

TWINE

2007 WINTER EDITION VOL. 29/NO. 1

From Counter Terrorism to Pathogen Detection

Researcher invents new technologies
to mass produce human anti-toxins
and gauge infections



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New Great Lakes Program to Provide Regional Research Collaboration

by Jill Jentes Banicki,
Ohio Sea Grant Communications

People will soon find more Great Lakes research information faster thanks to a new multi-agency, bi-national collaborative program, the Great Lakes Regional Research Information Network (GLRRIN).

Funded in June 2006 by NOAA Sea Grant, GLRRIN is a network of representatives from all federal and state agencies and seven Sea Grant programs within the Great Lakes region. "GLRRIN is designed to foster research coordination in the Great Lakes region by enhancing communication and collaboration among agencies and research scientists, along with encouraging public involvement," states Dr. Jeff Reutter, Ohio Sea Grant director and one of the two U.S. leaders of the program.

Led by four bi-national coordinators (two from academia and two from federal or provincial agencies) for each Great Lake and an overall group of four for the region, the network is patterned after the Lake Erie Millennium Network (LEMN). "LEMN has been a successful network because it has provided one point of contact for scientists on Lake Erie, allowing us as a Lake Erie region to collectively develop strategies and collaborative research proposals," explains Reutter. "GLRRIN will let us broaden that network to have all Great Lakes represented."

GLRRIN will offer scientists and interested citizens a one-stop shop for Great Lakes research information.

Researchers new to the Great Lakes region can find out about funding organizations and their priorities, along with what current Great Lakes researchers are doing in order to possibly coordinate collaborative research efforts. Media and others interested in the Great Lakes will have a clearinghouse of Great Lakes research information from the major organizations—federal, state, and non-profit groups—in charge of the lakes' management. "People viewing the program's information will be able to learn about the major environmental issues facing the Great Lakes and the most current research going on in the region to resolve them," says Dr. Jan Ciborowski of the University of Windsor and the Canadian coordinator of the program.

A cornerstone of the clearinghouse program will be the program's web site to be unveiled later this spring at the International Association for Great Lakes Research (IAGLR) conference. The main web site, along with each of the five lakes' sub sites, will house press releases, factsheets, and announcements related to Great Lakes research; funding sources and their proposal guidelines; and a database of current research projects.

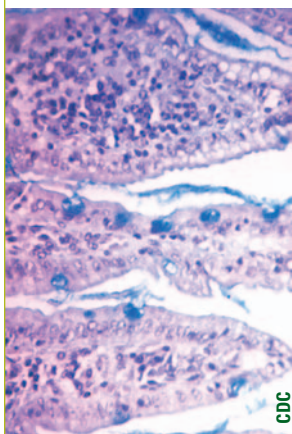
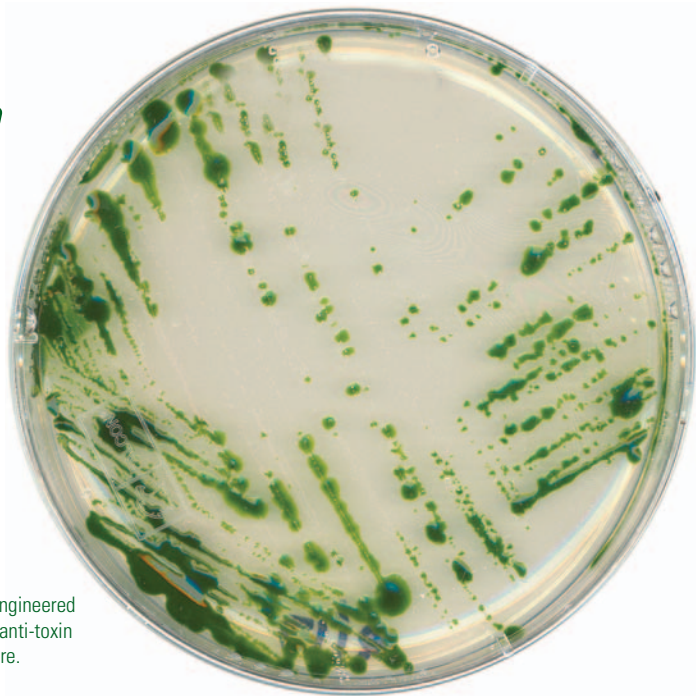
GLRRIN will be introduced during both presentation and poster sessions at the IAGLR conference in May. For more information about GLRRIN, contact Dr. Jeff Reutter at reutter.1@osu.edu or 614.292.8949. **TL**

From Counter Terrorism to Pathogen Detection

Researcher invents new technologies to mass produce human anti-toxins and gauge infections

by Jill Jentes Banicki, Ohio Sea Grant Communications

Dr. Sayre was recently funded by NIH to use his engineered *Chlamydomonas* algae to mass produce a human anti-toxin to protect the U.S. military from nerve gas exposure.



Cholera bacteria

For nearly 15 years, Ohio Sea Grant researcher Dr. Richard Sayre of Ohio State University has been using *Chlamydomonas reinhardtii*—a unicellular alga found all over the world—to separate heavy metals from Lake Erie sediment. He used that same alga as a vehicle to safely and cheaply vaccinate fish from a disease that kills one third of the U.S. trout population. Later he broadened its use again as a biosensor, making it glow a fluorescent yellow when a heavy metal was present.

So what more can this little alga do?

How about mass producing an antidote to protect the public from a biological terrorist attack? Thanks to Dr. Sayre and his team, the alga that originally had set its sights on extracting heavy metals faster has just added counter-bioterrorism to its resume.

Now Sporting Military Fatigues

As the wars around the globe continue to escalate, so have the threats of bioterrorism attacks. Recent chemical warfare events like the sarin nerve gas attacks in 1994 and '95, injuring thousands in Japan, have added to the need to improve precautionary measures to immunize the public from future attacks. As a result, the U.S. military has focused its attention on finding antidotes for such lethal chemical agents as the nerve gas sarin.

In recent years, the military has developed a protein which acts as a detoxification sponge for sarin exposure. The protein prevents an individual, who has been or may be poisoned by the gas, from showing any of its effects if that detox protein is in their bloodstream. Unfortunately, the current process to make this protein is too time-consuming and too expensive.

Enter Sayre's algae (now sporting military fatigues).

Using his previous Sea Grant work, Sayre and two Ohio State research teams received a grant from the National

Institutes of Health (NIH) to mass produce the human protein via his bioengineered *Chlamydomonas* algae. "Unlike the current production process which harvests the protein from blood, *Chlamydomonas* allows us to make potentially large amounts of the protein and to produce it faster," says Sayre.

Their first job will be to perfect the human protein so that its effectiveness can be enhanced. "Right now an individual requires a shot within ½ hour of exposure or monthly doses to maintain its effectiveness; neither of which is the most beneficial for troops on the battlefield," states Sayre. "Once we develop a gene encoding a more-potent detoxifying protein, we can genetically insert it into the alga and the alga can produce it as part of its life cycle."

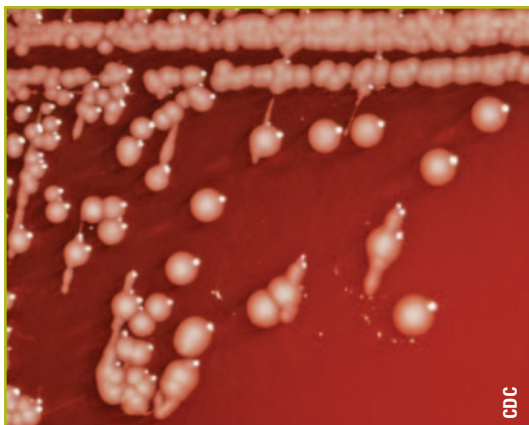
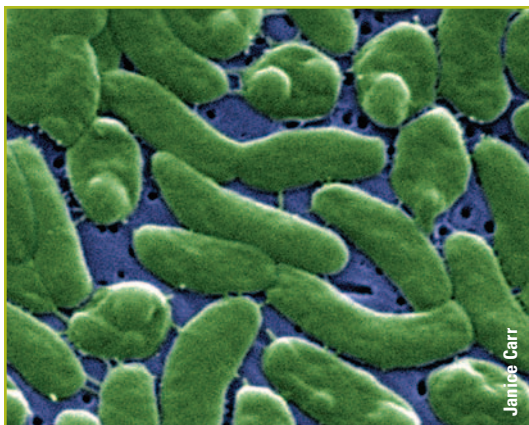
The hope is that by year three of the five-year project, Sayre and his team will demonstrate the feasibility of their strategy leading to the development of large-scale production facilities that could provide the antidote for the military and later for the entire U.S. population.

A pond the size of 60 acres and one-foot deep could possibly generate the entire nation's supply of the human anti-toxin.

Gauging the State of Bacterial Infections

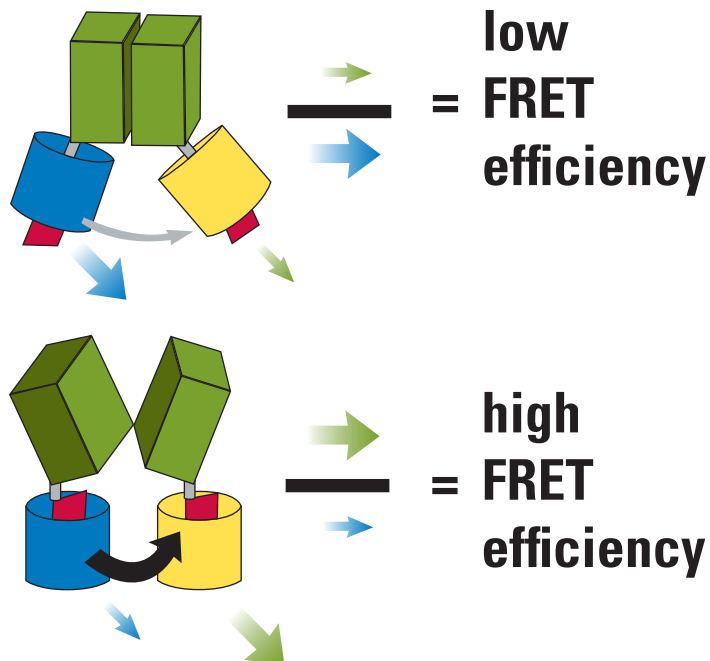
Over the last five years, Sayre has also expanded his Sea Grant work with biosensors. His past biosensor project used the *Chlamydomonas* algae as a means to signal whether a heavy metal was present. "If a heavy metal was in the sediment, it attached to the alga's protein indicator, which produced a fluorescent yellow light," explains Sayre.

Dr. Sathish Rajamani, a former graduate student in Sayre's lab, realized they could use a similar process to identify molecules produced by pathogenic organisms.



Sayre's patent-pending biosensor process can detect the state of more than 50 pathogens within minutes. Pathogens include food poisoning pathogens like salmonella (above) and *E. coli*, along with *Vibrio harveyi*, a pathogen in fish and aquatic animals and *Helicobacter pylori*, an ulcer-causing bacterium.

How the Bacterial Biosensor Works



Sayre's biosensor process measures the state of bacterial infections using a free protein attached to two fluorescent (blue and yellow) proteins. If bacteria compounds exist in the organism's blood, they attach to the receptor protein (green) causing a change in shape of the receptor protein. This shape change makes the blue fluorescent protein move away from the yellow fluorescent protein, causing the biosensor to produce more blue and less yellow fluorescent light (low FRET or fluorescence resonance energy transfer). If no bacteria exist, the energy transfer between the two fluorescent is higher and the biosensor exhibits a more yellow or green color (a higher ratio of yellow to blue fluorescence or high FRET). The state of the bacterial infection determines the color of the biosensor's fluorescence—the more pathogenic the bacterial infection, the more vibrant the biosensor signals blue.

Current technology to measure pathogens involves either immuno-detection or mass spectroscopy—both of which are slow, technology-difficult, and expensive. Incorporating a biosensor to gauge an infection, however, would be cheaper, highly specific, and give practically instantaneous results. “With the recent rise of salmonella and *E. coli* outbreaks around the country, there was definitely a need to quickly and inexpensively detect pathogens,” says Sayre.

The key to a bacterial biosensor is its ability to measure the quorum sensing (QS) compounds or the molecules that bacteria give off as they become pathogenic or disease-causing. “If we could get the bacteria's QS compounds to bind to a biosensor, we could quantify them and determine how pathogenic the bacteria were,” explains Sayre.

The biosensor itself—this time without the algae—consists of a receptor protein (that binds to the QS molecule) attached to one blue fluorescent and one yellow fluorescent protein (see diagram). If no bacterial QS molecules are

in the blood sample, the receptor does not bind to anything and the biosensor produces a green light. If bacteria QS compounds do exist in the organism's blood, the QS compounds attach to the receptor protein, causing the biosensor to produce a blue color. The more pathogens the sensor detects in the blood, the more vibrant the sensor signals blue.

To make it the most effective, Rajamani and Sayre chose a class of QS-binding proteins that could be used to detect the widest range of pathogens. More than 50 different pathogens can be detected by the Sayre lab biosensor, including deadly food poisoning pathogens like salmonella, *E. coli*, and cholera, as well *Vibrio harveyi*, a pathogen in fish and aquatic animals and *Helicobacter pylori*, an ulcer-causing bacterium.

“Although this biosensor process won't tell us if the infection is completely gone, it will within minutes tell us the progression or digression of a bacterial infection by the intensity of biosensor's fluorescence,” explains Sayre.

Rajamani and Sayre currently have a patent pending for the design of the biosensor. The biosensor process will be used to test for infections in blood and urine; for bacterial biofilm formation in industrial applications; and for bacterial pathogens in fish in aquatic systems.

“What's great about this technology is it allows a technician to take a blood or urine sample and know within a minute whether the antibiotic that was administered is working,” concludes Sayre. “If the biosensor glows less (blue), we know that infection is less prominent and therefore, the treatment is working.” **TL**

Dr. Sayre was recently named a Fulbright Scholar for his Chlamydomonas work. He currently has four patents pending for his Ohio Sea Grant research on biosensor, heavy metal removal, animal supplement, and vaccine technologies.

For more about this Ohio Sea Grant research, contact Dr. Sayre at 614.292.9030 or sayre.2@osu.edu.

If You Put it on the Web, They Will Come!

by Dr. Rosanne Fortner, COSEE Great Lakes Director

Well, maybe we can't generalize to quite that extent, but recent experience with The College of Exploration's presentation of a COSEE Great Lakes workshop seemed to be just what the recruiters ordered.

What began as a 1½ day workshop for a small group of interested educators, *Environment & Education for the Inland Seas*, was transformed by the magic of web-based streaming video into a desktop in-service program for over 400 participants. This remarkable opportunity began with the annual conference of the North American Association for Environmental Education in October 2006 in St. Paul, Minnesota. COSEE Great Lakes leaders conducted an in-person workshop that received enthusiastic evaluations and generated interest in COSEE events and materials. Unlike many workshops, however, this one didn't end with the post-test.

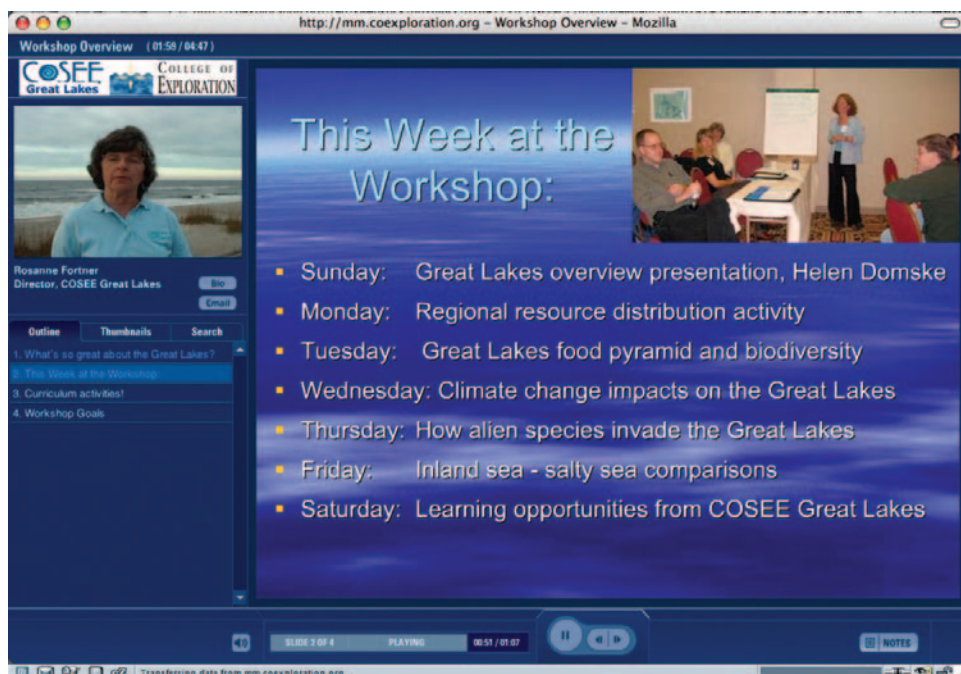
The St. Paul workshop was videotaped by leaders of The College of Exploration (TCOE), a COSEE partner for media-based education.



Using formal presentations and actual teacher preparation activities, daily interactive web pages were created for an online course entitled, *What's So Great About the Great Lakes? Inland Seas Environment and Education*, held December 3–9, 2006. This online workshop attracted participants from 20 states plus Puerto Rico, Canada, and China. Twenty-eight participants were from Ohio.

The course gave educators the opportunity to discover how collaborative learning could bring information and opportunities to groups much larger than we imagined. The web environment consisted of a group of "rooms", built with Caucus® software, that allowed participants to interact with one another and with the course files. Each room had its own list of discussion items for student participation. The room for this course included:

- a Great Lakes room where the Realplayer presentations and discussions were held;
- a Resources room for sharing materials and posting information about web sites, books, curricula, music, and other teaching aids;
- several Assignment rooms for people who were taking the workshop for credit, where they could post their coursework and discuss it with a course moderator; and
- a Cafe where participants could chat about various subjects. A starter topic of "share a memorable Great Lakes experience" brought in photos, life events, and wonderful perceptions of the Lakes.



With the software up and running, and the experience of TCOE staff to answer all our questions and tolerate our disparate learning curves, the week of learning went like this:

- Sunday - Great Lakes overview presentation
- Monday - Regional resource distribution activity
- Tuesday - Great Lakes food pyramid and biodiversity
- Wednesday - Climate change impacts on the Great Lakes
- Thursday - Aquatic invasive species in the Great Lakes
- Friday - Inland Sea vs. Salty Sea comparisons
- Saturday - COSEE Great Lakes: Looking back and looking forward!



Each day, curriculum activities from Ohio and other Sea Grant programs were presented, and regional scientists were online to answer questions about their topics. COSEE leaders were also able to interact with their state participants.

Staff and participants alike were astonished by the ability of the program to allow in-depth discussions, to expand the limits of what people thought the Internet could do, and to bring to everyone a much richer array of materials, contacts, and experiences than a traditional workshop could accomplish. Perhaps the greatest part is that all the material remains on the Internet for others to use and review by simply registering for free at coexploration.org/coseegreatlakes.

We were delighted with every aspect of our first experience with the talented group of TCOE professionals, and will be offering other workshops with them in coming years. The 2007 workshop topics are Lake Superior and Lake Huron. Watch the COSEE Great Lakes web site at coseegreatlakes.net for information about these great opportunities! TL



COSEE Great Lakes Events for 2007

This year's Lake Exploration Workshop for COSEE Great Lakes focuses on Lake Huron. It's scheduled for August 11–August 17 at the Maritime Heritage Center of the Thunder Bay National Marine Sanctuary, in Alpena, Michigan. Details will be available online at coseegreatlakes.net/events.

Twenty teachers will receive scholarships for “marine immersion” experiences in workshops offered by COSEE partners in the Great Lakes region or on marine coastlines. The list of available experiences is posted online and includes several Stone Lab courses for educators, as well as a Tropical Marine Ecology Workshop in Curaçao offered through New York Sea Grant.

Support is available in each state for student groups to participate in lake science programs and for scientists to host teachers in their labs for “Educator House Calls.” Inquiries should be addressed to Dr. Rosanne Fortner at director@coseegreatlakes.net.

Other COSEE Great Lakes events will be announced online and in *Twine Line* as they are developed. Supported by the National Science Foundation and NOAA, this five-year program offers excellent opportunities for scientists and educators to collaborate on the development of Great Lakes and ocean science literacy.

Great Lakes, Great Fellows

Ohio Sea Grant is proud to announce the three Teacher Fellows for 2007. They are:

- Pamela Argabrite, a 4th grade teacher at Donovan Elementary School in Lebanon, Ohio;



Argabrite

- Sam Roman, a 6th grade science/math teacher & technology coordinator at the Empire Computech Center for the Cleveland Municipal Schools;



Roman

- Loretta Harvey, a biology and GED science teacher at the Ohio River Valley Juvenile Correction Facility in Portsmouth.



Harvey

Teacher Fellowship recipients receive full tuition for summer quarter, room and board for three weeks at Stone Lab, textbooks, and support to attend professional meetings during the academic year.

Selected teachers must be science educators in the upper-elementary to high school levels who are eligible for graduate work. Fellows must also demonstrate use of classroom technology, be professionally active, and have an interest in Great Lakes education.

Questions about the program should be addressed to Dr. Rosanne Fortner at director@coseegreatlakes.net.

Good Things Come in Small Packages

Tiny plankton producing oxygen near Dead Zone

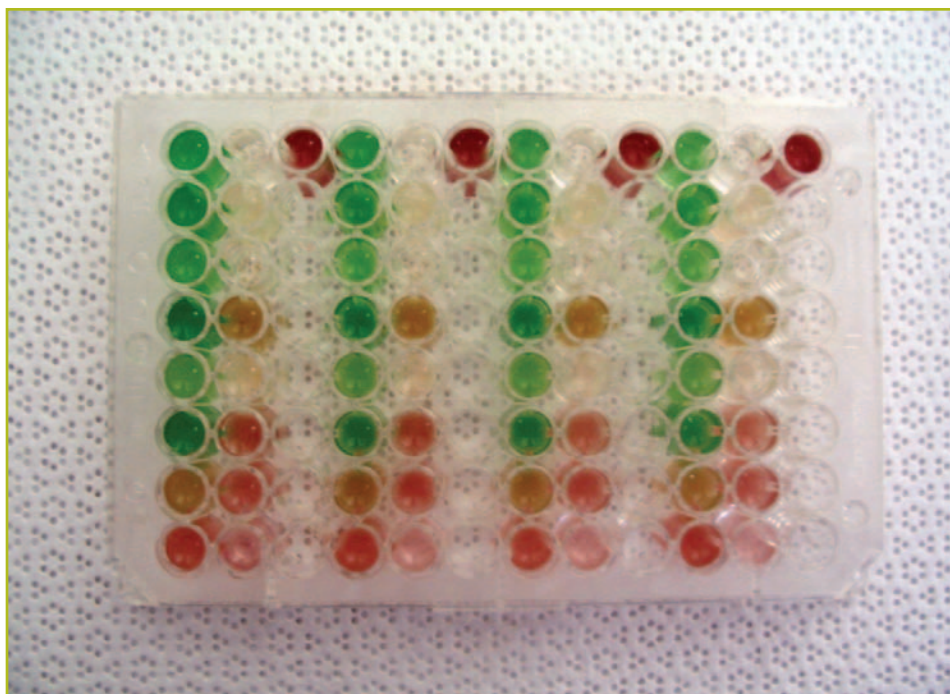
by Abbie Basile, Ohio Sea Grant Communications

For many, the words “Lake Erie” bring to mind large things: big sport fish, sprawling waterfront homes, and an enormous body of water bordering four states and two countries. Similarly, much of the Lake Erie research of which the public is aware deals with larger biological organisms—larger algae and zooplankton, the small fish that eat the zooplankton, and the large fish that feed on those smaller fish. Over the years, the smaller lake life have been somewhat overlooked.

However, for two Ohio Sea Grant researchers, the Lake is all about a community of tiny bacteria living in the Central Basin’s Dead Zone. Drs. George Bullerjahn and Michael McKay, both biologists at Bowling Green State University, have found microscopic plankton that not only thrive in the low-oxygen environment of the Dead Zone, but actually contribute oxygen to the watery world in which they live.

Picoplankton are minute, less than two millionths of a meter, or two microns, in size; 100 could easily fit across the width of a human hair. The specific types of plankton the researchers are studying are referred to as picocyanobacteria, a subset of what is commonly known as blue-green algae.

In August 2002, Bullerjahn and Dr. Steve Wilhelm, a biologist at the University of Tennessee, were on Lake Erie gathering water samples in the Central Basin, north of Cleveland, to take chlorophyll measurements. When they pulled up their sample from 16 meters down, they were surprised to see that their filter had turned bright red. “Usually, the filter is green and brown. To find a sample that is pink or red was strange and very unexpected,” recalls Bullerjahn. The pair took similar samples in 2004 and 2005, both before the seasonal Dead Zone established itself and in late-summer, when it was in full swing.



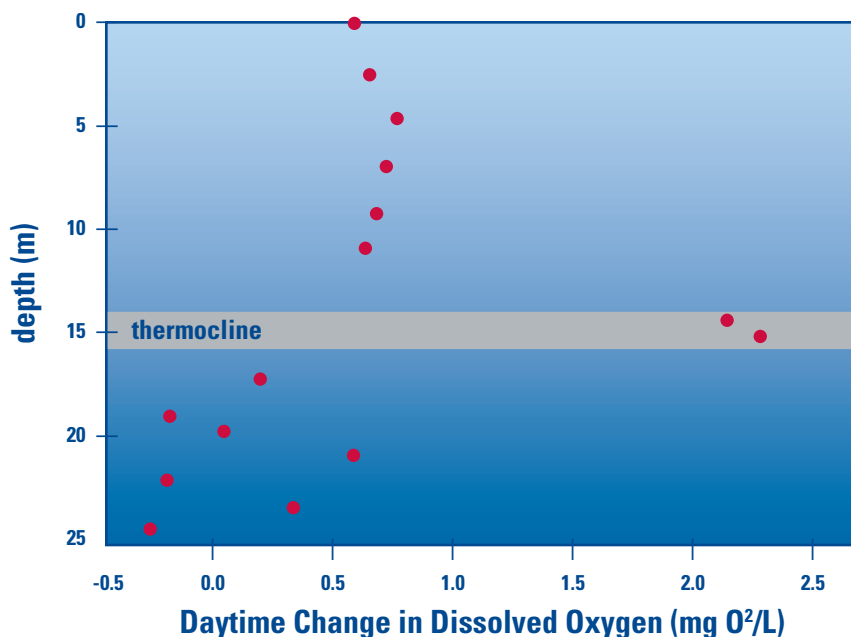
Shown above are various *Synechococcus* strains. The tray’s red picocyanobacteria are from a deep-water chlorophyll layer, while the blue-green samples were taken from near-shore surface waters.

To identify what they had in their sample, the researchers analyzed DNA sequences of the ribosomal RNA genes present. Bullerjahn and McKay, working with Wilhelm, found the bacteria were oxygen-producing *Synechococcus*. These organisms appear to have a close evolutionary relationship to cyanobacterial communities in European and Japanese lakes, earning them the label of “cosmopolitan,” a term scientists use to denote relationships between far-flung organisms from around the world. At the same time, they were performing ground-breaking identification work on Lake Superior’s cyanobacteria community. McKay notes, “We found there was no close evolutionary relationship between the picoplankton in Lake Superior and that in Lake Erie. In fact, the picoplankton community in Lake Superior is found

nowhere else in the world.”

Beyond the genetic analysis of the Lake Erie picocyanobacteria community, these researchers wanted to know what relationship existed between the miniscule plankton and their Dead Zone environment. This specific region in the Central Basin is so named because of its extremely low oxygen levels, also known as hypoxia, in mid-to-late summer. As oxygen is depleted, the presence of organisms, such as fish, that require oxygen to exist dramatically decreases. This lack of visible life makes the area appear to be dead.

However, Wilhelm, Bullerjahn, and McKay have found something in their pre- and post-Dead Zone sampling that is in sharp contrast to the dreary portrayal of the region. “The picocyanobacterial population size and its genetic diversity increase during the Dead



Water samples taken from the Dead Zone show that oxygen concentration directly below the thermocline was significantly higher during the daytime, indicating a rapidly photosynthesizing population.

Zone period,” states Bullerjahn. “Our work has revealed that factors like hypoxia may actually stimulate the abundance and genetic diversity of the cyanobacterial community.”

This large population of microscopic bacteria that is producing oxygen thrives in one specific place in the Dead Zone. In the summer, the upper water in the Central Basin is heated while the lower water remains cold and dense, with little oxygen. The water layer between these two temperatures is known as the thermocline and this is where the blue-green algae reside.

The algae’s descriptive name provides a clue for another part of its life story, with the green coming from the chlorophyll it contains. Chlorophyll plays a key role in photosynthesis, the process where sunlight is used to produce nutrition and oxygen is generated as an important by-product. “These small organisms conducting plant-like photosynthesis comprise upwards of 50% of the total chlorophyll in the Great Lakes,” notes McKay. “This community can also be performing up to half of the photosynthesis that occurs off-shore.”

The researchers feel this new information can play a key role in developing more accurate ecosystem models. “This *Synechococcus* community is highly active in photosynthesis in a part of Lake Erie that is typically not considered very productive,” explains Bullerjahn. “There may be more nutrient recycling to other organisms going on in the Central Basin than we previously believed.” Their research has the potential to revolutionize science’s thinking regarding productivity of large lakes, including everything from oxygen sources to human use of the fisheries.

With the support of Ohio Sea Grant funding, these scientists will be carrying out a far more detailed examination of the Lake’s picoplankton. Bullerjahn states, “Until 20 years ago, these cyanobacteria hadn’t even been documented. When you generally think of blue-green algae, you tend to think of the bad guys, such as poisonous *Microcystis*. What we’ve discovered are the good guys who are doing a great deal of photosynthesis in the Lake.” Future research will tell us just how large the positive impact is of these, the tiniest of Erie’s inhabitants. **TL**

For more information about this Ohio Sea Grant funded project, contact Dr. George Bullerjahn at bullerj@bgnet.bgsu.edu or Dr. Mike McKay at mmckay@bgnet.bgsu.edu.

The Lake Erie Discussion Board

Ohio Sea Grant Extension developed a Lake Erie Discussion Board in 2002 to provide an online venue for questions about Lake Erie and its resources. Over the years, Extension agents have fielded questions about such topics as the dead zone, current fishing techniques and regulations, and Lake Erie water levels.

The online discussion board has proven to be very popular, averaging 60,000 hits per month. To celebrate its success as one of the top Ohio Sea Grant web pages, Extension would like to share questions posed and their answers.

Question

Some maps of Lake Erie’s Western Basin include submerged well heads and net stakes. What are they and do they present hazards? Are they found in U.S. waters?

Answer from Fred Snyder

Submerged well heads generally refer to gas wells and should be on the Canadian side. For shallow-draft sport boats, these should not present navigational hazards.

Net stakes are used to set pound nets, which might be thought of as “fish corrals.” These nets have not been used for several decades in Ohio waters, although Ontario may still have some in use. Most pound net stakes in Ohio waters have probably decomposed or been torn out by ice, but some may still exist. In 25 years, I’ve never heard of a boat hitting one.

Question

What has the state done to control or eliminate lampreys in Lake Erie?

Answer from John Hageman

The Great Lakes Fishery Commission controls sea lampreys with a piscicide, TFM, in Lake Erie streams containing spawning populations. Since larval sea lampreys take 4-17 years to metamorphose into the parasitic adult, the streams only require the poison treatment about every five years. In other Great Lakes, additional control measures are used, such as other chemicals, low head dams, and sterile male releases. Pheromone attractors may be used in the future to lure sexually mature lampreys into traps before they can spawn. Overall, these programs, costing millions of dollars a year, control lampreys to the extent they no longer impact our sport fish significantly.



Stone Lab's Dirty Job

by Daniella Nordin, Ohio Sea Grant Communications



Wanted: Snake Researcher.

*Must be able to work long hours catching, weighing, and inducing vomit in Lake Erie water snakes.
Cannot be afraid to get dirty. Benefits include working outdoors. Strong stomach a must.*

Welcome to Kristin Stanford's Dirty Job. Based at Ohio State's Stone Laboratory, "The Island Snake Lady," as she is affectionately referred to, spends her time studying the federally-threatened, state-endangered Lake Erie water snake (LEWS). It lives only on the shores of the western Lake Erie islands, and until Stanford arrived five years ago, had a lousy reputation.

LEWS make for bad neighbors. Though they are non-venomous, they are ill-tempered and quick to bite. The combination of a nasty personality and people's innate fear of snakes has made LEWS an unpopular resident along the shorelines of Lake Erie.

But Stanford, a Northern Illinois University Ph.D. candidate, wouldn't want to be anywhere else. Her ultimate goal is to remove the snakes from the endangered species list. "LEWS may be the smelliest, nastiest, and dirtiest snakes out there, but it's important that I see the recovery of this species through to the end," she explains.

Working with the U.S. Fish and Wildlife Service and the Ohio Department of Natural Resources Division of Wildlife, Stanford coordinates and fulfills the goals set out in the Federal Recovery Plan designed for LEWS. One of the objectives includes enhancing public awareness of LEWS through education and outreach efforts. What's the surest way to reach a large number of people? TV.

Maybe you've heard of *Dirty Jobs*, the Discovery Channel program in which host Mike Rowe performs difficult, messy, and oftentimes chaotic occupational duties alongside professional workers. The appeal of the show is the juxtaposition of Rowe, a well-spoken, sarcastic man with a self-deprecating wit participating in various blue-collar situations, and the colorful men and women who actually do that job for a living. *Dirty Jobs* airs every Tuesday to an audience of more than one million viewers, making it the top-rated show on the Discovery Channel.

"I went to the show's message board and posted a letter," says Stanford. "I never thought they would get back to me. But they emailed me the very next day and the rest is history!"

The *Dirty Jobs* crew visited Stone Lab last summer and filmed 12 hours of Stanford and Rowe catching, tagging, and manually regurgitating LEWS. Those 12 hours were condensed into 15 minutes and aired on the *Dirty Jobs* season premier in November, with 1.6 million people tuning in. Since its premier, the show has aired at least eight times to an estimated 10 million viewers.

"From the outreach perspective of my job, I think I could pretty much throw the towel in right now and claim the program a huge success," notes Stanford. "I'm the kind of person though, who likes to keep pushing—the more

people who are educated about LEWS, the better."

Starring on *Dirty Jobs* is the most far-reaching thing Stanford has done yet to educate people about LEWS and she doesn't plan on slowing down anytime soon. "This experience will open new doors for me and I'm not about to go through them sitting down!" she states.

Stanford's research is supported by endowments through Ohio State's Stone Laboratory where she teaches a Herpetology course and co-leads a Research Experience for Undergraduates (REU) Scholarship Program, in which students can participate in LEWS research. For more information on Stone Lab's REU Program, visit stonelab.osu.edu/reu. For more information about Stanford's research, visit her web site respectthesnake.com or contact her at theislandsnakelady@yahoo.com. TL



Stanford's *Dirty Jobs* feature has aired at least eight times to an estimated 10 million viewers since its premier in November.

Stone Lab's New Summer Offerings

by Daniella Nordin, Ohio Sea Grant Communications



This summer, Stone Laboratory will offer new opportunities for undergraduates and graduates in biological sciences, education, and natural resources. Spider Biology, Aquatic Entomology, and the Entomology REU will add to the already diverse offerings of more than 30 different science courses available on Gibraltar Island.

EEOB 694: Spider Biology

The shores of Lake Erie are famous for both the abundance and the variety of spiders that live there. Dr. Richard Bradley, Associate Professor of Evolution, Ecology, and Organismal Biology at Ohio State's Marion Campus, will cover all you could ever want to know about spiders during the week of July 8–14.

For the first time at Stone Lab, students will be introduced to the diversity of spiders, along with their behavior and ecology. They will learn how to identify and become familiar with the most common spider families in Ohio.

Other topics will include spider anatomy, classification, and web building techniques. Spiders are among the most important predators in natural ecosystems and are effective at controlling pest insect populations. "The behavior of spiders is surprisingly complex and fascinating," notes Bradley. "I am excited to offer a course dedicated solely to them."

ENT 612: Aquatic Entomology

Northwest Ohio is abundant with aquatic habitats ranging from wetlands and rivers to lakes. Dr. Ferenc de Szalay, Associate Professor of Biological Sciences at Kent State University, and his students will explore aquatic ecosystems and the insects that inhabit them.

Aquatic Entomology, offered from July 19–August 18, will teach students about aquatic insect anatomy and ecology as well as field sampling and identification techniques. The course will



combine lectures on insect biology with field trips to sample habitats, using Ekman dredges, core samples, activity traps, and sweep nets.

"Stone Lab is the perfect site to teach Aquatic Entomology," says de Szalay. "Students will see aquatic insects in a wide range of freshwater habitats, from coastal and inland wetlands to rivers." Understanding aquatic insects has many practical applications. For example, they are key components of food webs, and they can be important indicators of water quality.

Entomology REU Scholarship Program

Stone Lab's Research Experience for Undergraduates (REU) Scholarship Program offers students a real-world research experience in data collection and analysis, scientific reading and writing, and oral presentation skills while providing a full scholarship for tuition, room and board, and lab fees.

Overseen by Dr. Doug Kane, Visiting Assistant Professor of Biology/Toxicology at Ashland University, the new entomology REU will allow students to investigate the devastating effects of the Emerald Ash Borer (EAB), a non-native beetle that entered the United States in the summer of 2002.

"During visits to several Lake Erie islands, students will determine forest composition by identifying trees and measuring their densities and sizes," states Kane. "They will look for new evidence of EAB activity and examine the ecological effects of this beetle." The data gathered can help homeowners, arborists, and landscapers make informed decisions about treating trees for this borer. TL



For more information on these and other opportunities offered at Stone Laboratory, visit

stonelab.osu.edu

Gibraltar Island Tours

Come to Gibraltar Island this summer to learn about the island's history and the current Lake Erie research taking place there. Each Wednesday, from June 20–August 15, a two-hour “Science & History Tour” will be offered on Gibraltar from 11:00am to 1:00pm.

Tour guides will lead a one-hour walking tour of the island including Perry's Lookout, the geologically significant glacial grooves, Stone Lab buildings, and the outside of Cooke Castle. The second hour will focus on current Lake Erie research being conducted at Stone Laboratory on topics such as mayfly populations, aquatic invasive species, and the federally-threatened Lake Erie water snake. Participants will view live plankton samples, as well as preserved specimens from the Lab's collection. Tours are provided on a first-come, first-served basis, with a maximum of 75 people.

At the tour's end, an optional box lunch is available for \$7.70 if

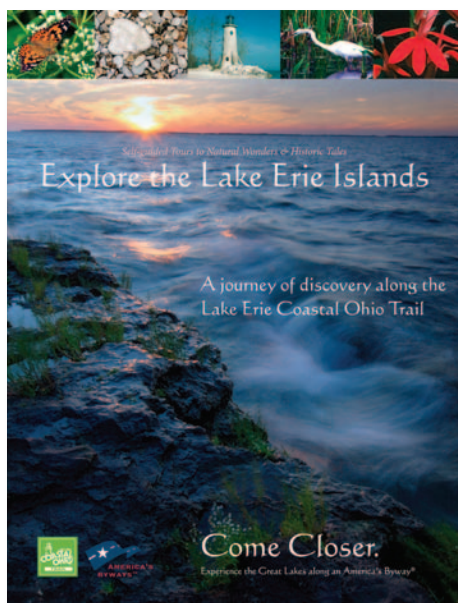
ordered upon arrival on the island. An outdoor picnic lunch will be held, weather permitting.

The tour fee is \$10, with proceeds going toward Stone Lab student scholarships. Transportation to Gibraltar Island is provided by water taxi for at a cost of \$6 round-trip. Participants need to arrive by 10:45am at the Boardwalk Restaurant Harbor Taxi Landing on South Bass Island.

For more information contact Kelly Dress at dress.3@osu.edu or 614.247.6500.



Two New Lake Erie Guides



Lake Erie Islands Guide to Nature and History

The Lake Erie Islands within the Western Basin provide habitat for endangered species, are home to the globally-rare alvar community, and are within some of the most productive waters of the Great Lakes. The heritage and natural wonders of these islands are now being given the attention they deserve.

A new full-color, 64-page guide highlighting the Canadian and U.S. islands will be available in spring 2007. It contains listings for 36 sites of interest on Kelleys Island, South Bass Island, Middle Bass Island, North Bass Island, and Pelee Island. Information about the islands' unique evolution and heritage, as well as checklists for some of the

plants, reptiles, birds, dragonflies, and commonly found butterfly communities are included. The guide also has details on how to get to the islands and where to find information regarding shipwrecks, kayaking, lodging, and more. Over 40 experts were called upon to provide information and review the publication.

This publication was funded by the Lake Erie Protection Fund, KeyBank, Ohio Sea Grant, and the Lake Erie Coastal Ohio Trail and was developed in partnership with these organizations and The Nature Conservancy Ohio Chapter.

To receive a copy, email cruickshank.3@osu.edu or write to: Ohio Sea Grant Publications, 1314 Kinnear Rd., Columbus OH 43212. There is a \$3.00 postage fee.

Lake Erie Lighthouses & Maritime Adventures Map Available

This free brochure and map highlights 31 lighthouses, maritime museums, and museum ships along Ohio's portion of Lake Erie. Discover which Lake Erie lighthouse is the sister light of the Huron Lighthouse. Find out which lakeside town is known as the “Town of Sea Captains.” Learn which lighthouse was staffed by the first female lighthouse keeper on the Great Lakes.

The award-winning guide features a variety of sites including: the Great Lakes Marine and Coast Guard Memorial Museum in Ashtabula; the lighthouses of Cleveland, Toledo Harbor, Cedar Point, the Lorain Breakwater, and South Bass Island; and the Steamship William G. Mather Museum. This guide was developed by the Lake Erie Coastal Ohio Trail, a new national scenic byway that travels along Lake Erie between Conneaut and Toledo. Funding was provided by the Ohio Lake Erie Protection Fund, U.S. EPA's Great Lakes National Program Office, and the visitors bureaus of Greater Cleveland, Greater Toledo, and Ashtabula, Lake, Lorain, Erie, and Ottawa counties.

To receive a copy, email cruickshank.3@osu.edu or write to: Ohio Sea Grant Publications, 1314 Kinnear Rd., Columbus OH 43212.

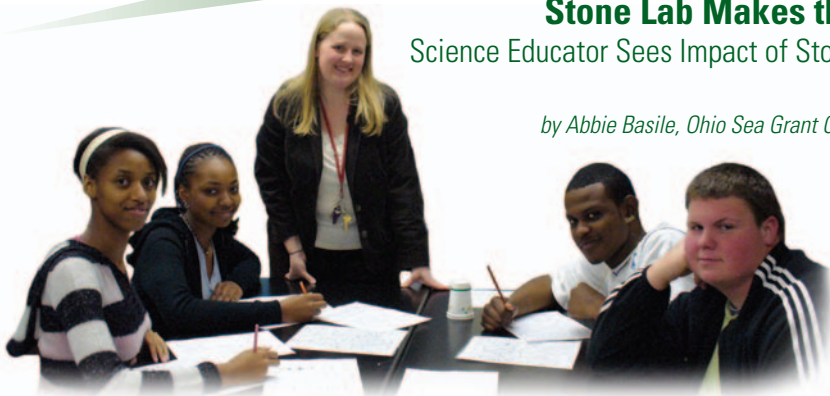


Student Spotlight

Stone Lab Makes the Grade

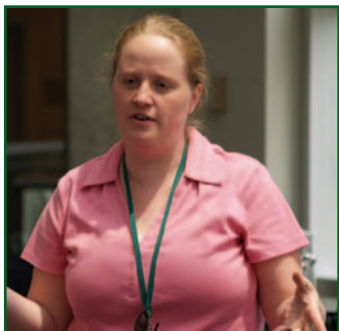
Science Educator Sees Impact of Stone Lab in Her Teaching

by Abbie Basile, Ohio Sea Grant Communications



When Georgia O'Hara was growing up, she knew she wanted to be a teacher. However, it wasn't until after she took her first class at Stone Lab as a high school student that she decided to teach science. It was the wide array of scientific topics that captured her attention. "There's always something new to learn in science," she explains.

Now a Biology and Environmental Science teacher at Centennial High School in Columbus, Ohio, Georgia has returned to Stone Lab several times to take courses as an educator. This past summer, she took Ornithology for Teachers and Local Flora. Georgia, along with 15 other educators, also traveled the southern shore of Lake Erie aboard the U.S. EPA research vessel *R/V Lake Guardian*, as part of the COSEE Great Lakes program.



"My Ornithology and Local Flora classes helped me build my scientific knowledge," says Georgia. In addition to subject competency, how a teacher shapes a lesson plan is key to creating a successful learning experience for her students. "Being able to share ideas with educators from across the state is a significant benefit of attending Stone Lab," she observes. "My fellow students last summer were some of the warmest, most positive people I've met. They were an exceptional group of people to learn with and to learn from."

Georgia acquired the tools and confidence to create and implement fresh teaching approaches in her classroom. She is using her newly attained knowledge to carry out an ambitious classroom project. She

plans on having each of her students create a science portfolio that focuses on their local environment. "Everything I learned up on the Lake has prepared me well for this new and challenging project," Georgia states. Her Stone Lab professors were great role models in teaching her two important lessons about best practices for teaching: the importance of clearly communicating expectations to students, and of being flexible about meeting student needs.

Courses on Gibraltar Island also offered Georgia a wonderful opportunity to gain insight into the research process. "Getting to interact with field researchers in class, in the dining hall, and on field trips, helped me to understand what their world was really like," she says. "In turn, that helped me to show my students that scientists work in all types of settings and that not all research happens in a laboratory."

She would like more teachers to have the opportunity to benefit from the Lab. "For many teachers, the cost of tuition, plus room and board, is daunting. A scholarship would open this door for them," Georgia notes. "The amount of learning that a scholarship supports, combined with the depth and richness of the Stone Lab experience, is unmatched."

Georgia hopes to finish her master's thesis this summer and to pursue a Ph.D. in education. She plans on taking Stone Lab classes for as long as there are new courses for her to attend. "There are very few quality opportunities for science teachers to get professional development," she explains. "I give the Stone Lab program an A+. It's the best of the best." **TL**



Georgia on deck during the COSEE Great Lakes Education course.



FRIENDS OF STONE LABORATORY

Dear friends,

The wish-list generated by FOSL's Executive Committee and Board is being prioritized. Below are some of the items at the top of our list. We plan on making various purchases over the next few months. As always, donations of both equipment and funds are appreciated.

- Cameras for the laboratory scopes
- Various meters for the research vessels
- An underwater camera and a web camera for the lighthouse
- Gear for the new electro-fishing boat

As part of our 25th Anniversary year, we are updating the annual FOSL brochure and endowment list. We also plan to create an official FOSL logo that will likely incorporate a 25th Anniversary tagline. I welcome your suggestions on the logo design.

In recruitment news, we are working on the always important goal of increasing Stone Lab enrollment. We would like to establish a FOSL student chapter at Ohio State and are looking for motivated undergraduates to head up this group. We are also asking everyone to consider visiting your former high school or college to spread the word about Stone Lab courses. A PowerPoint presentation and handouts are available from Ohio Sea Grant. If you wish to assist with recruitment, please contact me so that I can make sure that you receive the appropriate materials.

Finally, there is great news from the Ohio Statehouse. Representative Chris Redfern was successful in getting \$500,000 into the capital budget for Stone Lab. This should allow us to make huge improvements in the Research Building and the Lab. These funds cover some original "wish list" items, freeing up money for other needed purchases.

In closing, please don't forget to support the education and research programs of Ohio Sea Grant and Stone Laboratory by purchasing your Fish Lake Erie specialty license plate, or by donating online at ohioseagrant.osu.edu/donate.

See you at our upcoming Spring Work Weekend on April 21-22!

Sincerely,

Christopher J. Winslow
FOSL President

cjwinsl@bgnet.bgsu.edu



Spring Work Weekend - Technology Marches On!

One of the first ways FOSL was able to help Stone Laboratory was through hands-on work. The creation of "work weekends" gave FOSL members a chance to make a dent in the myriad lists of odd jobs that needed to be done. These tasks improved the efficiency of the Lab's operations and created a better experience for the students and faculty. Work weekends were traditionally held in the spring to open up the Lab, and in the fall to help shut it down for the winter. With the creation of the workshop programs, the Spring Work Weekend moved to earlier in the season and became all the more important to kicking off the programs for the year.

Our next Spring Work Weekend is scheduled for April 21-22, 2007. It is essential that we have a large turn out of volunteers for this event. Why? The title of this article gives a hint. The use of technology to transmit and store information has had an enormous impact on libraries. Many of the major scientific journals are now published electronically without a print counterpart. In addition, humidity and temperature extremes present problems for the Stone Lab library's printed materials. In light of these factors, Ohio State's library wants to remove the greater portion of the Lab's library stacks.

One of the major tasks for the weekend will be to move the library items to South Bass Island and then load them for transport back to Columbus. Some of the work weekend "regulars" may remember when the library stacks were moved from Bayview over to Gibraltar in 1998, and what an effort that was. It isn't exactly a task equal to building the Great Pyramid, but a large number of volunteers will make the job much easier.

Please set aside the weekend of April 21st for Stone Lab. The weather is always perfect for FOSL events. So, come and enjoy the beauty of the islands and do a good deed too. Please bring work clothes, along with your own bedding, towels, and toiletries. Meals and ferry passage will be provided. To volunteer, contact Stone Lab at 614.292.8949. For updates, see stonelab.osu.edu/fosl.



FOSL moved the library stacks from Bayview to Gibraltar in 1998.

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 unequalled learning experience available to all outstanding students." Members of the Friends provide a way for former students to support the facility by raising awareness and funds for scholarships, research, and equipment.

FOSL

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Kelly Dress, Office Associate (dress.3@osu.edu)

Dates to Remember

Spring Work Weekend, 4/21/07
OAS State Science Day, 5/12/07
Stone Lab Open House/FOSL Weekend, 9/8/07
Buckeye Island Hop, 9/29/07

FOSL NEWS

Diving Into His Work

Like many of the staff at Stone Laboratory, Matt Thomas wears many hats. His official title is Assistant Lab Manager, but he also fulfills roles as workshop instructor, researcher, and boat captain. Matt received his U.S. Coast Guard Masters license this past fall. With the increased Lake Erie water clarity, researchers at Stone Laboratory now incorporate approximately 200 official diving events per year into their research projects.

As the Diving Safety Officer for Stone Lab, Matt supervises the safe execution of all of the Lab's diving activities. He also serves on Ohio State's Diving Control Board, which oversees the university's 600 or more dives per year.

Since scuba diving can involve a wide variety of equipment, methods, water conditions and locales, it is important that Matt continuously hone his skills in order to review research diving proposals.

To that end, he recently participated in a winter diving exercise with other dive instructors and members of the Sandusky Fire Department. The dive took place at a private lake where the group had to chainsaw through 13 inches of ice. Water visibility was less than three feet, so

the divers were tethered and utilized underwater communications equipment. This type of training is critical to a safe diving program. We thank Matt for his dedication, particularly when it involves such chilling conditions.

More Friends

Stone Laboratory has been fortunate in having the value of the Lab's education recognized by various organizations. Long before the Friends of Stone Laboratory was founded, the Oakland Park Conservation Club provided scholarship money for students. Stone Lab is pleased to have another prominent supporter in the Ohio Chapter of the American Fisheries Society (OCAFS). In 2005, OCAFS helped create the Ohio Aquatic Sciences Scholarship to foster the academic development of future fisheries and aquatic science professionals. OCAFS formed this scholarship by pooling their contributions with other prominent fishing/conservation groups such as Ohio BASS Chapter Federation, Muskies Inc.-Cleveland Chapter, Ohio Central Basin Steelheaders, and the Ohio Small-mouth Alliance. The students of Stone Laboratory thank these organizations for their active support of environmental education. We look forward to a close alliance for many years to come.



Rod Althaus, Dive Instructor

Stone Lab's Matt Thomas joins in a winter diving exercise.

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