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Aquatic Sciences Chronicle

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

INSIDE:



Revving Up a New ROV



Great Lakes Dredging



Focus on Wild Rice

SEA GRANT RESEARCH

Tracking methylmercury with genes

Page 5



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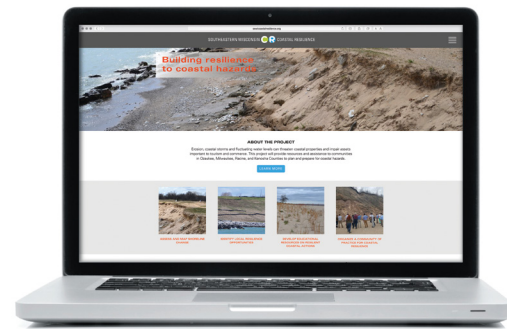
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With five senses, more and more people are favoring just one them — hearing — when seeking entertainment and information. Podcasts are ascendant. In 2017, the Pew Research Center found that 4 in 10 Americans ages 12 or older had listened to a podcast and 24 percent had listened to a podcast in the past month, up from just 9 percent in 2008.

Sea Grant and the Water Resources Institute capitalize on this popular way to learn by sharing water science news via podcast. In addition to legacy offerings on topics such as aquaculture and mercury in the environment, Science Communicator Marie Zhuikov has kicked off a brand-new series, Wisconsin Water News.

At five episodes and counting, four-to-seven-minute segments bring Sea Grant and Water Resources stories alive by featuring the voices of scientists, resource managers, stakeholders and staff in audio presentations of news pieces that are also shared in print or electronic formats.

“I’m enthusiastic about highlighting the people behind news,” Zhuikov said. “Audio lets people jump off the pages of my story notes.”



Unstable Environment? Check a Stable Website

sewicoastalresilience.org

The rising water levels of Lake Michigan have rendered southeastern Wisconsin’s shoreline dangerously fluid. Now there’s help for communities along that coast-line and others facing coastal resilience challenges. The Southeastern Wisconsin Coastal Resilience website provides a one-stop spot to learn about coastal hazards, resilience resources and local initiatives. It’s also a way to connect with others facing similar hurdles and delve into blog posts.

Lake Michigan water levels were below the long-term average from 1999 to 2014, but they began to rise and have remained high for the last four years, heightening coastal hazards. Ozaukee, Milwaukee, Racine and Kenosha counties are particularly vulnerable to damage to beaches, homes, bluffs and infrastructure like harbors or marinas.

The website is one facet of a larger project launched by Sea Grant and partners, including the Wisconsin Coastal Management Program of the Wisconsin Department of Administration, UW-Madison Department of Civil and Environmental Engineering, and Southeastern Wisconsin Regional Planning Commission with funding from a National Oceanic and Atmospheric Administration Coastal Resilience Grant.

WATER RESOURCES RESEARCH



David Newala

New Projects Address Wisconsin Groundwater Resources

Three new projects funded by the University of Wisconsin Water Resources Institute (WRI) began in July. The projects will span two years and represent the best in terms of topical relevance and scientific quality of those submitted to the committees that review them.

“Relevance and quality are basically the two things we look at,” said Jennifer Hauxwell, WRI’s assistant director for research and student engagement. “These are all really good, well-proposed studies that definitely hit on important topics and priorities for our state. They all have implications for how we manage this amazing shared resource.”

These three projects, funded through the University of Wisconsin System with money from the U.S. Geological Survey, are in addition to other ongoing work supported by WRI, including a larger suite of partner-funded projects.

Since 1990, the Water Resources Institute has funded more than 190 research projects throughout Wisconsin. — MEZ

Project 1 Two UW-Milwaukee researchers are looking at arsenic concentrations in private well water in Outagamie, Winnebago and Ozaukee counties. Arsenic is a naturally occurring element that can cause health problems when it appears in drinking water. The standard well-testing practice is to flush wells for more than an hour before sampling, which can lead to an underestimate of the actual level and types of arsenic in the water. This project will compare samples taken with and without flushing. The samples taken without flushing could lead to a better understanding of arsenic concentrations in Wisconsin’s private drinking water wells so that long-term exposure health risks can be more accurately assessed, and more effective water treatment techniques can be developed.

Project 2 Two investigators from the UW-Madison campus will spend time in the Wisconsin Central Sands area collecting data about nitrogen fertilizer use and irrigation management with future weather patterns in mind. The goal is to optimize economic returns for potato and vegetable farmers and increase irrigation water use efficiency in the area, while reducing the amount of nitrogen lost to the groundwater system.

Project 3 Another UW-Madison researcher will analyze how tiny natural particles (dissolved organic matter) found in drinking water react when disinfectants (like chlorine) are added during treatment. Such reactions can pose a human health risk because they form harmful byproducts. Also, little is known about the type of dissolved organic matter (DOM) in groundwater, despite groundwater’s importance as a major source of drinking water in Wisconsin. Water samples from 20 drinking water utilities in the state will be collected and analyzed for DOM before and after treatment with chlorine. Closing this knowledge gap could lead to safer drinking water treatment practices by water managers.

Revving Up a New ROV

On a sun-drenched, nearly cloudless spring day with sight lines from the eastern horizon to the western, a group of middle-school educators and students were on Lake Mendota in Madison to plumb what they *couldn't* see. They were engaged in water-quality analyses. The occasion also represented the maiden voyage of the Trident, a remotely operated underwater vehicle (ROV) Sea Grant obtained through an organization known as OpenROV for use as a teaching tool.

Prairie River Middle School Teacher Lynn Kurth brought four students from her hometown of Merrill, Wis., and Sue Nelson accompanied four charges from her middle school in Rochester, Minn.

This cross-border camaraderie had its origins aboard a replica three-masted wooden schooner out of Milwaukee, the Denis Sullivan. Last summer, Kurth and Nelson met as part of an educator workshop sponsored by the Minnesota and Wisconsin Sea Grant programs and with financial support from the Center for Great Lakes Literacy. Kurth was not only a dab hand on the boat, having participated in previous sails, but also an enthusiastic mentor for Nelson as they both strive to bring the Great Lakes alive in their classrooms.

Jake Walsh, a freshwater ecologist working as a researcher with the University of Wisconsin Center for Limnology, captained one boat. UW-Madison is the birthplace of the study of freshwater lakes, known as limnology, so it was fitting to have his expertise. Walsh's work has focused on understanding how species invasions, eutrophication, climate change and human decision-making affect lakes.

Also part of the expedition was Tori Kiefer, a maritime archeologist with the Wisconsin Historical Society. Kiefer hopes shipwrecks can inspire the students to delve further into Midwestern culture.

"Shipwrecks are a Snapchat into our history. We can learn a lot about history, farming and immigrants through shipwrecks. A lot of our cities are the way they are because of shipping. Shipwrecks are a great way to understand people," she said.

Walsh seconded that view. In a brief orientation before the students clambered into matching boats housed in a drive-in slip beneath the Hasler Laboratory of Limnology, he said, "This building

was built in the 1950s, but people have been studying this lake for more than 100 years. Lake Mendota is one of the most-studied lakes in the world. You get to be part of this long history of studying to understand this lake." He continued, "A lot of people have been here for a long time. We've sunk a lot of stuff. There will be stuff to look at."

Although educators may not be able to replicate a sunny May day on Lake Mendota, an ROV and curriculum are available for teachers to check out of the Wisconsin Water Library go.wisc.edu/hnuyzi for use in a small swimming pool to be set up in a classroom. Kurth was instrumental in creating the teaching kit, which promotes learning about engineering, maritime history and underwater exploration. — MH



Maura Harrington/Aquatic Sciences Center



Maura Harrington/Aquatic Sciences Center

Students eager to learn on Lake Mendota in Madison, Wis.

Guilt by Association Tracking methylmercury with genes

Fish consumption advisories are designed to protect people from unsafe levels of mercury and other contaminants, but what if many of them are based on incorrect assumptions about how methylmercury forms and accumulates in aquatic environments? Sea Grant-funded researcher Trina McMahon, professor of bacteriology at UW-Madison, is exploring that possibility, but first, she'll have to track down where the methylmercury is coming from.

Inorganic mercury is transformed into methylmercury, the most toxic and easily bioaccumulated form of mercury, by the actions of microbes naturally found in aquatic environments. Accurate predictions of the amount of methylmercury in fish are based on how much methylmercury the fish is likely to have consumed.

Unfortunately, it's impossible to tell how much methylmercury is being produced at a particular location in real time — bacteria convert mercury into methylmercury and back again, chemical reactions can de-methylate it, and physical processes can settle out particles.

McMahon describes trying to measure methylmercury: "What people do is measure the concentration of methylmercury over space and time. If they see higher levels in a particular area or at a particular time, they infer it's being produced there because if it wasn't being produced it would have been de-methylated by something. A lot of it is inferred."

A group at Oak Ridge National Laboratory in Tennessee enabled researchers to bypass some of that inference by identifying a gene required to convert mercury to methylmercury. If the gene is present in a water sample, the bacteria that convert mercury to methylmercury are there too.

McMahon and her team, including graduate students Elizabeth McDaniel and Ben Peterson, used a new detection method to search for that gene. Their research revealed that mercury-methylating bacteria are present at locations in the water column where oxygen is depleted, suggesting that mercury can be methylated in the water column, not exclusively in anaerobic environments with lots of organic matter (like swamps and wetlands) as had previously been believed.

McMahon is currently working with water samples from the Great Lakes and Madison's Lake Mendota to quantify the abundance of mercury-methylating bacteria and determine where they are in the water.

She said, "You see that there is methylmercury there; we're hoping to see that it correlates with the genes being there. But we really have to show the organisms are methylating it at that moment, and that's hard to do. We just have guilt by association."

The concentration of methylmercury in the water (instead of the sediments) has serious implications for the bioaccumulation of mercury in the food chain. Zooplankton, which form the first link of the food chain, spend most of their time at the bottom of the aerobic zone. If methylmercury is forming at the top of the anaerobic zone, zooplankton may be much closer to methylmercury production sites than previously thought. The more methylmercury zooplankton consume, the more fish consume.

It's possible there are other genes involved in methylation than the one found at Oak Ridge, and



graduate student McDaniel is comparing microorganisms that can methylate to see if there's something about their metabolisms that gives them the ability to methylate mercury.

She said, "There's this big question: How are they methylating mercury, and why?"

Answering that question might resolve more than curiosity. Once McDaniel locates the genes that are involved, she could delete them to see how that affects the methylation process. The implications of that remain to be seen.

McMahon said, "It's hard to imagine at this moment how something you learn from the genomes could remediate, clean up, methylmercury in a system. But you never know. Basic science has a way." — EAW

UW-Madison Professor Trina McMahon and her team are challenging assumptions about where methylmercury forms in the water column.



Science Is Fun, Part 2!

The library continues to expand its collection of books that encourage water exploration and experimentation with children ages three and up. To complement our lesson plans and STEM Kits (see page 11), the library has these books and many more available for checkout. To see some of our previously highlighted titles, see our 2018 *Chronicle* article at go.wisc.edu/234chc.

11 EXPERIMENTS THAT FAILED

Written by Jenny Offill; pictures by Nancy Carpenter. New York: Schwartz & Wade Books, Random House, 2011.

This humorous book teaches the scientific method to young kids with some zany hypotheses — such as “Can a washing machine wash dishes?” Each experiment includes the hypothesis, a list of materials, a procedure and results.

EXPLORERS’ SKETCHBOOKS: THE ART OF DISCOVERY & ADVENTURE

Compiled by Huw Lewis-Jones and Kari Herbert; foreword by Robert Macfarlane. San Francisco: Chronicle Books, 2017.

The sketchbooks and journals in this book allow us the opportunity to see, through their own eyes and thoughts, the reactions of 70 intrepid individuals as they journeyed into frozen wastes, high mountains, barren deserts and rich rainforests of our planet.

SCIENCE ARTS: DISCOVERING SCIENCE THROUGH ART EXPERIENCES

Written by MaryAnn Kohl and Jean Potter; illustrations, K. Whelan Dery. Bellingham, Wash.: Bright Ring Pub., 1993.

Activities allow children to explore the world of science through art with open-ended experiments including crystals, light, constellations, plants and more.

STEAM KIDS: 50+ SCIENCE, TECHNOLOGY, ENGINEERING, ART, MATH HANDS-ON PROJECTS FOR KIDS

Written by Anne Carey, et al. San Francisco: Left Brain Craft Brain, 2016.

Created by an MIT engineer, educators, designers and home-schooling experts, this book provides activities that will inspire children to ask questions like a scientist, build like an engineer, create like an artist and have fun.

Anyone in Wisconsin can check these books out from Wisconsin’s Water Library. Please send an email to askwater@aqu.wisc.edu.

THE DREDGE REPORT

Evaluating Optimum Timing for Dredging Great Lakes Harbors

It can’t happen just any old time. Removing or adding sediment in a harbor to help ships pass or for construction projects is regulated by state and federal rules designed to lessen impacts to the plants and animals living in both marine and fresh water.

“We used to call them fish windows,” said Gene Clark, Wisconsin Sea Grant coastal engineer. “But we’ve learned that other species can be affected by the timing of dredging as well — things like mussels, amphibians and wild rice. It’s not just a fish window, it’s an environmental window for dredging.”

These timing windows were first created almost 50 years ago, spurred by the passage of the National Environmental Policy Act in 1969. They hardly ever change and are enforced through the permitting process by the U.S. Army Corps of Engineers and state departments of natural resources. The windows were designated by natural resource experts, but specific science-based data to help them were lacking.

According to a white paper on dredging windows in the Duluth-Superior Harbor by Minnesota Sea Grant in 2017, a number of new scientific tools are now available to “evaluate the specific impacts of dredging, to more accurately monitor the biological integrity and specific biological functions of different parts of our harbors, and to assess changes due to season variation. In addition, new engineering technologies have resulted in new dredging methods and construction options to reduce the impacts of the dredging process, as well as in-water facilities maintenance and fabrication.”

Bringing dredging windows up to date was one of the most important issues identified by harbor stakeholders when asked where they thought Sea Grant could make a difference, Clark said. At stake is money and time, not to mention the well-being of the environment.

Marie Zhukov/Wisconsin Sea Grant



Dredge operating in the Duluth-Superior Harbor.

“The timing of the dredging windows can be very strict, and they can make projects more costly,” said Clark. “The problem doesn’t just affect the Duluth-Superior Harbor. All dredging projects on the Great Lakes have this issue, too.”

Clark believes that with more information about where critical habitats are in the harbor and when important wildlife activities are going on, such as fish spawning, money can be saved on behalf of taxpayers and contractors.

Clark teamed with Dale Bergeron, former Minnesota Sea Grant maritime extension educator, and members of the Duluth Seaway Port Authority to work on the issue. They had been working for a year to write a white paper, develop a process for deciding what studies are needed, and provide a template for studies in other ports.

“Our goal is to facilitate discussions between the regulatory agencies, the U.S. Army Corps and the contractors,” Clark said.

They also plan to work with academic researchers to find funding for the studies.

“Perhaps in a couple of seasons, we’ll have enough information so we can actually make a difference in when dredging windows are set, and potentially save the corps some money, save the contractor money and save some angst on behalf of the permitting agencies,” Clark said. — MEZ

“At stake is money and time, not to mention the well-being of the environment.”



OUTREACH

Clean Marina Program Gets a Boatload of Grant Money

The Wisconsin Clean Marina Program has been awarded \$200,000 from the Fund for Lake Michigan. The grant runs for three years and supports increased staffing and a renewed focus on encouraging more certifications.

“This grant is really giving a shot in the arm to this program. It’s a boatload of money to encourage clean marinas,” said Julia Noordyk, Sea Grant’s water quality and coastal communities specialist. “There was a big surge in membership for clean marina certifications (when the program started). But the last four to five years, it’s plateaued off.”

Former Sea Grant staff member Victoria Harris has been with the program but plans retirement. The grant will extend her contract, allowing overlap for training her half-time replacement. The grant will also cover student work.

To become a certified clean marina, businesses voluntarily adopt a list of best-management “green” practices. Program staff conduct site visits, verifying practices and offering training.

Since 2009, the program has certified 21 marinas. With three certifications pending and 14 marinas interested in the program, the staff will have plenty to do.

The Clean Marina Program is currently administered by the Wisconsin Marine Association (WMA) with financial and technical support from the Wisconsin Coastal Management Program and assistance from Sea Grant.

“Frankly, this grant is saving the Wisconsin Clean Marina Program,” said Michelle Shrider, WMA president. “We see the program being able to go into the long-range future with this help.”

Shrider said another goal is exploring sustainable funding for the program. “Ideally, we’d like to get some support from government agencies in Wisconsin, which is often the case for other clean marina programs around the country.”

Vicki Elkin, executive director for the Fund for Lake Michigan, said the program fit perfectly with the fund’s goals to have a positive impact on Lake Michigan’s water quality.

“Funding this project is an opportunity to scale up a proven program and have a real, measurable impact on Lake Michigan,” Elkin said. “It’s pretty clear that demand for the program exceeds available resources. It’s also an opportunity for us to touch a lot of communities at once. Many of our projects are place-specific — we fund in Kenosha, Racine, Sheboygan, Milwaukee and Door County — but this allows us to touch the entire shoreline at one time and work with marinas that we could never work with one-on-one just because there’s so many of them. I’m excited about it.”

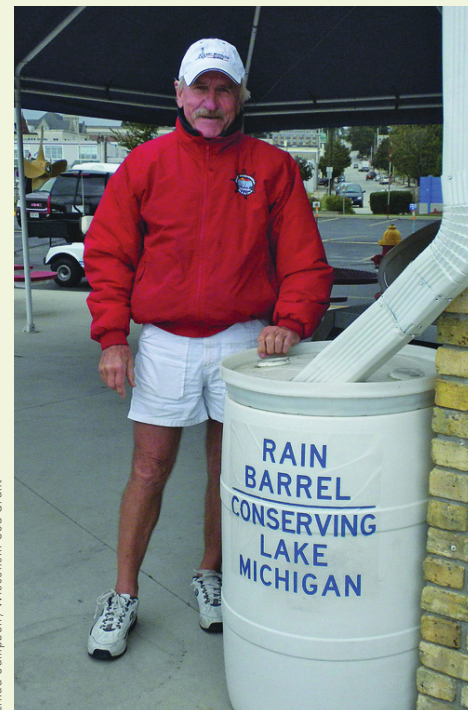


The Manitowoc Marina uses best-management cleaning practices to keep polluted water from running off into the harbor, which they learned through the Clean Marina Program.

Noordyk stressed that although the focus of the new grant is on improving Lake Michigan water quality, funding from the Wisconsin Coastal Management Program and the WMA will continue to support the clean marina coordinator to travel to the numerous Lake Superior and inland marinas.

“The Wisconsin Clean Marina Program is built around partnership and collaboration between many stakeholders,” said Todd Brieby, coastal nonpoint and education coordinator with the Wisconsin Coastal Management Program.

Additional Clean Marina partners include the University of Wisconsin-Extension, the Wisconsin Department of Natural Resources-Office of Great Lakes, SmithGroupJJR and the U.S. Coast Guard. —MEZ



Dennis Cherney with the marina in Port Washington points out a rain barrel, the installation of which is just one of many best-management practices of a designated clean marina.

Wild Rice Focus of NOAA Grant, Outreach Efforts in Lake Superior States

“We have a lot of hurdles to get over for wild rice restoration, and the biggest is ignorance,” Native American Elder Jeff Savage remarked at the Second Annual Lake Superior Manoomin (Wild Rice) Restoration Workshop in Duluth, Minnesota, in April. Savage, director of the Fond du Lac Cultural Center and Museum, was taking part in a panel discussion about the cultural significance of wild rice with elders from tribes in northern Wisconsin, Michigan and Minnesota.

As the elders shared their memories and insights, plans were in motion to address the ignorance hurdle. The workshop was organized by the National Oceanic and Atmospheric Administration (NOAA) Office of Coastal Management, whose staff were also in the process of deciding which projects will receive funding to create a wild rice education and outreach toolkit for Lake Superior audiences.

NOAA announced in late spring that the Sea Grant programs in Wisconsin, Michigan and Minnesota will receive funds to create a manoomin toolkit. Leading the effort in Wisconsin will be Deidre Peroff, Wisconsin Sea Grant’s social scientist. She stresses that the project, which is designed to integrate traditional knowledge about wild rice with Western knowledge, is more of a tribal effort than a Sea Grant effort.

“We’re working with the tribes to develop and share materials that would be useful to them to promote awareness and conservation of manoomin. While we can’t begin to understand manoomin from a tribal perspective, we can encourage others to respect it as a significant cultural and regional resource,” Peroff said.

The two-year project, which started in June, involves fostering a regional network of partners including tribal, government, university and community representatives. That network will produce an educational toolkit focusing on increasing awareness about wild rice and providing guidance on how to protect and restore it. Also, an online database of resources will be created about the cultural and regional significance of wild rice, harvesting procedures, and its ecological functions and importance. The database will provide links to commercial distributors, current research and outreach projects.

Peroff said that while the toolkit is a collaborative effort, Wisconsin Sea Grant will work primarily on the database, Michigan Sea Grant on the development of project outreach materials, and Minnesota Sea Grant on youth education activities.

“The idea is to have a place where anyone can reference information about wild rice, whether that’s educational, outreach materials or research that’s been done,” Peroff said. “There’s lots of information out there, but some of it needs updating. We just want to make sure we understand what’s out there, what’s most useful and which audience to target.”

Even some of the elders who participated in the panel discussion might find the information useful. Several of the six said they were “new” to wild rice — they didn’t grow up harvesting it and have just only begun to learn about it.

Roger LaBine of the Lac Vieux Desert Band of Lake Superior Chippewa said that the first time he saw wild rice was when he was a teenager at a funeral reception dinner. “I wouldn’t eat it because I thought people were eating grubs. I didn’t know what it was because it was gone from my community.”

Thankfully, LaBine now understands manoomin’s importance to his people.

“Losing rice would be like losing our language,” he said.

This toolkit project should go a long way toward ensuring that this doesn’t happen. For more information, contact Deidre Peroff at dmperoff@aqua.wisc.edu. —MEZ



Native American elders discuss the cultural significance of wild rice during a panel presentation at the Second Annual Lake Superior Manoomin Restoration Workshop.



Carly Ziegler, top, is a science curriculum developer for Isthmus Montessori Academy Public in Madison. Zachary Rozmiarek, bottom, is a fifth-grade teacher at River Crest Elementary School in Hudson, Wis.



RESEARCH IN REAL LIFE

Wisconsin Teachers Cruise Lake Ontario

Two Wisconsin teachers joined a dozen others from around the Great Lakes on a week-long research cruise in July on Lake Ontario with scientists for a Shipboard Science Workshop hosted by the Center for Great Lakes Literacy. Aboard the Environmental Protection Agency's R/V Lake Guardian, the teachers learned the techniques scientists use to study large lakes.

The research cruise departed from Buffalo, N.Y., and ended in Youngstown, N.Y., with stops in ports along the way to learn about the ecology, history and economy of the lake.

Carly Ziegler, a science curriculum developer for Isthmus Montessori Academy Public in Madison, and Zachary Rozmiarek, a fifth-grade teacher at River Crest Elementary School in Hudson, lived and worked alongside Great Lakes scientists to collect zooplankton, phytoplankton and bottom-dwelling organisms in addition to taking and testing water samples.

The teachers will be bringing their new knowledge back to their classrooms and school districts.

"The beautiful thing about lake science is, all you need to do is be by a lake and you can do it. There are so many questions we can ask about how humans impact our lakes, about the resiliency of lake ecosystems, and their future and their past. It's pretty easy to engage kids in lake science," Ziegler said.

Rozmiarek, a former interpretive ranger for the National Park Service in the Apostle Islands National Lakeshore, is planning to combine his previous field experience with the cruise experience to help his students this fall.

"The opportunity to travel and meet other teachers and collaborate with them, doing something that's environmentally based, as well, really got me interested in the cruise," Rozmiarek said. "I think a big thing is just sharing the hands-on experience... like working with the park service, with my students. I'll be pulling my experiences into my lessons."

Rozmiarek said his school has run a program in the past where the children raise trout in tanks in the classroom and then release the fish into a local river at the end of the school year. Several issues kept the program from happening this year, but he hopes they will be able to raise trout next year.

"A lot of the things we used during this workshop could relate nicely to what we will teach about the trout," Rozmiarek said.

The Shipboard Science Workshop is coordinated by the Great Lakes Sea Grant Network and the U.S. Environmental Protection Agency's Great Lakes National Program Office. Funding comes from the Great Lakes Restoration Initiative.

— MEZ



Updated Lesson Plans and STEM Kits Available

Teachers, librarians and other educators looking for materials on water-related subjects have a terrific new resource. Updated lesson plans and STEM kits are now available for use and geared towards learners ages 3 through 9.

The lesson plans are downloadable from the Wisconsin Water Library, and the three STEM kits, which contain all of the books and materials for a complete storyhour, are available for checkout by Wisconsin residents directly from the library at go.wisc.edu/8g3520.

"Public librarians have been asked to do more and more science content, in addition to supporting literacy and school readiness, and these lessons plans will support that," said Anne Moser, senior special librarian at the Water Library, which is housed in the Aquatic Sciences Center on the UW-Madison campus.

"Kids really enjoy learning about water, especially when it's hands-on," said Moser. The resources are designed to be fun and interdisciplinary, mixing science information with things like art projects, songs and age-appropriate science experiments.

Topics are varied and include frogs, ponds, how buoyancy works, issues of water quality and quantity, beach pollution and more.

The lesson plans and STEM kits are designed to contain all that a librarian, teacher or other adult needs to dive in and present that topic in a way that engages young children. All resources have been reviewed and vetted by youth services specialists at UW-Madison's iSchool, the university's library and information program.

Questions may be directed to askwater@aqua.wisc.edu. — JAS

FEATURED VIDEOS



CONNECTING WATER WORK AT UW-MADISON

go.wisc.edu/9g310p

Meet Carolyn Voter, a project assistant for Water@UW-Madison, an umbrella organization that connects faculty, staff and students with water interests.



WISCONSIN WATER RESOURCES FELLOW PROTECTS DRINKING WATER

go.wisc.edu/30scx9

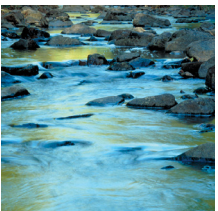
Wisconsin welcomes Stephanie DeVries, a new Water Resources Fellow at the University of Wisconsin Water Resources Institute. DeVries is studying the transport of nitrates in drinking water and working with communities to better manage their water.



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Aquatic Sciences Chronicle

a joint newsletter from UW Sea Grant and UW Water Resources



CALENDAR OF EVENTS

OCT. 9-13, 2018

North American Association for Environmental Education
Spokane, Wash.
naaee.org

OCT. 17-18, 2018

14th Annual Great Lakes Restoration Conference
Detroit
healthylakes.org

OCT. 24-25, 2018

Great Lakes Beach Association and Great Lakes Water Safety Consortium Joint Conference
Independence, Ohio
go.wisc.edu/q82vj3

OCT. 16-19, 2018

Wisconsin Wastewater Operators' Association
Lake Geneva, Wis.
wwoa.org/organization/annual-conference

NOV. 7-9, 2018

Wisconsin Association for Floodplain, Stormwater and Coastal Management Conference
Pewaukee, Wis.
wafscm.org/annual-conference



Video on the Waves

Come aboard for the Shipboard Science voyage. Feel the waves slap the sides of the historic schooner replica the Denis Sullivan. Walk the decks with the crew and a group of teachers bound by mentoring, learning and enthusiasm for the Great Lakes, which they most assuredly have taken back to classrooms to inspire others. The sights and sounds are all possible through a video, go.wisc.edu/xhb24x.



David Ruck Now