agricultural, forest, suburban, or urban zones filled with impervious surfaces—makes a difference in the amount of pollution that ends up in the water. Dr. Darla Munroe and her graduate student Grey Evenson found that for every percentage increase in urban land use in a watershed, water clarity decreased by .574 cm.

The other is a point with moderate people and moderate levels of ecologic degradation caused by phosphorus, and that's sustainable. If we could get to that point, we could go on forever."

Martin at Ohio State and his graduate student, Eric Roy, have sought to determine if a stable state can, in fact, be maintained, given competing environmental interests and the inevitable shocks that happen to an ecological system.

"On one side, you have farmers who want to put more phosphorus on their farm to grow more food and industries that want to discharge more phosphorus into the lake," says Martin. "On the other side, you have people who want the lake to look nice, who want their housing values to stay high. So, environmental management is determined by how hard each side pushes to create or limit regulations, leading to a relative balance. We wanted to see, then, what happens when you then perturb the system by adding an exotic species like zebra mussels."

Using data from Sandusky Bay, Roy found that adding the mussels to a relatively stable system causes a drop in both agricultural benefits and environmental benefits, even if the management level remains constant. The damage, however, can be lessened by adding or restoring phosphorus-filtering wetlands along the edges of Lake Erie, decreasing it by 12% with no additional regulation.

"Wetland treatment systems are large, government-level projects that can produce some results with very little management," Martin says. "That could help with maintaining those balance points."

The way land is used—whether as wetland, agricultural, forest, suburban, or urban zones filled with impervious surfaces—makes a difference in the amount of pollution that ends up in the water. To see whether a correlation exists between land use and water quality, Dr. Darla Munroe, Assistant Professor in the Department of Geography at Ohio State, and her graduate student Grey Evenson created a model using land use data derived from satellite images of the Great Lakes region.

"We wanted to test the assumption that there was a connection between the two, using data sets that were available from various agencies," explains Evenson. They determined water clarity using Secchi depth measurements, which are taken by lowering a disk on a rope into the water and recording the point at which the disk is no longer visible. Overall, they found that for every percentage increase in urban land use in a watershed, water clarity decreased by .574 cm, which is likely to cause a downward shift in population, starting the cycle over again.

"The region has generally been going through industrial activity declines, so that should have a positive effect on water quality, which, long term, will attract more people to the region, which ultimately will have a negative effect on water quality," Evenson says.

Going Forward

Understanding the interactions between the physical, biological, and economic systems affecting Lake Erie is an important step toward better resource management. Each model brings to light new information that could help government and regional planning agencies to better oversee the lake itself, as well as the environmental impacts of developing new housing, businesses, factories, and agriculture. Planning as a watershed, rather than as individual communities, is the key to responsible growth.

For these researchers, collecting additional data about the lake and people who choose to live near it will allow them to more accurately predict changes before they reach a threshold point. Their findings will benefit not only the Lake Erie region but all other large lake communities around the world. **T**L

Photo by Erin Quinlan

Collaborative Effort Nets Seven Grants

Projects to Study Phosphorus in Lake Erie

Collaboration surely has paid off for five groups of Great Lakes scientists from throughout the U.S. and Canada, all recipients of funding from the U.S. Environmental Protection Agency's Great Lakes National Program Office. Two additional proposals were also funded by the Lake Erie Protection Fund, for a grand total of $750,000 in grant backing.

Dr. Jeff Reutter, Director of Ohio Sea Grant and Stone Laboratory, envisioned this broad collaborative effort as a way to create an overall package that was greater than the sum of its parts.

"Instead of supporting seven individual proposals, our plan was to develop seven collaborative projects and include a strategy to synthesize the results from all seven to enhance the value of the research to the Great Lakes management community," explains Reutter. "Clearly the reviewers were pleased with the investigators, the proposed projects, and the strategy, as all seven projects were funded."

Each of the seven projects will study an aspect of the phosphorus problem on Lake Erie and include researchers from Ohio State University, with other investigators from Case Western Reserve University, Kent State University, the University of Toledo, Defiance College, Heidelberg University, John Carroll, the University of Windsor, and Buffalo State College-State University of New York.

The research is slated to begin this spring, wrapping up in 2010. **T**L

Funded Projects

- BMPs for Mitigating Phosphorus Movement From Agricultural Fields, Dr. Robert Mullen, Ohio State University
- Connecting Phosphorus Load, Transport, and Biological Use in Lake Erie: How Does *Microcystis* Use Phosphorus and Where is the Bloom Trigger Point?, Dr. David Culver, Ohio State University
- Lake Erie Algal Source Tracking (LEAST), Dr. Tom Bridgeman, University of Toledo
- Linking Soil Test Phosphorus with Agricultural Runoff Phosphorus, Dr. Elizabeth Dayton, Ohio State University
- The Nearshore and Offshore Lake Erie Nutrient Study (NOLENS), Dr. Christopher M. Pennuto, Buffalo State College-State University of New York
- Sources and Transport of Bioavailable Phosphorus to Lake Erie, Dr. Gary W. Winston, Heidelberg University
- Using Satellite Imagery for Fisheries Management, Dr. Stuart A. Ludsin, Ohio State University

THE OHIO STATE UNIVERSITY

University Awards Sea Grant and Stone Lab with Top Outreach Honors

The Ohio Sea Grant and Stone Laboratory Program was selected as one of two Ohio State University nominees for the National Association of State Universities and Land Grant Colleges 2009 C. Peter Magrath University Community Engagement Award, which honors the nation's best university outreach and engagement partnership projects. The program, competing with 26 other Ohio State projects, received top billing for its 30 years of collaborative work to help restore Lake Erie's ecosystem and revitalize its surrounding economy. More than 300 coastal community and university partners were recognized for their diverse and longstanding work with Ohio Sea Grant and Stone Lab over the years. In honor of those strong partnerships across Lake Erie's coastline, the program is considering plans to plant a tree in each of Ohio's coastal counties. Congratulations to all the coastal partners who have played such important roles in Lake Erie's recovery. **T**L

GONE FISHING

STUDY OFFERS SNAPSHOT OF THE OHIO CHARTER INDUSTRY

by Stacy Brannan,
Ohio Sea Grant Communications

In the warmer months of every year, groups of friends get together, rent a charter boat, and spend a day out on Lake Erie, fishing for walleye and learning a thing or two from their charter boat captain. In 2006, charter groups spent an estimated $12.8 million on charter fees. And because nearly 81% of charter clientele live 50 miles or more from the home port of the charter they hire, they spend perhaps another $11 to $13 million each year eating in nearby restaurants, sleeping in area hotels, and shopping in local establishments.

Often, they would not otherwise have the chance to get out on the lake and catch walleye, the highly prized sport fish Lake Erie is known for, since the boats and gear tend to be specialized and rather expensive.

Tracking the trends on this information provides an important look at the Ohio charter fishing industry and its contributions to the economy of the Lake Erie region.

Since 1985, Ohio Sea Grant has led a continuing study to do just that, with the most recent results—from 2006—being published in the October 2008 edition of *Fisheries*, the journal of the American Fisheries Society.

"Ohio Sea Grant has been serving the charter industry since the early 1980s," says Frank Lichtkoppler, Co-Coordinator of Ohio Sea Grant Extension. "Every four or five years, we've collected this data to take a snapshot of charter industry issues. This is the sixth in a series."

The study was led by Lichtkoppler and two other Sea Grant Extension Specialists, Fred Snyder and Kelly Riesen. They randomly selected 517 Ohio licensed charter guides and received responses from 249.

In 2006, there were 786 licensed captains in the state, compared with 861 when the previous study was conducted in 2002. This 9% decrease in the number of available captains led to the remaining captains making an average of 2.6 more trips per firm in 2006 than in 2002.

"We've seen a trend since about 1990, a decline in the number of captains, and a trend upward in the number of trips that the remaining captains make," Lichtkoppler explains. "Prices have increased, expenses

Advertising to women, who currently make up only 25% of anglers nationwide, may bring new business to the charter industry.

Nearly 81% of charter clientele live 50 miles or more from the home port of the charter they hire, spending another $11 to $13 million each year eating in nearby restaurants, sleeping in area hotels, and shopping in local establishments.

have increased, including gas and oil. It continues to be a secondary enterprise that people use to, perhaps, purchase a bigger boat than they would have been able to buy otherwise."

However, most charter firms continue to have difficulty breaking even. After costs were subtracted from revenue, the average firm reported a loss of over $7,743. Gas prices and the general economic downturn were listed as potential reasons for the difficulty. Responding captains also mentioned as concerns illegal fishing practices, impacts of invasive species, such as zebra mussels and round gobies, and ability to draw clients.

"A lot of times the issues are way beyond the control of any one captain or even an association," Lichtkoppler continues. "But usually you can identify some things they can work on to maybe improve things."

The study in *Fisheries* does suggest a few things charter boat captains may be able to do to bring in more business. Aside from the obvious actions, such as raising rates and increasing the number of trips taken each season, charter firms may find some success in targeting women, who currently make up only 25% of anglers nationwide.

"Advertising can be directed toward women's organizations, clubs, and publications, and charter trips could be designed with amenities and activities that hold extra appeal to women," the study states.

This is especially important, given the "walkaboard," all-inclusive nature of charter trips. With gear provided, people who might be interested in trying something new but aren't sure about the expense of buying their own equipment have the opportunity to spend a day on the lake.

The authors further suggest contacting previous clients. This action may serve to rekindle previous client relationships and, perhaps, uncover specific reasons they stopped hiring charters, which could then be addressed directly to the client and in future marketing strategies.

These suggestions were presented to industry members at Ohio Sea Grant's annual Charter Captains Conference on March 1, 2009, at the Cedar Point Conference Center at the Bowling Green State University-Firelands Campus in Huron, Ohio. Snyder, who organizes the conference every year, uses information gained in the survey to tailor the topics that are covered.

"The Ohio Charter Captains Conference is designed to strengthen the charter industry through education in business management and regulatory and environmental issues," says Snyder. "Results from the Sea Grant charter fishing survey help me identify weaknesses in the industry that our conference can address."

And what's good for the charter boat business is good for business well beyond the Lake Erie shore. **T**L

In His Element

Sea Grant Researcher Creates New Lake Erie Model

by Stacy Brannan, Ohio Sea Grant Communications

When it comes to the physical attributes of Lake Erie, there is a big difference between the coastline, where the water is warmer and features like tributaries cause currents to swirl and shift, and the open water miles off the shore.

Previous computer-based models of the lake used a structured grid made of equally sized squares, or elements, that were so large—5 kilometers, or approximately the size of 55 football fields—they simply couldn't accurately report shoreline details. And because the the elements had to be one constant size, areas of the lake would be left out of the model or pieces of land would be incorporated, resulting in simulations that did not correctly reflect real-life observations.

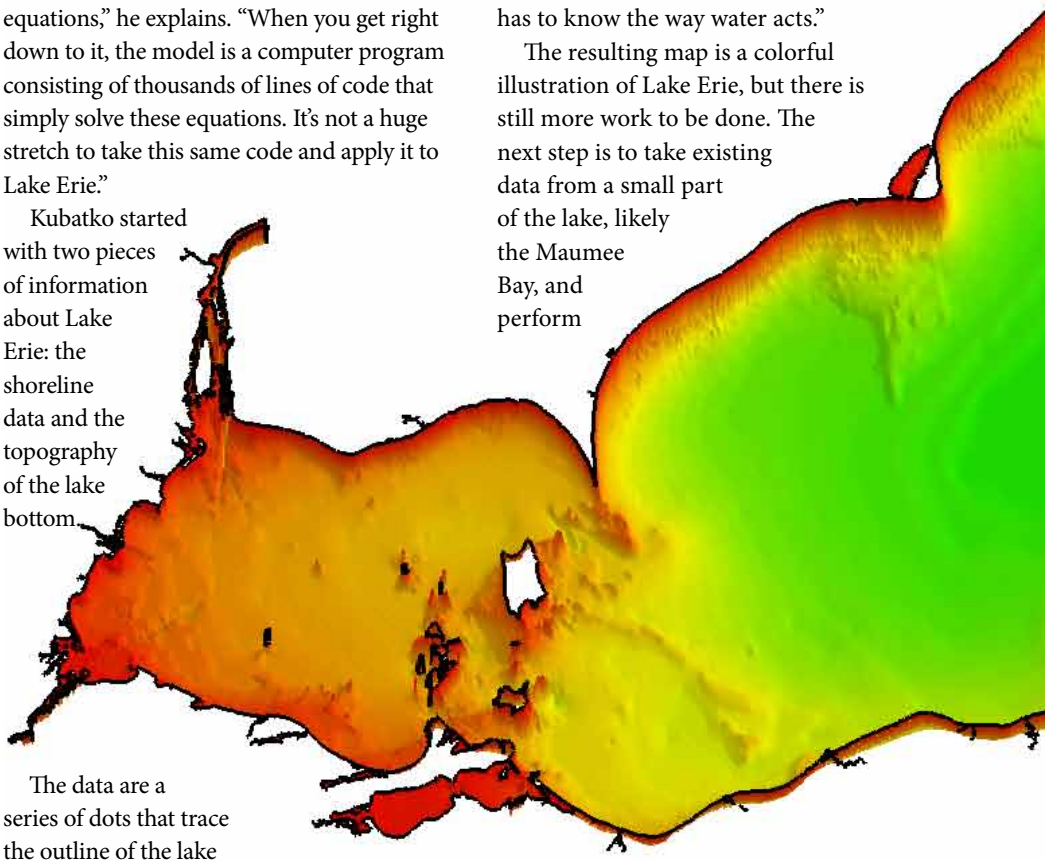
Dr. Ethan Kubatko, Assistant Professor in the Department of Civil and Environmental Engineering and Geodetic Science at Ohio State University, has spent the last year generating a new kind of model—one that, when completed, should be able to precisely predict Lake Erie's intricacies.

The model uses something called a finite element grid—a series of triangles that can vary in shape and size, effectively hugging the coast. Having higher resolution triangles as small as half a football field at the shore and larger ones in the deep water allows for better results.

"As you approach the coast, you start to encounter things like bays, inlets, man-made channels, and small tributaries, the geometry of which simply can't be represented using elements that are as big as kilometers," Kubatko says. "Smaller triangles also allow us to report more detailed flow patterns near the shore. Those currents are different than the middle of the lake, where the water flows more freely."

Kubatko worked on a similar model of the Gulf Coast as part of his Doctoral dissertation, and got the idea to create the Lake Erie simulation after speaking with Dr. Jeff Reutter, Director of Ohio Sea Grant and Stone Laboratory, about the need for very detailed mapping of wind trajectories, water currents, and changes in water level for the Great Lakes. "The flow of water in the Gulf of Mexico, Lake Erie, or any other lake or ocean is governed by the same set of fundamental equations," he explains. "When you get right down to it, the model is a computer program consisting of thousands of lines of code that simply solve these equations. It's not a huge stretch to take this same code and apply it to Lake Erie."

Kubatko started with two pieces of information about Lake Erie: the shoreline data and the topography of the lake bottom.



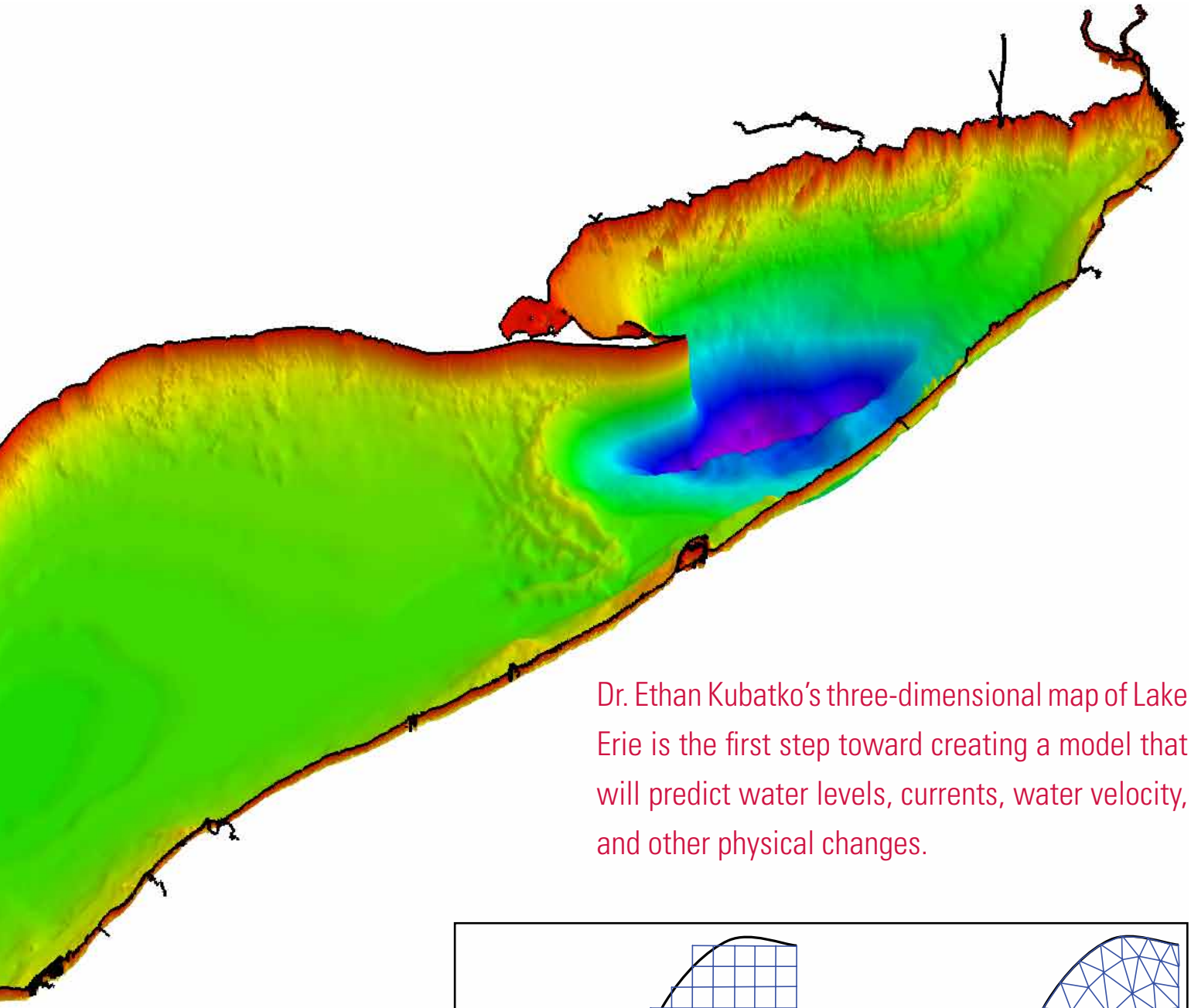
The data are a series of dots that trace the outline of the lake and must be connected by hand before the grid is then laid horizontally over the surface.

Each corner of a grid triangle has a depth value attached to it, and the computer estimates the values of all the points in the middle. It then calculates the unknown pieces of the equations: the free surface, which is the top of the water that is never at rest; the velocity; and how much the water is moving up and down.

"The model has to keep two things in mind," Kubatko notes. "First, whatever comes in and out of the triangle has to be matched by a difference in the height of the water. So, if some amount of water comes in, the surface has to rise by a small amount, just like in your bathtub at home. Second is the mass of the water and how much force is required to move it around. It has to know the way water acts."

The resulting map is a colorful illustration of Lake Erie, but there is still more work to be done. The next step is to take existing data from a small part of the lake, likely the Maumee Bay, and perform simulations to verify that the model is accurate. Such "reality checks" will allow Kubatko to compare data points and make adjustments if necessary, which should ultimately lead to a well-honed representation.

"The mapping of the lake is really the first component we need to do simulations that would predict water levels, water velocities, and other physical changes," Kubatko explains. "We could use it to not only predict large-scale water circulation patterns, but also to perform smaller,

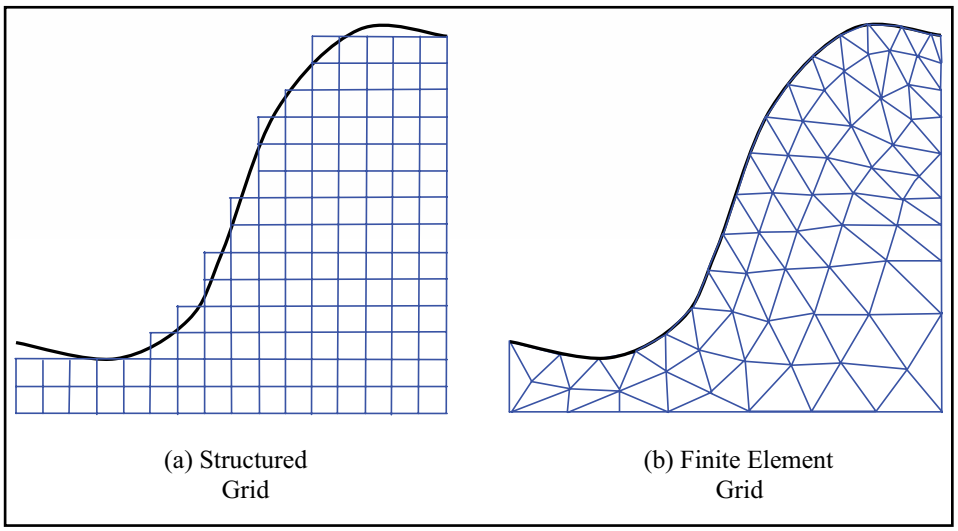


Dr. Ethan Kubatko's three-dimensional map of Lake Erie is the first step toward creating a model that will predict water levels, currents, water velocity, and other physical changes.

region-scale studies or even track the flow of pollutants in Lake Erie."

Being able to predict what might happen to sediment or chemicals as they flow into Lake Erie could be helpful to Great Lakes managers. "Because Dr. Kubatko's new model is capable of reducing the size of the grid in and around islands, reefs, tributaries, and anywhere we experience turbulence, we should be able to greatly increase the accuracy of predictions of the movement of things like sediment, toxic substances, harmful algal blooms, and nutrients like nitrogen and phosphorus," says Reutter. **T**L

For more information about this Sea Grant-funded project, contact Dr. Kubatko at ***kubatko.3@osu.edu*** or visit his web site at ***www.kubatko.com/ethan***.



Previous computer-based models of the lake used a structured grid made of equally sized squares, or elements, causing areas of the lake to be left out of the model and pieces of land to be incorporated, resulting in simulations that did not correctly reflect real-life observations. Dr. Ethan Kubatko's finite element grid incorporates a series of triangles that can vary in shape and size, effectively hugging the coast and allowing for better results.

CSI: Lake Erie Tours

New tour links culture with science

Ever wondered about the mysterious algae that creeps in and covers Lake Erie every summer? Wanted to track down some of the alien invaders people are always talking about or learn how a guy named Perry took back Lake Erie from the mighty British in 1813? Well, brush off your detective skills, grab your magnifying glass, and head to Put-in-Bay to discover some not-so-hidden clues at CSI: Lake Erie—the ultimate who-done-it.

These three-stop guided tours will have you uncovering mounds of evidence, starting at Perry's Victory and International Peace Memorial, where you'll learn about the Battle of Lake Erie very close to the scene of the crime. Stop number two, the newly reopened Aquatic Visitors Center, will have you pulling out that magnifying glass to spot spirogyra and other organisms concealed in Lake Erie's waters, and the South Bass Island Lighthouse, your third stop, will bring to light the importance of working together to restore our most precious resources—the Great Lakes.

Once you've gathered all the clues, you'll head back to the memorial, where you'll be sworn in as an official Lake Erie Investigator and sign a pledge to become a better steward of our heritage and environment.

"CSI: Lake Erie will be a fun way to learn," says Melinda Huntley, Tourism Director for Ohio Sea Grant. "Our partnership with the National Park Service is an exciting one, because they bring their mastery of interpretation to the project. It also gives us an opportunity to link the science of Lake Erie to its history."

The tours will be held beginning at 10 a.m. Thursdays through Saturdays, July 2-September 6, 2009. Cost is $5. For reservations, call the National Park Service at 419.285.2184, ext. 227. TL

Educator Spotlight

A Dozen Years of Dedication

by Stacy Brannan, Ohio Sea Grant Communications

It's common for students to catch the Stone Lab "bug" after spending time on Gibraltar Island. After all, the nation's oldest freshwater biological field station offers a rare opportunity to study science outdoors, collecting specimens and experiencing nature up close. Lisa Bircher was hooked after just one week of catching real bugs out in the field.

"I took my first course in 1997, Insect Biology for Teachers with Dr. Carmen Trisler, and it was great," she says. "After that, I didn't stop talking about Stone Lab for a month."

Lisa, a science teacher at East Palestine High School in East Palestine, Ohio, may well be Stone Lab's most dedicated student. In the past 12 years, she has taken 23 classes for a total of 70 credit hours, including one-week courses like Herpetology, Field Ecology, and Oceanography for Teachers and five-week classes like Limnology and Ichthyology.

She was one of a group of teachers who worked closely with Dr. Rosanne Fortner, then-Education Coordinator for Ohio Sea Grant and now Director of COSEE Great Lakes, to earn her Master's degree as a Stone Lab Teacher Fellow through Ohio State University's School of Natural Resources.

The program combined Stone Lab field classes and some online courses taken through the American Meteorological Society. Lisa even took a class on Ohio State's main campus via teleconference. Her Master's project was to build on previous research about how teachers evaluate and respond to the Stone Lab experience.

"Lisa is surely a lifelong learner by anyone's description," Fortner says. "She has worked with others from the Stone Lab Teacher Fellows program to bring the lab to the attention of science teachers and environmental educators throughout the state. Her enthusiasm for learning in the field courses leads others to consider enrolling."

Even after all those courses, Lisa still isn't done. She is currently pursuing a Doctoral degree from Kent State University, focusing on how students learn in different environments. "I think it was the continuous education I got at Stone Lab that made me serious about becoming a true, formal scholar," she explains.

And the lab that got her started on this path is still very much a part of her life, as she is now serving as President of the Friends of Stone Laboratory (FOSL). In the last few months, she has worked with FOSL members and Stone Lab staff to establish a new FOSL e-mail listserv and create a gift registry through Lowe's home improvement stores to increase Stone Lab in-kind donations.

"Being FOSL President is a chance for me to collaborate with a lot of other people who are dedicated to supporting this wonderfully unique place," Lisa explains. "I really thrive on the exchange of ideas. The things we're doing are making Stone Lab better and better."
FOSL

Friends Of Stone Laboratory

Dear *friends,*

Thank you to everyone who helped out at the recent Spring Work Weekend. This was one of our biggest and most successful events ever! I want to give my special thanks to the Stone Lab staff, who identified and prioritized the jobs that needed to be done and handled the many questions and unexpected situations that arose throughout the weekend.

FOSL has recently agreed to support laboratory operations by purchasing a credit card machine, which will allow Stone Lab to accept and process credit cards for fees, tuition, and other purchases. FOSL will also assist with the operations of the bookstore this summer. We are confident that both of these actions will benefit the staff and students at the lab.

We'd also like to extend our congratulations to the Ohio Sea Grant and Stone Laboratory Program for recently being nominated for the C. Peter Magrath University Community Engagement Award. *This award recognizes excellence in outreach and engagement partnership projects. Those of us in FOSL are very proud to be one small part of this high-profile and effective organization.*

Once again, we are indebted to all of our members for their continued support. Feel free to contact me or any board member with your suggestions and ideas.

Sincerely,

Lisa Bircher *epal_lb@access-k12.org*
FOSL President

A Whirlwind of Activity

There is something about coming to Stone Lab in the spring that inspires people to work hard to get the facilities ready for yet another season. That was truly the case on April 18-19, when old and new friends got together for our annual FOSL Spring Work Weekend. The beautiful, sunny, and warm weather allowed a group of nearly 50 people to tackle a wide range of tasks. Jobs included cleaning residence rooms, gutters, and carpets, as well as painting the ceiling tiles in the dining hall and accomplishing a very thorough tidying up of leaves, branches, and landscaping on Gibraltar.

Beyond the usual cleaning and rearranging in the Research Building on Peach Point, there was also some very ambitious cleaning being done in the Aquatic Visitors Center next door. Ohio Sea Grant has agreed to take responsibility for the use and operations of the old ODNR Aquatic Visitors Center, which needed some revamping of the many displays and aquaria.

Even with all that was accomplished, there are always more tasks that need to be done. If you couldn't make it for this event, please consider volunteering during the summer program. There are numerous opportunities for your help in a wide variety of tasks. For more information, contact the Stone Lab office or our volunteer coordinator, Lydia Bailey, at *bailey.297@osu.edu*. **FOSL**

Alpha Omicron Pi Rocks the Rock

The Ohio State University chapter of the sorority Alpha Omicron Pi helped out during the Spring Work Weekend. Twenty-two of the sisters arrived on Friday for a pizza dinner and an evening enjoying Gibraltar, and each one pitched in on Saturday to help with the necessary chores. Stone Lab and FOSL were very grateful for AOII's participation in this spring's event.

If you are a member of a fraternal, service, or alumni organization and your group would like to give back to the community, please consider Stone Laboratory. For more information, contact the Stone Lab office. **FOSL**

FOSL

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

F.T. STONE LABORATORY FIELD STATION

The Ohio State University
PO Box 119, Put-in-Bay, OH 43456
419.285.1800, 614.247.6500, Fax 614.247.6578
stonelab.osu.edu

STONE LAB STAFF

Dr. Jeffrey M. Reutter, Director (*reutter.1@osu.edu*)
Eugene Braig, Assistant Director (*braig.1@osu.edu*)
John Hageman, Laboratory Co-Manager (*hageman.2@osu.edu*)
Matt Thomas, Laboratory Co-Manager (*thomas.347@osu.edu*)
Arleen Pineda, Program Coordinator (*pineda.2@osu.edu*)
Kelly Dress, Office Associate (*dress.3@osu.edu*)

Stone Lab Open House
September 12

Buckeye Island Hop
October 3-4

A Reorganized Stone Lab

For several years, Ohio State's island campus, Stone Laboratory, has been operated by three separate Ohio State organizations: Facilities Operations and Development for building and grounds maintenance; Student Life for dining hall and dorm operations; and Ohio Sea Grant for education and research. As of April 2009, the entire operation has been placed under the leadership of Ohio Sea Grant and Dr. Jeff Reutter.

A new Stone Lab organizational structure was developed by Dr. Reutter, and new job classifications, descriptions, and titles were created for most of the staff. This will allow the Stone Lab staff to be more fully integrated into the mission and critical program goals of Ohio Sea Grant. Names and titles of the current Stone Lab staff have been changed as follows:

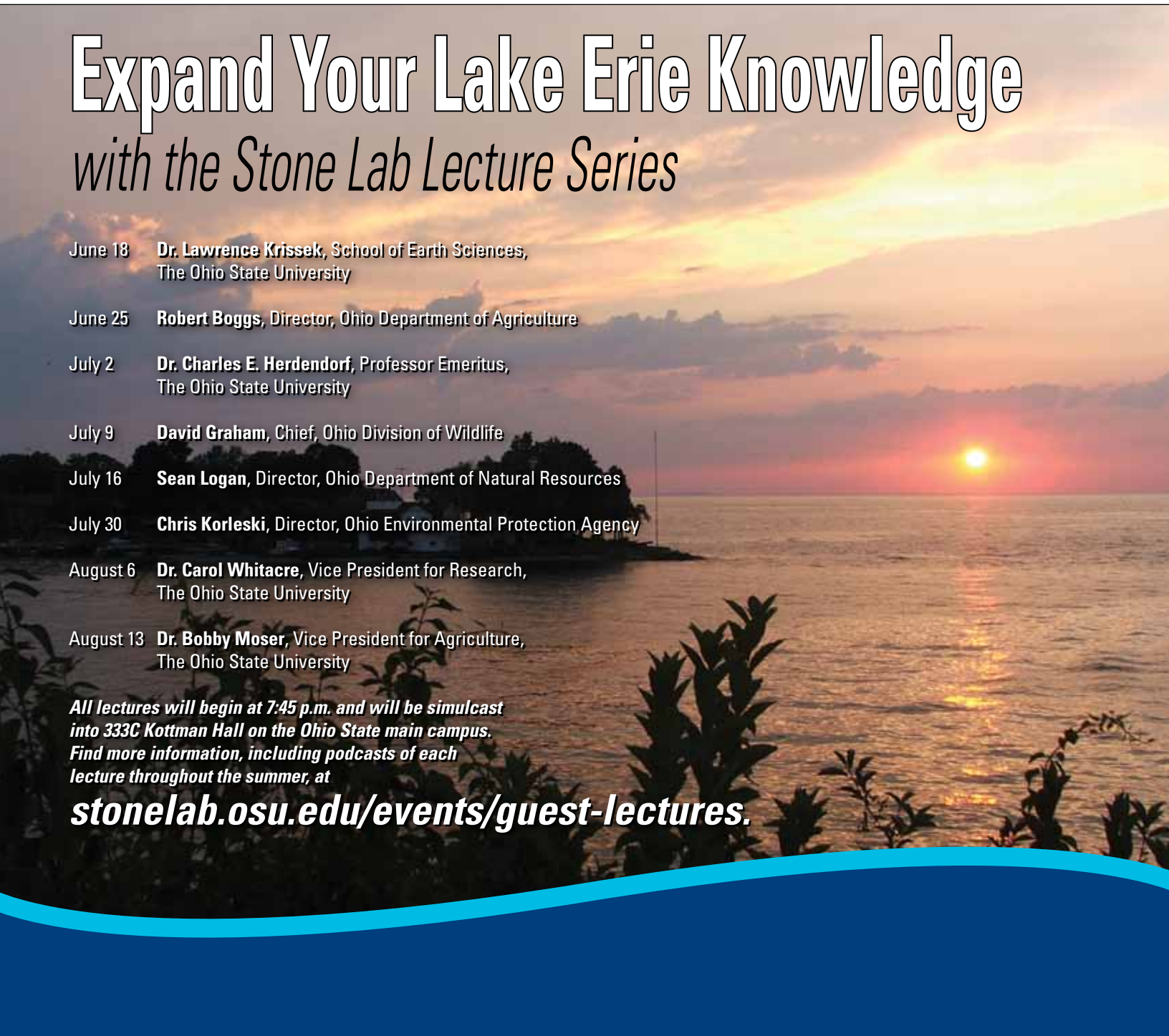
John Hageman, Education and Outreach Manager
Matt Thomas, Research and Operations Manager
Art Wolf, Operations Associate—Boats and Facilities
Mark Wilhelm, Operations Associate—Landscaping and Grounds
Robin Glauser, Operations Associate—Dining and Residence Halls
Kelly Dress, Office Associate—Business Operations

A special "thank you" goes out to the Stone Lab staff for the tremendous level of cooperation they have shown during this transition. The outstanding talent of these individuals will certainly result in the continued success of the program.

TWINELINE

Ohio Sea Grant and Stone Laboratory
The Ohio State University
1314 Kinnear Road
Columbus, OH 43212-1156

Non-Profit Org.
U.S. Postage
P A I D
Permit No. 711
Columbus, OH



Expand Your Lake Erie Knowledge

with the Stone Lab Lecture Series

June 18 **Dr. Lawrence Krissek**, School of Earth Sciences, The Ohio State University

June 25 **Robert Boggs**, Director, Ohio Department of Agriculture

July 2 **Dr. Charles E. Herdendorf**, Professor Emeritus, The Ohio State University

July 9 **David Graham**, Chief, Ohio Division of Wildlife

July 16 **Sean Logan**, Director, Ohio Department of Natural Resources

July 30 **Chris Korleski**, Director, Ohio Environmental Protection Agency

August 6 **Dr. Carol Whitacre**, Vice President for Research, The Ohio State University

August 13 **Dr. Bobby Moser**, Vice President for Agriculture, The Ohio State University

All lectures will begin at 7:45 p.m. and will be simulcast into 333C Kottman Hall on the Ohio State main campus. Find more information, including podcasts of each lecture throughout the summer, at

stonelab.osu.edu/events/guest-lectures.