Venturing Into SCIENCE EDUCATION

Branching Out With STEM

SCIENCE TECHNOLOGY ENGINEERING & MATH
Upwellings

An upwelling occurs in a lake or ocean when strong, steady winds push warm in-shore surface water away from shore causing colder, nutrient-rich water to rise.

Upwellings is published quarterly by the Michigan Sea Grant College Program, a cooperative effort of the University of Michigan and Michigan State University. The program supports understanding and stewardship of the Great Lakes through research, outreach and education.

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Upwellings
Michigan Sea Grant College Program
520 E. Liberty St., Suite 310
Ann Arbor, MI 48104

MANAGEMENT TEAM
Director: Jim Diana
(734) 763-5834, jimd@umich.edu
Associate Director: William Taylor
(517) 353-0647, taylorw@msu.edu
Acting Director: Jennifer Read
(734) 936-3622, jenread@umich.edu
State Extension Coordinator: Chuck Pistis
(616) 458-6805, pistis@msu.edu
Communications Director: Elizabeth LaPorte
(734) 647-0767, elzblap@umich.edu

STAFF
Stephanie Ariganello, Communications Coordinator
(734) 615-0440, stephaa@umich.edu
Mary Bohling, Southeast Urban Extension
(313) 833-3275, bohling@msu.edu
Mark Bredel, Northwest Extension
(231) 922-4628, bredel@msu.edu
Sandra Enness, Communications Manager
(517) 353-9723, enness@msu.edu
Sonja Joseph Joshi, Regional Extension
(734) 741-2283, Sonja.Joseph@noaa.gov
Ron Kinnunen, Upper Peninsula
(906) 226-3687, kinnune1@msu.edu
Elyse Larsen, Fiscal Officer
(734) 764-2421, marsee@umich.edu
Dan O’Keefe, Southwest Extension
(616) 846-8250, okeefed@mail.msu.edu
Amy Samples, Community Outreach Coordinator
(734) 647-0766, asamples@umich.edu
Brandon Schroeder, Northeast Extension
(989) 984-1056, schroe45@msu.edu
Steve Stewart, Southeast Extension
(586) 754-2351, stewart@msu.edu
Rochelle Sturtevant, Regional Extension
(734) 741-2287, Rochelle.Sturtevant@noaa.gov
Lynd Vaccaro, Coastal Research Specialist
(734) 763-1530, lvaccaro@umich.edu
Jessica Vera, Accounting Clerk Intermediate
(734) 763-1437, jessvera@umich.edu
Laura Welsh Florence, Education Specialist
(734) 647-9730, lwelsh@umich.edu

WE’VE MOVED
The Michigan Sea Grant Ann Arbor office has moved! Our phone numbers remain the same, but the physical address has changed. Please make a note of the new location:

Michigan Sea Grant College Program
520 E. Liberty St., Suite 310
Ann Arbor, MI 48104-2210

RECORD NUMBER OF FELLOWS
Five students from Michigan universities have been awarded fellowships that focus on Great Lakes and marine issues. The paid positions (hosted through several different agencies) help students build professional networks and gain experience in natural resource management and policy careers. The fellows are Cassie Bradley, Liz Durfee, Zach Hecht-Leavitt, Eric MacMillan and Kyle Molton.

“We are happy that Michigan Sea Grant could help five highly qualified graduates of Michigan universities secure fellowships — a record number for us,” said Jim Diana, Michigan Sea Grant Director. “These students will have an excellent opportunity to apply their academic training to real world issues. The internship is their next step in becoming environmental leaders.”

To read more, visit www.miseagrant.umich.edu/research/fellowships

GREAT LAKES WHITEFISH COOKBOOK FEATURED
Wild Caught and Close to Home: Selecting and Preparing Great Lakes Whitefish was featured recently in the Grand Rapids Press. Said article author Vicky Ferguson: “I had a difficult time choosing a recipe to include with this story, as I am a fan of fish. Most of the recipes sounded appealing to me and are on my “to cook” list…”

Read the full story here: www.mlive.com/food

IRISH BOAT SHOP HOSTS CLEAN MARINA PROGRAM OPEN HOUSE
Event provided an overview on the program and demonstrated best management practices in action

Marinas in Michigan have an additional role to play as community representatives — aside from the obvious jobs they do as marinas, said Michigan House Rep. Greg MacMaster (R-Kewadin). MacMaster noted that people gauge communities by the roads they use to travel in and out of town.

“Marinas are another venue where there is the potential to leave an impression,” he said. “This program is a shining example of the private-public partnerships we have in our state. Having a clean marina speaks volumes for the community that it is part of.”

MacMaster spoke at the Michigan Clean Marina Program Open House at the Irish Boat Shop in Charlevoix in August. Michigan Sea Grant and the Michigan Boating

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The Lake St. Clair Water Trail, a 45-mile kayak and canoe course, was inaugurated on Aug. 30 in New Baltimore. The free event was open to the public and featured paddling demonstrations that allowed people to try out different makes and models of kayaks and paddleboards. The impetus behind the water trail was to showcase what the area has to offer while building up sustainable use of Michigan’s resources. Water trails not only increase appreciation for and knowledge of a waterway, they have also been shown to bolster local economies.

“More than 8 million people live within an hour’s drive of Lake St. Clair,” said Mary Bohling, MSG southeast district extension educator. “Water recreation draws visitors and travelers to Michigan — the lake’s economic contributions are significant to the region.”

The Lake St. Clair Coastal Water Trail is in good company. The newly launched path links the St. Clair River Blueway on the St. Clair River with the Detroit Heritage River Water Trail on the Detroit River and western Lake Erie. The trail completes a system of water trails that extends from Lake Erie to the Detroit River, through Lake St. Clair, up to Lake Huron. The Lake St. Clair trail moves the state closer to having a statewide water trail system that has enormous potential for advancing environmental, recreational and economic benefits to local communities, and the state as a whole. The Lake St. Clair Coastal Water Trail specifically includes an educational component that offers paddlers information on natural resources, wildlife habitats, special environmental areas and angling locations.

“The trail provides a unique recreational opportunity to experience the water and shoreline from a new vantage point and also has the potential to positively impact shoreline communities by drawing diners, shoppers and sportsmen to the area,” said Kathy D. Vosburg, chair of the Macomb County Board of Commissioners.

Michigan Sea Grant and the Lake St. Clair Tourism Development Program partnered on the project.

Free copies of the Lake St. Clair Coastal Water Trail map are available at the Edsel and Eleanor Ford House, Metro Beach Metropark, Great Lakes Docks and Decks, local coastal municipality offices, select marinas, and online through the Michigan Sea Grant bookstore at www.miseagrant.com.

**WHAT IS A WATER TRAIL?**

A water trail (also sometimes called a blueway) is a route along a river, lake, canal or bay specifically designed for people using small boats like kayaks, canoes, single sailboats or rowboats. It is comparable to a hiking trail or greenway. The trails often have well-developed access and launch points, and include nearby amenities, sites of interest like those of historical, environmental or cultural significance. Water trails facilitate recreation, and ultimately increase visibility of and knowledge about local water bodies.

**WHY WATER TRAILS?**

Water trails are showing up along waterways across the country and have many great positive impacts such as increased access to the water, and promotion of stewardship and conservation. Paddling is one of the fastest growing forms of recreation, and trails can provide numerous benefits to local communities, residents and visitors. Some of these benefits include:

- **Education**: Paddlers are able to learn first-hand about the river or lake and surrounding watershed while they paddle the water trail.

- **Recreation Tourism and Economics**: Water trails spark recreation and tourism in an area. They have relatively low overhead compared to other recreational attractions, but can provide immense economic returns.

- **Stewardship/Advocacy/Conservation**: Once a water trail is established in an area, it can lead to a new sense of enthusiasm from the surrounding community and paddlers alike.

- **Health**: Communities with water trails provide places for people to engage in healthy physical activity. Water trails can provide local opportunities for enjoying rivers by paddling, swimming and fishing.
Charlie and his yawning and nodding are fictional, but the idea that math is boring is real in many peoples’ minds. However, breaking down those misconceptions — that math is boring, science is ruled by nerds, and physics is only for geniuses — has become a national priority. STEM stands for science, technology, engineering and math, and is at the center of a critical effort that has moved to the forefront of education in the U.S.

STEM education has become a priority since the National Science Board reported STEM is of vital importance to the U.S. That report has been underscored as President Barack Obama has consistently identified a need for a focused education effort — calling it out at various turns, pinpointing STEM during the State of the Union address, and designating resources to support teacher professional development. Michigan Sea Grant has long promoted multidisciplinary education through a variety of avenues. Learning about our environment while interacting with it — be it in the form of digging through real data, testing water quality or writing poetry on the shores of a lake — has been at the core of Sea Grant educational efforts for decades. Sea Grant education programs promote a more inquiry-driven, interactive way of teaching students about STEM.

WHAT IS IT?

According to the National Science Foundation, STEM is a way of transforming the typical teacher-centered classroom by encouraging a curriculum that is steered by discovery and exploratory learning. This approach to education requires students to actively engage in a situation in order to evaluate data, analyze results and develop conclusions. Often we hear people say “I just can’t do math” or “it doesn’t click” about science. However, when placed in a context, say a water quality project, suddenly the information makes more sense. Combining a problem-based approach with a real-life issue is a very effective way to learn more about science, technology, engineering and math.

While some classrooms have engaged in fieldwork for some time, many students and teachers are finding greater learning opportunities where math and science subjects are in sync with technology and environmental stewardship. Michigan Sea Grant has been instrumental throughout the state in supporting educators who use or want to use a multidisciplinary approach to teaching about science, math and technology.

*As for our fictional Charlie, he yawns 40 times and nods off 24 times during that math class. Did you figure it out correctly?
BUILDING ROBOTS
What happens when fifth and sixth grade students get the chance to build underwater robots during science class? They get a sense of teamwork, learn new technological skills, study science and data in an exciting way, and make connections within their local watershed and surrounding community.

For the past few years, Bob Thomson’s classes at Sanborn Elementary School in Ossineke (in northeast Michigan) have worked with Michigan Sea Grant, U.S. Fish and Wildlife Service, Michigan Dept. of Natural Resources Fisheries Division, Huron Pines AmeriCorps, the NOAA Thunder Bay National Marine Sanctuary and others, to learn about the Thunder Bay watershed. The students have performed water quality testing, macro-invertebrate studies, learned about and experimented with zebra mussels, and each year create three Remote Operated Vehicles, or ROVs. The educational aim of the program is to:

- Create a continuing record of data of the Thunder Bay River watershed by testing the biotic (living) and abiotic (nonliving) indicators in the river’s ecosystem.
- Understand how invasive species affect the health of the watershed and disrupt the food web.
- Use data and observations collected while monitoring as a starting point for students to create their own research projects.

MSG Extension Educator for northeast Michigan, Brandon Schroeder, notes the project is a wonderful model of inquiry-based learning. Student studies grow from exploration and questions about the watershed and the impacts of invasive species. They ask questions like how are invasive species affecting Great Lakes food webs and fisheries? And how do zebra and quagga mussels colonize (attach to) different surfaces in Thunder Bay? The students seek answers through research projects; for example, students build the ROVs to study the attachment rates of invasive mussels on Lake Huron shipwrecks. The project also contributes to the community, by creating a baseline of data for a location where it isn’t currently collected.

“Combining a problem-based approach about a real-life issue is a very effective way to learn more about science, technology, engineering and math.”

Schroeder continued: “Projects like these grow natural resource awareness and understanding among students, inspire community pride through partnerships between students and community, and empower youth to contribute as environmental stewards and informed community members and future leaders.”

One fifth-grade student, Keeghan Newhouse, said the project changed his point of view. “I have never liked coming to school, except this year,” he said. “Working in the river and on the research project made me want to come to school.”

Thomson works with the different agencies involved, like MSG, to maintain the program from year to year. The project was initially supported through the Northeast Michigan Great Lakes Stewardship Initiative (www.nemiglsi.org) — a program facilitated by Michigan Sea Grant, coordinated with many school and community partners.

“This is an exciting and memorable project, and the learning experience is something the students will benefit from long into life,” said Schroeder. “These students are not only learning science, but gaining important life skills as they work with resource management agencies and coastal community partners to apply their newly gained knowledge and skills to explore real-world issues and research questions.”

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Q&A: Guided Inquiry

We recently asked Laura Florence, Michigan Sea Grant education specialist, about inquiry-based learning and instruction. What is it? Read on to find out.

WHAT IS INQUIRY-BASED INSTRUCTION?

Teachers often struggle with using inquiry-based instruction in formal education classrooms. This is completely understandable, since just defining inquiry can be confusing! In general terms, inquiry can be defined as seeking information or knowledge through questioning. This is something that all of us do, every day. Scientific inquiry refers to both the ways in which scientists study the natural world and the ways in which students develop knowledge and understanding of science. Guided inquiry is often defined as a teaching technique; according to the National Science Education Standards, inquiry instruction involves active learning that emphasizes questioning, data analysis and critical thinking. The degree of complexity in an inquiry activity varies, and activities can be seen on a continuum along which students can progress as they move toward deeper scientific thinking.

WHAT DO YOU MEAN WHEN YOU SAY “THE INQUIRY CONTINUUM”? 

Most students need practice to develop their inquiry abilities. The continuum focuses on how much information is provided to students and how much guidance the teacher provides. A four-level continuum—confirmation, structured, guided, open—is helpful in classifying the levels of inquiry activities. At the first level, confirmation inquiry, students confirm a principle through an activity in which the results are known in advance. In structured inquiry, students investigate a teacher-presented question through a prescribed procedure. In guided inquiry, the teacher provides the question, but students design and select the procedures. In the highest level, open inquiry, students formulate the questions in addition to designing and selecting the procedures.

WHAT MAKES IT A VALUABLE EDUCATION TOOL?

A Chinese proverb says, “Tell me and I forget. Show me and I remember. Involve me and I understand.” Inquiry-based approaches teach science concepts by directly involving students in the process of “doing science.” Methods used by scientists to conduct their research are, at their core, inquiry. Students who actively make observations, collect, analyze and synthesize information and draw conclusions based on their data are developing critical problem-solving and high-level thinking skills.

“Tell me and I forget. Show me and I remember. Involve me and I understand.”

— Chinese proverb

CAN ALL STUDENTS LEARN SCIENCE THROUGH INQUIRY?

Yes, definitely! Some teachers perceive inquiry-based activities to be best suited for bright students, but students at all levels can benefit. It’s important, though, to keep the inquiry continuum in mind when choosing activities. If activities are too challenging, students will not learn the content effectively. But, if the activities are too easy, students will not develop higher-level thinking skills. In a classroom, this means that all students may not be doing the same version of an activity at the same time.

CAN YOU PROVIDE AN EXAMPLE OF AN INQUIRY-BASED ACTIVITY?

The Great Lakes provide endless opportunity for scientific inquiry. Take overland and over the lake surface temperatures, for example. Teachers could have students select locations throughout the Great Lakes, and then go online to find temperature data for all of the Great Lakes from 1882-2007 on the Teaching with Great Lakes Data website (www.greatlakeslessons.com). Students then compare temperatures at given time periods and draw conclusions about differences across different regions and lakes.

HOW CAN IT BE USED INSIDE AND OUTSIDE THE CLASSROOM?

Successful inquiry-based instruction is about more than just curriculum materials. The teacher is the key element in the classroom. Key things teachers can do to promote inquiry include:

■ Ask open-ended questions: What are you thinking? What do you think would happen if…? What is the evidence for that?
■ Make changes slowly, allowing gradual transitions to more open-ended activities.
■ Have students create their own data tables, rather than providing pre-constructed ones. Provide some of the lab procedures, but encourage them to write others themselves.
■ Attempt the activity before the lecture, then help students connect the results of the activity to the subject matter being taught.

ABOUT LAURA

Laura Florence joined Michigan Sea Grant in 2010. Laura provides support and coordination for Michigan Sea Grant’s education programs. She works on the Great Lakes Lessons: Teaching with Great Lakes Data website, organizes workshops and presentations for teachers, contributes educational content to Sea Grant communications and print materials, and is part of the Sea Grant Education and Communications Services team in Ann Arbor. She can be reached at: (734) 647-9730 or via email at lwelsh@umich.edu
A group of Alcona Community High School students regularly trade their classroom for a visit to a local state park boasting eight miles of undeveloped Lake Huron coastline — Negwegon State Park. The activities were part of a project to document the park’s history, natural resources and eco-tourism potential.

“As a result of this project,” said environmental science teacher Brian Matchett, “students gained valuable skills in communication, research and sign development, all while meeting many of the Biology standards required by the State of Michigan. My students learned the importance of working with agencies such as Michigan Sea Grant, the Michigan Department of Natural Resources (DNR) and the National Forest Service to develop their knowledge of Negwegon’s unique ecosystems.”

Matchett said the project stoked the students’ enthusiasm, renewing interest in science and community. “Students were excited to come to class each day and work on their portion of this service learning project.”

The project first gained momentum in 2008 when the students toured the park with DNR and Michigan Sea Grant staff. The students divided into themed “investigation teams” and paired up with resource experts and/or technical advisors to explore the park with the charge to not only learn, but to also consider an appropriate educational or interpretive product they would eventually develop for the park. The students explored the park’s diverse shoreline habitat and fish species; they studied interior woodland and wetland habitats; they learned about wildlife interactions and food webs; and they photo-documented historical sites and archaeological artifacts. Michigan Sea Grant staff, including Schroeder, served as advisors for the group, providing expertise in water quality and fisheries, coastal shoreline habitat and wildlife.

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The project didn’t end with the first school year. The student-initiated interpretive signs project has been passed on from class to class, and those involved have engaged their peers through arts and English classes to help develop the signs. Last fall, five of the 12 student-developed interpretive signs were installed throughout the park. The area’s unique ecology is called out and described by student photos and writing on the signs posted. As Alcona students continue their explorations at Negwegon, these projects provide an invaluable service and contribution valued by DNR Parks and Recreation and coastal communities of northeast Michigan, accomplishing education and interpretation priorities identified by both, said Schroeder.

“The students put a tremendous amount of energy and research into developing these signs,” said Schroeder. “Beyond their learning experience, these signs represent a valuable community contribution. It’s a very tangible thing for the students — they can see people enjoying and interacting with the products of their work.”

CLASSROOM SUPPORT

While field projects are great ways to teach and learn, there are also a variety of materials available for STEM education inside the classroom. Since widespread budget cuts have limited field trips and reduced spending for textbooks and other materials, low-cost materials such as online lessons and assessment tools, classroom posters and learning guides are becoming ever more valuable for educators.

“More teachers are discovering the great educational resources like those focusing on observing system technology, climate and water quality through the Teaching with Great Lakes Data website,” said Elizabeth LaPorte, Michigan Sea Grant director of education and communications services. “Between the resources online and through our bookstore, we offer teachers and others photographs, diagrams, fact sheets, guidebooks, posters and other materials.”

Partnerships with the state Department of Environmental Quality, DNR and support from federal grants (e.g., NOAA - Great Lakes Observing System), has helped to extend Sea Grant education efforts in Michigan and throughout the nation. For example, Michigan Sea Grant facilitated 10 teacher professional development workshops using the Teaching with Great Lakes Data website in partnership with other Sea Grant programs in the Great Lakes region.

Lyndsey Manzo, Ohio Sea Grant educator and science teacher at Westerville North High School in Ohio, has used Teaching with Great Lakes Data within her classroom.

“I love the sample inquiry questions provided with the data,” she said. “I gave students the E. coli data set and asked them to create a graph that would help them answer their [assigned] question. This allowed time for me to circulate around the room and help students set up their graphs and see where skills might be lacking. After students had graphed data and interpreted it by writing a short answer to their question, we discussed them as a class.”

Manzo said there are great resources that supplement the lessons. “I especially love the map that shows the Great Lakes basins. I couldn’t have done a lot of my Great Lakes teaching without that.”

She said she’s also used other resources, including the climate, weather and climate change fact sheets. “I use them because they are written at a readability level appropriate for my students, the photos are engaging, and I know they have hard science behind them. I think they also do a good job of showing students scientific applications in society.”

Studies have shown that fourth grade students in Michigan generally have little understanding of the Great Lakes. GLEP helps bridge this gap, and is correlated with Michigan’s Grade Level Content Expectations, and the Great Lakes Literacy Principles.

CRUISING THE EDUCATIONAL SEAS

It is not just formal students who can get in on STEM learning in a more engaging way. Each year thousands of people board Summer Discovery Cruises to learn about Great Lakes ecology, history, lighthouses, shipping and many other themes. The experience is made to be interactive. Discovery Cruises provide an opportunity for participants to touch a Lake Sturgeon, take photographs of nearby freighters, view live video from a Remotely Operated Vehicle (ROV), see historical photographs, and examine weather balloons, while sailing on the varied educational cruises.

Michigan Sea Grant leads the Summer Discovery Cruises program in partnership with Michigan State University Extension and the Huron-Clinton Metroparks. Cruise themes are wide and varied, but generally involve some kind of science or ecological component. For example, this past season, one cruise on the Detroit River focused on a nature/history adventure. Cruisers were taken to many islands, probed the bottom for
invertebrates, investigated the fish and bird life of the river, got a taste of the rich history of the area (Did you know that a Navy pilots once practiced their bombing techniques off of Grosse Isle?), and peered into the long-term climate picture.

“Sea Grant’s mission is to engage in research, outreach and education, in order to help sustain the Great Lakes and their resources,” said Steve Stewart, Summer Discovery Cruise Program director and MSG’s education co-leader.

“The cruises do all of those things and in a really engaging way,” he said. “Those who take a cruise report that they feel more educated about specific lake-related issues and they are more likely to tell others about them.”

Through the years, Summer Discovery Cruises have reached nearly 10,000 people, with about one-third having taken multiple cruises.

The Great Lakes Education Program (GLEP) is another opportunity for students and teachers to get out on the water through a “schoolship” experience. Stewart also manages this successful program that introduces fourth grade students to the unique features of the Great Lakes through a combination of classroom learning and hands-on experience.

It is designed to stimulate interest in the Great Lakes and help students understand their role in protecting the vital freshwater resources.

The program integrates elements of biology, geography, chemistry, physical sciences and history in each of its three components:

- Classroom introduction to Great Lakes. Students learn about concepts such as the aquatic food web, the water cycle, watersheds, and the impacts of exotic species.
- Field trip on Lake St. Clair or the Detroit River. A two and a half hour educational cruise provides an opportunity for hands-on learning: students examine plankton samples, test water clarity, take benthic samples, take water and air temperatures, and more.
- Follow-up classroom experiments and discussion. Using data they’ve collected on the field trip, students conduct additional experiments and discuss what they’ve learned.

The Great Lakes Education Program is part of an approved science curriculum for fourth grade students and addresses an important need. Studies have shown that fourth grade students in Michigan generally have little understanding of the Great Lakes and local water resources. GLEP helps bridge this gap, is correlated with Michigan’s Grade Level Content Expectations, as well as the Great Lakes Literacy Principles, and helps prepare students for their roles as future decision-makers responsible for the state’s natural resources. More than 80,000 students, teachers, adult chaperones and volunteers in southeast Michigan have participated in the Great Lakes Education Program since it began in 1991.

“Getting people out on the Great Lakes genuinely makes it real for them and wakes them up to a whole different way of learning,” said Stewart.

Industries Association sponsored the event. Irish Boat Shop hosted the open house and organized a tour of the facilities to showcase best management practices at their facility. The marina has been in operation on Lake Charlevoix since 1971 and has been a certified Clean Marina since 2006.

As participants in the Michigan Clean Marina Program, marinas voluntarily pledge to maintain and improve Michigan’s waterways by reducing or eliminating releases of harmful substances and phasing out practices that can damage aquatic environments. In order to receive official certification as a Michigan Clean Marina, participants need to complete a 10-step process, including an online training course, a self-evaluation checklist and a site visit. Certified marinas strive for continuous improvement in daily environmental stewardship practices.

Chuck Pistis, MSG extension education leader, gave an overview of the program, discussing its benefits and successes.

“The relationship between boating and water quality is an intimate one. You can’t discuss one without considering the other,” said Pistis. “The fact that this is voluntary and that the practices certified Clean Marinas put into place are above and beyond regulatory standards is a strong mark of success. And customers are starting to look for and ask about the program.”

Representatives from the Michigan Department of Natural Resources, the Department of Environmental Quality-Office of the Great Lakes, and the University of Michigan Office of Community Relations also attended the event.

“No relationship is more inextricably tied to the health of the waterways by reducing or eliminating releases of harmful substances and phasing out practices that can damage aquatic environments. In order to receive official certification as a Michigan Clean Marina, participants need to complete a 10-step process, including an online training course, a self-evaluation checklist and a site visit. Certified marinas strive for continuous improvement in daily environmental stewardship practices.

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“The government, university and boating industry partnership is what makes the Clean Marina Program successful,” said Elizabeth LaPorte, director of communications and education services. “It’s really this unique partnership that has kept the program growing.”

For more information, see: www.michigancleanmarina.org
What do the Amazon River Basin and the Great Lakes have in common?

That question was recently explored by two groups of students — one group from Eastern Michigan University and one group from the University of Brasilia in Brazil.

What started as a cross-cultural exchange trip from Eastern Michigan University to Brazil (and in reverse) organically evolved into a parallel examination of the two major aquatic ecosystems, said Sonia Joseph Joshi, Michigan Sea Grant outreach coordinator based in Ann Arbor.

Joshi, along with faculty from Eastern Michigan University (EMU) and the University of Michigan, helped coordinate the trip. Originally the exchange was focused on political governance, environmental policy and sociology of the different countries. However, once they began setting up the inaugural exchange, it became clear that the geography of both locations had similarities, namely major water systems that influence politics, sociology, policy and environment on local, national and global scales.

Joshi, along with eight educators, staff and consultants, and 14 students — seven students from EMU and seven students from University of Brasilia — explored both the Amazon River system and the Great Lakes during the exchange trip.

“What most impressed me was the extent of the Great Lakes — it is huge! I was surprised with the amount of invasive species that are living in the lakes. Yes, I would like to come back in the future and visit the Great Lakes again.”

— Pedro Cunha
PARALLELS
Once organizers started to explore the two systems, they found several significant commonalities.

“Well, the size of the systems is the first thing that most people notice,” said Joshi. “The significance of the aquatic systems is also very similar. Not just local populations, but also the world, depend on the success of these water basins. Other areas of overlap include the incredible biodiversity that is supported by each of the basins and the complexity of governance — that crosses international boundaries.”

Like the Great Lakes, the Amazon is sometimes referred to as an inland sea, known to local populations as “The River Sea” because of the wide swath the water covers. The river runs through five countries, but the drainage basin (the watershed that contributes to the river) extends throughout South America. Even so, the vast expanse of the Great Lakes and the layers of governance and decision-making surprised the visiting students.

“…I was impressed by the size of Lake Michigan, especially from the Sleeping Bear Dunes,” said University of Brasilia student Lucas Galvao. “We had the impression it was the sea. For me, the most interesting thing was to know that the region is densely populated, and that people are talking about adaptation instead of only mitigation of climate change effects,”

Though Brazil contains the heart of the Amazon, few Brazilians actually see it. Joshi said that might be attributable to the expanse of surrounding rainforest and lack of tourism infrastructure.

“We took a trip to the entrance of the Amazon from the Rio Negro (Black River) and the rainforest, leaving from the city of Manaus” she said. “With the exception of one Brazilian student who was born there, none of them had ever visited the river before.”

LEARNING AFIELD
While in South America on the exchange, the students and organizers met with government officials, non-profit organizations, advocacy groups, indigenous tribes, and other researchers. When the students and faculty from Brazil visited Michigan, they attended classes at EMU, met with local Great Lakes organizations, government agencies, toured environmental research labs and took field trips to visit several of the Great Lakes.

Those included:
- Urban garden tour in downtown Detroit to show a strong example of how dense, city spaces can be used for agricultural endeavors. The students also toured a portion of the redeveloped Detroit River waterfront, set up through Mary Bohling, MSG extension educator for southeast Michigan.
- Sailed on a research vessel out of Muskegon, hosted through the Grand Valley State University Annis Water Resources Institute. The students experienced a taste of aquatic research while on the boat.
- Visited Sleeping Bear Dunes and studied the ecology of coastal Lake Michigan through hikes and lectures.
- Explored around Lake Huron and visited the NOAA Thunder Bay Marine Sanctuary in Alpena. There they investigated sociological issues, maritime heritage, ecology of Lake Huron and the economy.

“I would also point out the arise of water issues between the states and how the people in the region are mobilizing to preserve the Great Lakes and to keep it away from private interests that could harm this environment. Also, I didn’t how annoying and dangerous the Asian carps could be! I don’t know when, but I would like to come back and visit other lakes and other cities as well.”

— Lucas Galvao

Yeah, Pedro is right. The Great Lakes are really huge...it was fantastic. I was surprised by the amount of technology and strategies that the government has to use against the invasive species. If possible, I want to go there again to visit the other lakes, especially Lake Superior because it is the biggest one.”

— Thomaz Ribeiro Basbaum

The trip was a pilot, Joshi said, and EMU is exploring the possibility of making it a more permanent exchange option. “I hope they find the resources to do so,” she said. “It’s the kind of program that could really develop into an essential education piece. Both countries — and regions — have so much we can learn from one another. The students really went through a transformation in thinking about the value of these resources to the planet.”

— Thomaz Ribeiro Basbaum

A RIVER RUNS THROUGH IT
AMAZON RIVER FACTS
- Second longest river system in the world, and the most voluminous, with the largest drainage basin in the world. About 40 percent of South America falls within the drainage basin.
- The main branch of the river runs through parts of Brazil, Columbia, Ecuador, Bolivia and Peru.
- The width of the Amazon varies between one and six miles wide at low stage, but can expand during the wet season to 30 miles or more wide.
- The Amazon is called Solimões in Brazil but is known elsewhere in South America, and the rest of the world, as the Amazon.
- For a long time, there were no bridges that spanned the Amazon. Not because of its huge dimensions, but because the bulk of the river flows through tropical rainforest, where there are few roads or cities, limiting the need for crossings. However, in 2010, a massive bridge opened over the Rio Negro branch of the Amazon River, near Manaus, linking the large city and the whole northern/ northeastern Amazon to the southern Amazon area and the rest of the country.
- The watershed that contributes to the river — that crosses international boundaries.

Sources: World Wildlife Federation, wikipedia.com
People have inhabited the Lake St. Clair region for more than 9,000 years. Native Americans, fur traders, European settlers and modern North Americans have all called this region home. Since Cadillac, the explorer, arrived by canoe in 1701, Lake St. Clair has remained a recreational attraction. This new guide is a great resource for paddlers interested in carrying on that exploration. It features historic sites, launches and landings, routes and points of interest along the Lake St. Clair coast.

The Great Lakes Most Unwanted poster set, featuring one large poster and seven smaller individual species posters, is now on sale. Check out www.miseagrant.com to see the deal.