2019 issue 4

ASC
AQUATIC SCIENCES CHRONICLE

Erica Young / UW-Milwaukee

A GREAT LAKES SILICA MYSTERY

UNIVERSITY OF WISCONSIN SEA GRANT INSTITUTE | UNIVERSITY OF WISCONSIN WATER RESOURCES INSTITUTE

Aquatic Sciences Chronicle

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The University of Wisconsin Sea Grant Institute is part of a national network of 34 university-based programs funded through the National Sea Grant College Program, National Oceanic & Atmospheric Administration, U.S. Department of Commerce, and through matching contributions from participating states and the private sector.

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FEATURED VIDEO

Bonnie Willison / Wisconsin Sea Grant

What Makes Sea Grant Tick

go.wisc.edu/1l2gdt

The strength of any organization is its people. To help the public get to know the members of Wisconsin Sea Grant who stand ready to help them with a variety of challenges, we are building our collection of staff profile videos.

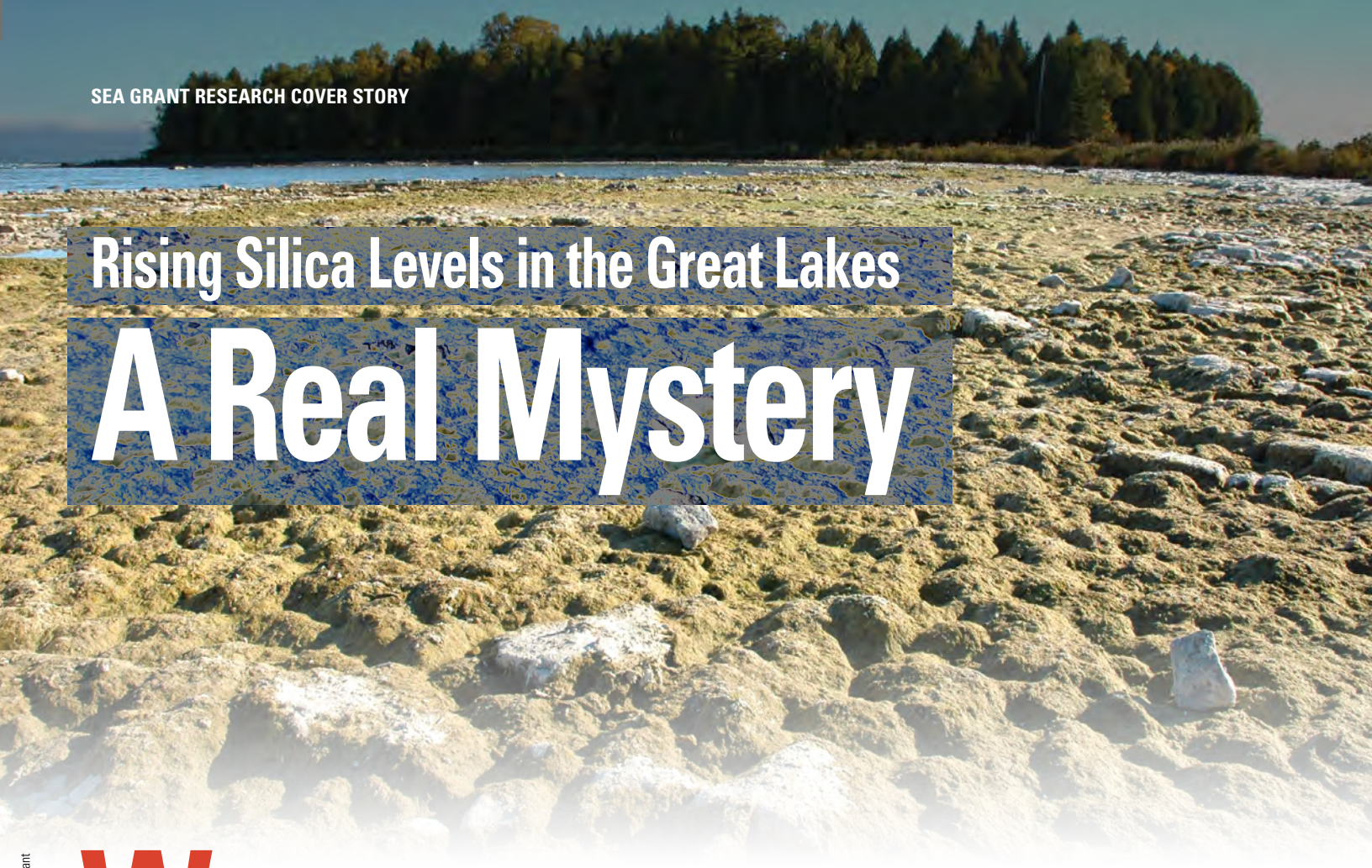
From Manitowoc to Milwaukee to Madison, Video Producer Bonnie Willison, who joined our staff earlier this year, has been shadowing fellow Sea Grant-ers to capture them in action and learn why they do what they do. In just 90 seconds, viewers get a vivid picture of what an individual staff member does.

Visit our YouTube channel and choose the "Meet Wisconsin Sea Grant" playlist, or go directly to **go.wisc.edu/1l2gdt**. You'll find people like Adam Bechle, who helps coastal communities cope with hazards like bluff erosion; Tim Campbell, who helps prevent the spread of aquatic invasive species; and Deidre Peroff, who uses her social science expertise to consider the human dimension of problems.

To stay on top of new videos as they come out, subscribe to our YouTube channel or follow us on Facebook or Twitter at the handle @UWiscSeaGrant.

At its core, Wisconsin Sea Grant is about leveraging the latest science to help Wisconsinites solve real problems. Get to know us; we're ready to help.—JAS

Cover image: Microscopic image of Cladophora filaments stained with a green dye that indicates biological silica in cells.



John Karl / Wisconsin Sea Grant

Rising Silica Levels in the Great Lakes

A Real Mystery

When John Berges and Erica Young arrived to work at the University of Wisconsin-Milwaukee in 2002, the nuisance algae Cladophora was the big issue. They began collaborating with other researchers to investigate causes of the massive algal bloom in Lake Michigan. If they knew what was causing it, they might have the keys to reverse it.

While they didn't immediately unlock the secrets of Cladophora blooms, they came upon another compelling finding that may play a role.

"We put some Cladophora under the microscope and what immediately impressed both of us was it was absolutely covered with diatoms — phytoplankton that use silica in their cell wall. They were living all over it!" said Berges, professor of biological sciences, and an affiliate of UW-Milwaukee's School of Freshwater Science.

After discovering that about 2% of the weight of Cladophora comes from silica, which Berges said is an "enormous amount," and that no one knew this before, they quickly focused on silica.

Silica is a compound of silicon and oxygen. It has mineral forms like quartz and is the main component of sandstone and other rocks. It also has a biological form (biogenic silica, which is contained in living things), and it plays an important role in the aquatic food web — limiting the growth of diatoms (single-celled algae) that fish depend upon for food. It also plays a critical role in carbon cycling, wetlands function and freshwater ecosystems. In humans, our bones, teeth and tendons need silica to remain strong and healthy.

Berges and Young discovered that throughout the summer, silica levels yo-yo in the lake.

"As the deep water from the lake upwells and comes into shore, the silica goes up because there's a deep reservoir of silica. But then, something in the nearshore sucks all that silica out and it goes way down again," Berges said.

The other thing they discovered is that silica levels in lakes Michigan, Huron and Superior have been rising consistently and drastically over the past 30-35 years. Before that, silica levels were sinking.

"There's no clear answer as to why," Berges said. "So, we've got ourselves a real mystery."

Along with Hunter Carrick, a biology professor at Central Michigan University, the duo successfully proposed a project to Wisconsin Sea Grant in 2018 for funding to study the changing silica dynamics in Lake Michigan for two years.

They are measuring dissolved and biogenic silica in three nearshore regions of Lake Michigan to characterize variations in response to rainfall and upwellings, assess its use by Cladophora and develop a picture of how it's used in the nearshore region.

"It's a fairly comprehensive look at the sources of silica in Lake Michigan," Berges said. "We'll measure it in rivers, we'll get a handle on it on both

A Lake Michigan beach fouled by Cladophora.

continued on page 13 >

wisconsinwaterlibrary

When I Grow Up, I Want to Be a…

With such a wide range of career options in the aquatic sciences, how could you ever choose just one? The Wisconsin Water Library has books on topics ranging from climate science to aquaculture, and everything in between. You can also visit the career resources section of our research guide for more information on professional organizations in water science: **researchguides.library.wisc.edu/waterscience**

ON A FARTHER SHORE: THE LIFE AND LEGACY OF RACHEL CARSON

By William Souder. New York, N.Y.: Crown Publishers, 2012.
This book is written in memory of Rachel Carson, author of "Silent Spring," a book that sparked the modern environmental movement. Her legacy is a great reminder that writing, art and other forms of communication are important for spreading awareness of environmental issues.

THE WORLD IS BLUE: HOW OUR FATE AND THE OCEAN'S ARE ONE

By Sylvia A. Earle. Washington, D.C.: National Geographic, 2009.
Written by one of the world's most renowned marine biologists and oceanographers, this book explores how oceanic and human survival are connected. Sylvia Earle is a firm believer in inspiring others by taking them diving to see the miraculous world beneath the waves.

THE SHIPWRECK HUNTER: A LIFETIME OF EXTRAORDINARY DISCOVERIES ON THE OCEAN FLOOR

By David L. Mearns. New York, N.Y.: Pegasus Books, 2018.
The author is a diver who has discovered some of the most fascinating and elusive shipwrecks. This memoir recounts his experiences chasing hidden treasures and what it's really like to be underwater for most of your career.

SOUNDINGS: THE STORY OF THE REMARKABLE WOMAN WHO MAPPED THE OCEAN FLOOR

By Hali Felt. New York, N.Y.: Henry Holt and Co., 2012.
This is the story of Marie Tharp, a geologist who created the first map of the ocean floor and proved there was more beneath the depths than nothingness. Her accomplishments involved geophysics, advanced technology and a keen eye for artistic expression.

Please visit the Wisconsin Water Library online at **waterlibrary.aqua.wisc.edu** for more information about the library's resources on a wide range of aquatic topics.

Anyone in Wisconsin can borrow these books. Just email **askwater@aqua.wisc.edu.**


Dave Landers


Kelly Koller


Clare Seguin


Ginny Carlton/Wisconsin Sea Grant

Teachers from Wisconsin and Minnesota learned about Great Lakes ecology through both native and Western cultural and scientific traditions as they sailed from St. Ignace, Mich., to Duluth, Minn.

Educators set sail for science workshop on Lake Superior

Eight educators from Minnesota and eight from Wisconsin — including teachers from Arbor Vitae, Ashland, Bayfield, Madison, Merrill, Oconto and Pulaski — sailed aboard a three-masted schooner from St. Ignace, Mich., through the Soo Locks to Duluth, Minn., in August. Their guides combined native and Western water science in a hands-on teach-the-teacher experience.

"Our goals for the educators' shipboard workshop included helping participants gain an understanding of Great Lakes ecology, getting hands-on experience sampling water quality and fostering awareness and appreciation for tribal approaches to research and natural resource management," said Marte Kitson, workshop leader and extension educator with Minnesota Sea Grant.

This year's shipboard science workshop included teachers, outreach professionals and Ojibwe knowledge keepers from Minnesota and Wisconsin who want to be part of a community of educators focused on increasing awareness and understanding of Great Lakes water science from both tribal and Western cultural and scientific perspectives.

"We shared the importance of Ojibwe cultural relationships to the ecology of Lake Superior and current tribal management strategies," said Nikki Crowe, workshop leader and tribal conservation coordinator with Fond du Lac Resource Management. "Ojibwe communities' connection to Lake Superior goes back hundreds of years."

During the workshop, educators learned about treaty rights and tribal approaches to natural resource management, toured the Great Lakes Indian Fish and Wildlife Commission, measured water quality and identified parts of the lower food web. The crew of the S/V Denis Sullivan also taught them to sail the replica 19th-century wooden schooner.

In addition to amazing stories about their sailing adventures, workshop participants took home curricula and resources to use in their classrooms and other teaching environments. Participants earned science education and graduate course credit as well.

The Wisconsin educators were Perry Smith from Arbor Vitae Woodruff Elementary, Christina Dzwonkowski-Burns from the Great Lakes Indian Fish and Wildlife Commission in Ashland, Michelle Carlile from Bayfield Elementary, Clare Sequin from Lincoln Elementary School, Ginny Carlton from Wisconsin Sea Grant in Madison, Olivia Dachel from Merrill High School, Kelly Koller from Oconto Falls Public Schools and Dave Landers from Pulaski Community Middle School.

"The educators will receive support from Sea Grant and Fond du Lac Tribal and Community College education/outreach specialists long after the trip," said Anne Moser, workshop leader, librarian and education coordinator with Wisconsin Sea Grant. "They'll be eligible for small grants and able to borrow monitoring equipment to implement what they learned on the ship in their own teaching."

This was the fourth year of a Great Lakes educator shipboard science workshop jointly coordinated by the Minnesota and Wisconsin Sea Grant programs, which together with Sea Grant educators from throughout the Great Lakes basin are part of the Center for Great Lakes Literacy. The center seeks to foster informed and responsible decisions that advance basin-wide stewardship by providing hands-on experiences, educational resources and networking opportunities that promote Great Lakes literacy among an engaged community of educators, scientists and citizens.

Funding for the 2019 workshop came from the Environmental Protection Agency's Great Lakes Restoration Initiative, Fond du Lac Tribal and Community College, U.S. Department of Agriculture, National Institute of Food and Agriculture, Thirteen Moons Extension Program and the Fond du lac Band of Lake Superior Chippewa. — MT, Minnesota Sea Grant

S'NO GROUNDWATER RECHARGE IF NO SNOW?

WRI project takes a look

"Snow cover acts as an insulating blanket. . .that buffers the soil from the extreme cold during January and February."

There's an old adage about the risks of building a castle upon sand. In contrast, Steve Loheide is building a hypothesis on sand. He theorizes that under a warming climate, Wisconsin's soil, whether sandy, silty or clay-like, is actually going to be colder due to less snow cover. Such a warming world with its paradoxically chillier soil will have a cascading effect on the state's groundwater levels. How and why will become clearer once the civil engineering professor completes work on a two-year project funded by the University of Wisconsin Water Resources Institute.

Loheide will be looking at soil types as well as the interplay of snow accumulation, snow loss, variations in the flow and amount of groundwater, and variations in heat transport to develop a regional model for the rate of groundwater replenishment, known as recharge.

Groundwater supplies 70% of the people who live in Wisconsin with their water for drinking, cooking and bathing.

"The No. 1 driver in how much recharge you get in the spring is how much precipitation you have," Loheide, of the University of Wisconsin-Madison, said. "Spring is always a hydrologically exciting time in Wisconsin. The snow is melting, evapotranspiration (moisture being taken up by plants and trees) is low and the soils are wet."

He said spring rains and snowmelt choose one of two paths: surface runoff or infiltrating the soil, where it might eventually recharge groundwater.

He continued, "Soil texture plays a big role" in determining which path will prevail. "Sandy soils are very rarely saturated. Even if they freeze, they're likely to freeze with pores that are going to remain open. Whereas if you have a silty clay soil that freezes under nearly saturated conditions, then that may act almost like an impermeable surface."

Loheide noted that because soil types vary — for example, loamy soil in Wisconsin's western and southwestern Driftless Area and sandy soil in the central part of the state — there will be non-uniform conditions around the state.

He went on to explain why now is optimum for undertaking this research. "We're at a point in time where we're really starting to see these changes in snow cover in the state. I think they're observable and real, so I don't think we are talking about changes that we might expect in 50, 70, 100 years."

He mentioned Wisconsin snowmobile clubs could attest to the changes in snow cover, confirming his own observations. "I can remember 30 years ago and it would seem like winter would come maybe in the late fall, November, December. You'd get a snowpack and it would pretty much stick around through the end of spring. In recent years, that's not what we've been seeing."

Now, he said, "We may have several intermittent melts across the winter. Well, that snow cover is really what's key. The snow cover acts as an insulating blanket…that buffers the soil from the extreme cold during January and February."

Just how threadbare has that blanket become through the decades? Loheide will rely on existing data sets on soil temperature and groundwater levels to make a determination. He's gathering information from sources like the National Weather Service's North Central River Forecast Center, Midwest Regional Climate Center, Illinois State Water Survey, Iowa State Soil Moisture Network, U.S. Geological Survey, Wisconsin Department of Natural Resources and Wisconsin Geological and Natural History Survey.

It's not just governmental agencies providing data. One person who's contributing is University of Wisconsin-Milwaukee Geoscientist Tim Grundl, whose research involved tracking noble gases in groundwater. In order to do that, for several years he monitored snow cover data and ground temperature information at Cedarburg Bog in Ozaukee County.

"I looked at it for a few years while my noble gas project went on, and I've just been storing it," Grundl said. "So, I'm really glad that Steve is taking this on" and putting the data gathered for another purpose to a new use.

Once the analysis is complete, the project, titled "Impact of Changing Snow Cover and Frozen Ground Regimes on Groundwater Recharge," moves into a predictive phase.

"We fully expect that there are going to be parts of the observational record that aren't able to tell us the complete story. So, modeling will allow us to use a suite of scenarios to consider every soil texture that we're interested in and then make fair comparisons between different climate realizations," Loheide said.

He continued, "We can run (through a model) the exact same climate on five different soil types, which empirically you can't get from observations," Loheide said.

The upshot is a peek into the possible future. "Is central Wisconsin going to be more like Illinois in the future? Probably. We might be able to decipher and anticipate some of the future trends," he said.

This, then, provides a means to gauge just how much groundwater is going to be available for all those Wisconsin homes that are castles, located on sandy ground, or not. — MH

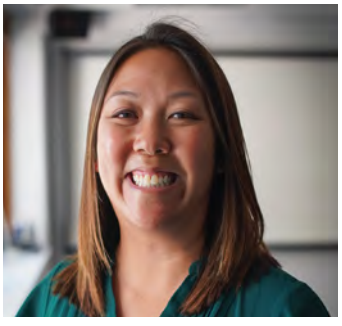
New Lake Superior Office Agent to Focus on Climate and Tourism

When Natalie Chin came to Superior, Wis., for her job interview with Sea Grant, the location struck a chord with her.

"There's something about the place that made it feel like it could be home," she said. "I like being close to the water. Superior and Duluth seem like interesting places — there's a lot to do and a lot going on."

"My parents instilled environmental values in me and my two younger sisters," Chin said. "We all have that proclivity toward caring for the environment."

She went to the University of Maryland, earning her bachelor's in biological resource engineering. During an internship in Washington, D.C., for the Woodrow Wilson International Center for Scholars, she became aware of the need for people who can work at the intersection of science and policy-making.



> "I'm focused on creating actionable science — science that's informed by by stakeholders and responsive to their needs, and also involves their input."

Chin, who earned her Ph.D. from Purdue University in agricultural and biological engineering, started in August as a climate and tourism outreach specialist. The post interested her because she wants to connect decision-makers with useful scientific information.

"I was looking for a position like this one where there was a heavy emphasis on community engagement, but I could still be connected with the science. I wanted to try to help people in the community — business owners and government folks — understand and use science for good policy."

Her new job will expand on her Ph.D. work, which explored the potential impacts of climate change on tourism in the Great Lakes. Her work focused mainly on Lake Michigan, and Chin is excited to continue it and learn more about Lake Superior, as well.

The four northern Wisconsin counties (Douglas, Bayfield, Ashland and Iron) will be her focus. She plans to assess community needs first, and expects that could take some time.

"I'm focused on creating actionable science — science that's informed by stakeholders and responsive to their needs, and also involves their input. There's a lot of opportunities to do that," Chin said.

Chin's passion for science and the environment started young and was honed during her academic career. She grew up in Virginia and by fifth grade, had joined a "save the manatee" club.

"That just really stuck with me," Chin said. "I saw it as a good place for me to be in terms of the work I do and wanting to make a difference for the environment." This led her to pursue her master's in public policy at George Mason University.

In addition to the environment, Chin has an interest in data science.

"I see potential for using scientific datasets and using scientific analysis and data availability to create decision-support tools related to climate and tourism that would be of interest to people broadly across the Great Lakes, but also in the tourism sector. It seems like an opportunity to engage with tribal communities and new communities, which is something I'm excited about. Seeing how it all evolves over the next year will be fun and I'm sure a bit challenging," Chin said.

"It feels like a dream job, and I'm excited that I get to stay connected to the Great Lakes," she said.

And Wisconsin Sea Grant is excited to have her!

To contact Chin, call (715) 399-4083 or email her at **cnchin5@aqua.wisc.edu.** — MEZ

Adapting Wisconsin's Inland Lakes to Climate Change

WRI FUNDS AID DISCUSSION, PUBLICATION

Bryce Richter / UW-Madison

Wisconsin's abundant inland lakes form a significant part of our state's identity, economy and how residents and visitors alike relax and have fun.

However, like the Great Lakes that border Wisconsin, inland lakes — of which Wisconsin has more than 15,000 — face threats due to climate change. Funding from the University of Wisconsin Water Resources Institute (WRI) helped convene a workshop with 48 expert attendees who discussed the latest scientific advances and adaptation strategies for Wisconsin lakes facing climate change.

The workshop took place in January 2018 near Tomahawk, Wis., at Treehaven, a conference facility owned by UW-Stevens Point. Attendees — a mix of researchers, outreach specialists and natural resource managers — represented 16 organizations and a range of professional disciplines. The results of that Wisconsin Initiative on Climate Change Impacts lake adaptation workshop have been distilled into an article in the journal Lake and Reservoir Management. **go.wisc.edu/576gq5**

Said Jennifer Hauxwell, associate director of the University of Wisconsin Aquatic Sciences Center, which houses WRI, "Our mission at the Water Resources Institute is to promote research, education and outreach to effectively confront water resources problems. In this case, we were able to bring people together to help understand the impacts of climate change to 15,000 of Wisconsin's true water treasures, our inland lakes."

Hauxwell is one of the journal article's authors, along with Aquatic Invasive Species Outreach Specialist Tim Campbell. The paper's lead author is Madeline R. Magee, Great Lakes and Mississippi River Monitoring Coordinator at the Wisconsin Department of Natural Resources. At the time of the workshop, Magee was completing a postdoctoral fellowship at the University of Wisconsin Center for Limnology.

Said Magee, "While lakes can look simple on the surface, the ecology under the water can be complicated. It's not an easy task to understand how lakes might be affected by climate and develop approaches to reduce those negative impacts. We needed to pull together a variety of perspectives and expertise to develop a holistic approach for managing lakes in response to our changing climate."

The paper's 13 authors looked at the big-picture question of how best to understand and adapt to climate impacts on inland lakes by focusing on four key categories: lake levels, water quality, aquatic invasive species and fisheries.

One important takeaway is that there is not a one-size-fits-all approach when thinking about lakes and climate change. The effects of climate change may look very different from one lake to another due to a complex interplay of factors.

Some of the factors that scientists have already observed with regard to climate change are a loss of winter ice cover, warming water temperatures, changes in water levels and fish populations and increasingly frequent harmful algal blooms, to name a few examples.

While focusing on what the latest science indicates and best practices for moving forward, the article does not neglect the human dimension of Wisconsin's climate challenges. As the paper concludes, communities themselves must be agents of change.

"Scientists can help people understand how various aspects of a lake might respond to changes in climate, what to plan for and what options might minimize impacts. However, it takes community involvement to determine what outcomes are desirable and what actions they are willing to take to achieve those outcomes," Hauxwell said.

In addition to the journal article, Magee also developed a "Climate Wisconsin 2050" pamphlet to reach a more general audience. It is available for download online and examines the same broad areas covered in the Lake and Reservoir Management article. **go.wisc.edu/210y4f** — JAS

Sam Chan / Oregon Sea Grant

Growing Aquaculture and Science Literacy

In Wisconsin, the word "farming" may first call to mind images of dairy cows or cornfields. But across the globe, the fastest-growing segment of agriculture is aquaculture.

As the Food and Agriculture Organization of the United Nations states on its website, aquaculture now accounts for nearly 50 percent of the world's food fish.

As a result of this growth, career opportunities for students with aquaculture training are abundant. The industry's rise also makes it highly relevant for K-12 teachers seeking to incorporate hands-on science learning in their classrooms.

Aquaculture Outreach Specialist Emma Wiermaa is enthusiastic about educational and professional opportunities in the field. UW-Stevens Point (NADF), based in Bayfield, and Wisconsin Sea Grant jointly fund her efforts.

Aquaculture education is a major component of Wiermaa's work. To connect with others eager to advance K-12 students' learning about the subject, she traveled to Maryland in July to attend the first-ever Sea Grant Aquaculture Education Network Summit.

Said Wiermaa, "It was so impactful to meet all these educators who share the same mission to promote STEM (science, technology, engineering and math) concepts through aquaculture. Teachers — especially agriculture teachers — get excited about it, and students love the hands-on learning."

In addition to teaching important scientific concepts, workforce development is another reason to introduce aquaculture principles in K-12 settings, said Wiermaa.

"Career opportunities in aquaculture are immense right now," she said. Students with an interest in fish biology and fisheries may not know about aquaculture jobs, gravitating instead to roles that are more visible or familiar, such as in state management agencies or the U.S. Fish and Wildlife Service. "We can help these students learn about opportunities they never even knew existed."

The business community and Wisconsin's economy stand to benefit from enhanced aquaculture education, too, Wiermaa said.

"A limiting factor for a lot of businesses starting up is that there are not a lot of graduates out there with significant experience behind them, especially for management roles. These aquaculture businesses need an experienced workforce" to thrive, she noted.

Brandon Gottsacker is president of Wisconsin-based Superior Fresh, located in Hixton, Wis., which is the world's largest aquaponics facility.

Gottsacker can attest to the need for skilled employees: "Aquaculture and aquaponic systems are extremely complex, and they require qualified staff to operate the systems effectively. Unfortunately, there are very few trained or experienced people available to the industry today, forcing Superior Fresh and similar companies to spend a lot of energy training people in-house."

While there are some teacher guides available, Wisconsin does not yet have a standard curriculum for aquaculture. The summit held in Maryland exposed Wiermaa to different curricular formats, and the varying backgrounds of attendees enriched the experience.

Wiermaa's next steps include continuing to work with colleagues she met in Maryland to build a network of collaborators. She also wants to reach out even more widely to Wisconsin educators to let them know that Wisconsin Sea Grant and UW-Stevens Point NADF are a resource they can call upon in order to teach aquaculture concepts in the classroom.

From teachers to fish farmers, there is a lot of support for aquaculture in the classroom and the development of robust, hands-on curricular materials, said Wiermaa. "Everybody wants this to happen because it's both STEM education and workforce development."

To learn more, contact Wiermaa at **ewiermaa@uwsp.edu** or visit **aquaculture.uwsp.edu**. — JAS

Photos by Maryland Sea Grant and Narayan Mahon for Wisconsin Sea Grant.


Narayan Mahon


Narayan Mahon


Narayan Mahon

Bringing Back the Bay Tour, the PCB Edition

The 6th annual Bringing Back the Bay Tour, conducted in Green Bay in September, shone a light on the 15-year, $1.2 billion cleanup of toxic PCB-laden sediments in the Fox River, which flows into Green Bay. Sea Grant Water Quality Specialist Julia Noordyk planned the event, along with other members of a group known as the Clean Bay Backers. State and local elected officials, conservation groups and those with state and federal management agencies, numbering about 75 people, attended and viewed dredging operations from the river itself while on a boat tour that also featured short talks on the health of the river. Attendees then visited the facility that is removing PCBs from sediment polluted with the chemical that was used to make carbonless copy paper before it was banned in 1979.

Bonnie Willison/Wisconsin Sea Grant

Practicing "Life Release" Safely

Although a Buddhist practice known as "life release" may not be a widespread activity in the United States, it can have environmental implications when it does occur. In this practice, an animal that would otherwise be killed is saved and often released, with the hope that it will live out its natural life span. This act of compassion is believed to bring spiritual merit to the person who releases the animal.

While the practice is not limited to a particular type of animal, in some cases it means that fish, crustaceans or other water-dwelling creatures are released in areas where they are not native, causing unintended impacts on local ecosystems. While this is well documented in some Asian countries, little is known about the practice in North America.

Current research seeks to develop a better understanding of this practice in the U.S. and provide guidance to natural resources managers. The research is supported by the Mississippi River Basin Panel on Aquatic Nuisance Species, the University of Wisconsin-Madison Division of Extension and Wisconsin Sea Grant. At Sea Grant, it falls under a broader portfolio of "closing aquatic invasive species pathways" efforts.

The intent is a win-win outcome: Those who practice life release as part of their religious activities can continue to do so, while the spread of invasive species is avoided.

Tim Campbell, aquatic invasive species (AIS) outreach specialist with Sea Grant and Extension, is leading the research with Bret Shaw, associate professor in the Department of Life Sciences Communication at UW-Madison and Extension. Graduate student researchers are also helping.

One output of the team's work will be print materials for natural resource managers based on a national survey. The resources will help managers understand life release practices and ensure they are performed in a manner that entails little to no risk of spreading AIS, while also respecting religious and cultural traditions that may be new to them.

This AIS work addresses a need voiced by natural resources managers, said Campbell. "They'd heard about this practice occurring and, since little was known about it, it's something they became concerned about," he noted. "They were interested in having someone investigate this topic before taking any action, and Bret and I jumped at the opportunity to help managers better understand the practice."

Sara Fox, a graduate student working for Extension, did significant legwork to establish connections with possible practitioners across the United States. Fox contacted more than 200 Buddhist temples, as well as Buddhist study programs and student groups. Because there are many different Buddhist traditions, some of those contacted were not familiar with life release, while others had heard of it but said that their temple or organization did not practice it.

For those who do participate in life release, there is no single way to go about it. It can be spontaneous or part of a larger group ceremony, and it does not always entail releasing animals into the wild.

Campbell and graduate student Peter Jurich have been interviewing people who practice life release.

Said Campbell, "Almost everyone has said they don't want to release things if they know they'll die right away, or if they know it will cause an environmental problem. So people are thinking about the issue."

Campbell is optimistic that the risks of this pathway can be minimized. "The people who are practicing life release would welcome engagement from natural resource professionals in order to make sure their practices are environmentally friendly and compliant with the law," he said.

For questions about this project, contact Campbell at **tim.campbell@wisc.edu**. — JAS

Wonderlane / Flickr

"Almost everyone has said they don't want to release things if they know they'll die right away, or if they know it will cause an environmental problem. So people are thinking about the issue."
—TIM CAMPBELL

Great Lakes Silica Mystery

A life release ceremony, or *tsethar,* in Vancouver, British Columbia.

< *continued from page 3*

sides of the lake, but also in organisms that might be using silicate and how much they contain."

Because so many organisms use silica, the researchers can think of many reasons why silica levels should be dropping. They aren't sure why the levels are rising. Berges said it's a "real head-scratcher."

Young, an associate professor of biological sciences and also an affiliate in freshwater sciences at UW-Milwaukee, is conducting parallel laboratory studies to determine how algae grow with and without silica. "If you've got these different types of algae in your system, where do you find the silica — where are the pools of silica?" Young said. "We know about this for diatoms, but for other algae, we are not as sure. This lab work will hopefully give us that kind of information."

Young and Berges spent part of last year at the University of Tasmania's Institute for Marine and Antarctic Studies and Australia's Commonwealth Scientific and Industrial Research Organisation growing marine phytoplankton and measuring the amounts of silica they contain.

"This helped us understand which species, both in marine and fresh water, that we might have neglected, could contain silica in addition to the diatoms. We found a number of cyanobacteria and some green algae, which are also found in fresh water, that seem to have very high silica. That was a surprise and will be really useful information," Berges said.

They also looked at silica levels in marine seaweeds surrounding the island of Tasmania.

Citizen science is yet another part of this project that's in the works. The researchers plan to host several workshops at ecology centers to train people to use their cell phones as microscopes so they can take images of Cladophora.

"We want people to go down to the shore, pick up the Cladophora, put it under their cell phone microscopes, and ultimately, snap pictures for us," Berges said. "Most cell phones have a GPS in them so they are geo-referenced, which will tell us where the Cladophora came from. If we realize this idea, we'll be able to collect data on where Cladophora is around Lake Michigan and what sort of 'load' of diatoms it has on it."— MEZ

OUTREACH

Marie Zhuikov / Wisconsin Sea Grant

Connecting Teachers and Students to the Lake Superior Watershed

Second-graders from Great Lakes Elementary canoe through a large culvert and squeal. Echoes of their delight reverberate across the St. Louis River bay on Barker's Island on a bright fall day.

In most classrooms, teachers would "shush" this kind of behavior. Not today. Not here.

These children are part of the Rivers2Lake Education Program, run by the Lake Superior National Estuarine Research Reserve.

Education Coordinator Deanna Erickson said she encourages such behavior. "We're working on making canoeing slow-paced and fun. We recognize that distance is not the objective for the kids. Staying upright is the objective, and liking it."

Rivers2Lake is showing children from school districts in Bayfield, Ashland and the South Shore of Lake Superior how nature can be a classroom. The program is also building a community of educators who are dedicated to sharing the Great Lakes with their students — all with funding help from Wisconsin Sea Grant for two years.

Erickson began the program seven years ago, using long-term mentoring as professional development for teachers to help them gain confidence in using outdoors learning with their classes.

"We're building a sense of place," said Erickson. "We're helping students and teachers feel a sense of engagement in their learning and feel excited about it. We're helping them build STEM skills through hands-on experience that connects with the science community here on the estuary."

The teachers of the canoeing second-graders began their participation in the program a few months earlier, during summer. Twelve teachers took part in a weeklong Rivers2Lake Summer Institute where they learned more about the St. Louis River and Estuary. They traveled to the upper reaches of the river, trapping water bugs in nets, learning how to test water quality and developing a relationship with the river. The teachers worked their way down to Lake Superior, comparing water quality results with their findings from other parts of the river.

After the institute, reserve staff met with the teachers individually. Erickson explained the process. "We sit down and learn what they're doing in their classrooms — what their needs with their kids are. Then we come up with ideas that relate to the Lake Superior Watershed. Then we go outside with the kids and do stuff."

The children on Barker's Island arrived at 10 a.m. They explored the reserve's Estuarium, which is a learning facility about the St. Louis River. Then they moved to the dock behind the Estuarium to test the river water for temperature and turbidity (cloudiness). Next, they honed their canoe skills (accompanied by an adult) by paddling in the bay along the island, culminating in a trip through the culvert and landing at the newly renovated Barker's Island Beach.

After landing, Erickson congratulated them. "You all did a great job! I am super impressed. You were safe, you had fun, and stayed balanced, which is awesome." She gathered the children together for a group cheer. "One, two, three, canoeing!"

The smiles on the children's faces attest to the connections they are making to their environment. More formal evaluation of the Rivers2Lake Program supports that as well. Erickson worked with a professor at the University of Minnesota Duluth to compare classrooms enrolled in Rivers2Lake with those not enrolled. "There was a significant difference in academic engagement between control classrooms and Rivers2Lake classrooms," Erickson said. "The Rivers2Lake kids really wanted to be in school more, which translates into more academic engagement."

Teachers are evaluated every year. Erickson said they show progress in their skills and confidence using outdoor- and place-based learning. One-on-one visits by Rivers2Lake staff twice per month throughout the school year help with that.

The Sea Grant funding covers costs for two staff members who help run the program. Other funding comes from the reserve and a grant from the National Oceanic and Atmospheric Administration's Bay Watershed Education Training Program, which is routed through the Great Lakes Restoration Initiative.

Once the field trip is over at 2 p.m., Erickson said the kids were "Really tired and kind of dragging. In my canoe, the little guy in the front, who definitely had a lot of energy, got really quiet. He sighed and said, 'This is so relaxing.' I just thought that was really sweet. That's exactly what you want a kid's first canoe experience to be."— MEZ

Second-graders from Great Lakes Elementary School land their canoes after a paddle on the St. Louis River Estuary near Barker's Island as part of the Rivers2Lake Program.

ASC

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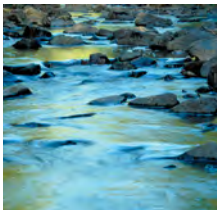
Aquatic Sciences Chronicle

a joint newsletter from UW Sea Grant and Water Resources Institutes



CALENDAR OF EVENTS

JAN. 8 AND FEB. 12, 2020
RiverTalks
Superior, Wis.
go.wisc.edu/k7213j

FEB. 1, 2020
Lake Sturgeon Bowl
Milwaukee
uwm.edu/freshwater/community-outreach/sturgeon-bowl

FEB. 16-20, 2020
Association for the Sciences of Limnology and Oceanography
San Diego
agu.org/ocean-sciences-meeting

MARCH 12-13, 2020
American Water Resources Association – Wisconsin Section Annual Meeting
Wisconsin Dells, Wis.
wisconsinawra.org

MARCH 5-7, 2020
Wisconsin Aquaculture Conference
Marshfield, Wis.
wisconsinaquaculture.com

End-of-Year Gift

Water powers our industries and quenches our thirst. We're fortunate in Wisconsin to have a lot of it. Our two programs — the University of Wisconsin Water Resources Institute and Wisconsin Sea Grant — do their part in researching the ways in which to best use water. You can help support these programs with an end-of-year gift to a fund housed at the University of Wisconsin Foundation. Visit **go.wisc.edu/n6xjc2** for an online form or contact Moira Harrington at (608) 263-5371 or **moira@wisc.edu** to learn more.