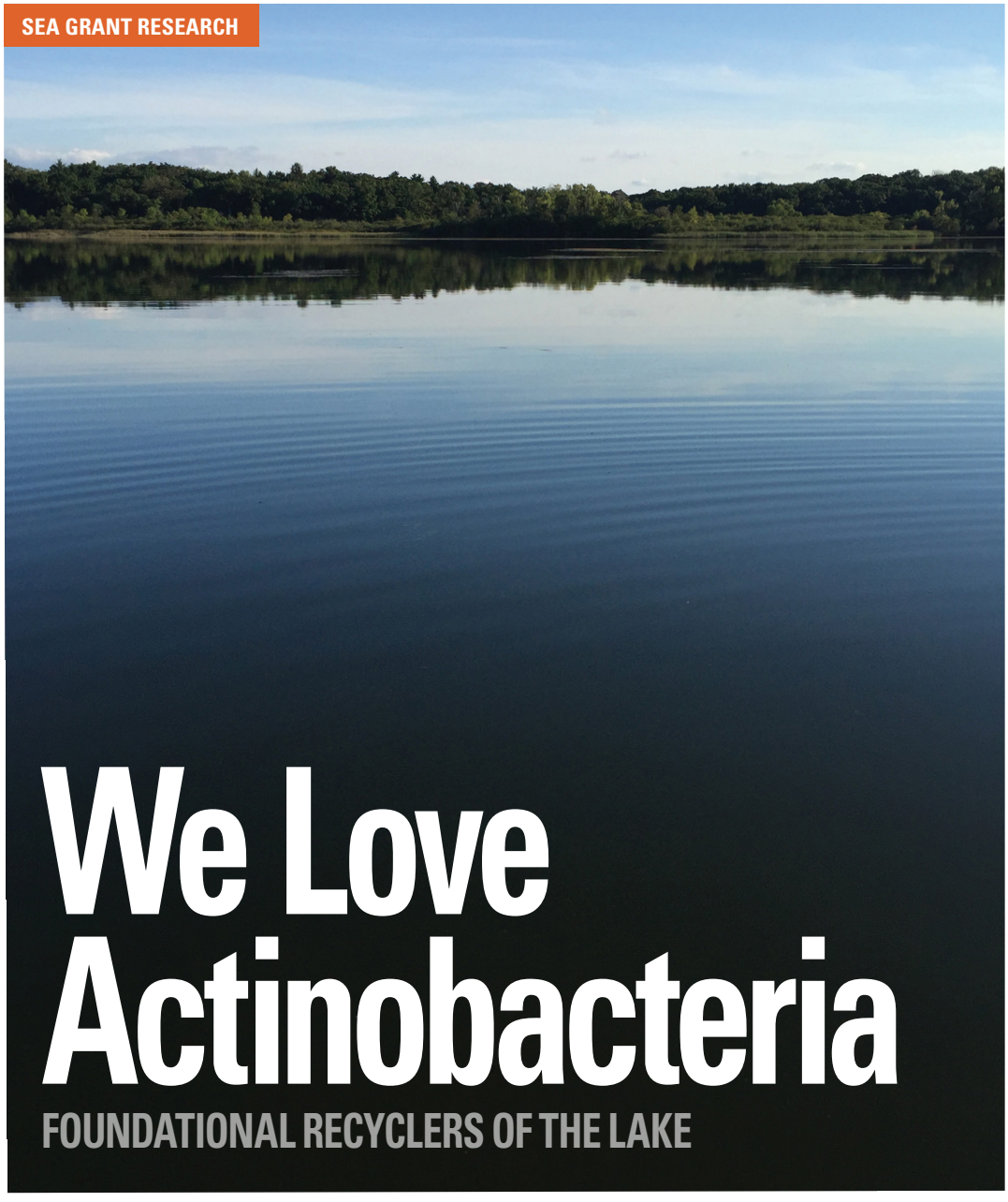
2016 volume 4

ASC
Aquatic Sciences Chronicle
aqua.wisc.edu/chronicle
UNIVERSITY OF WISCONSIN SEA GRANT INSTITUTE UNIVERSITY OF WISCONSIN WATER RESOURCES INSTITUTE

INSIDE:

SEA GRANT RESEARCH



Kristen Rost

We Love Actinobacteria

FOUNDATIONAL RECYCLERS OF THE LAKE

Every ecosystem has a top dog, a species that out-evolves and outcompetes everything else to survive and thrive under a wide range of conditions. In freshwater lakes, that champion is a special group of actinobacteria, small microbes — really, really tiny — that make up a superabundant group of bacteria that's involved in most of what goes on in the freshwater universe. >> *page 6*

Aquatic Sciences Chronicle
aqua.wisc.edu/chronicle

University of Wisconsin Aquatic Sciences Center
1975 Willow Drive
Madison, WI 53706-1177

Telephone: (608) 263-3259
Email: *chronicle@aqua.wisc.edu*

The Aquatic Sciences Center is the administrative home of the **University of Wisconsin Sea Grant Institute** & the **University of Wisconsin Water Resources Institute.**

Assistant Director for Comunications
Moira Harrington

Editor
Elizabeth A. White

Writers
Aaron R. Conklin, Moira Harrington, Anne Moser, and Marie Zhuikov

Designer
Kristen Rost

Circulation Manager
Linda Campbell

University of Wisconsin Sea Grant Institute is part of a national network of 33 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. *seagrant.wisc.edu*

University of Wisconsin Water Resources Institute is one of 54 Water Resources Research Institutes nationwide authorized by the federal Water Resources Research Act and administered through the U.S. Geological Survey. *wri.wisc.edu*

Sea Grant University of Wisconsin
WRI University of Wisconsin

SUBSCRIBE

Email **chronicle@aqua.wisc.edu** to request a no-cost subscription to the "Aquatic Sciences Chronicle," a quarterly publication. Please specify whether you prefer a mailed print edition or electronic delivery to an email in-box.

Get ASC News Alerts by Email

You can receive email notices about ASC news. Sign up at our pressroom link at ***seagrant.wisc.edu***.

FEATURED VIDEO

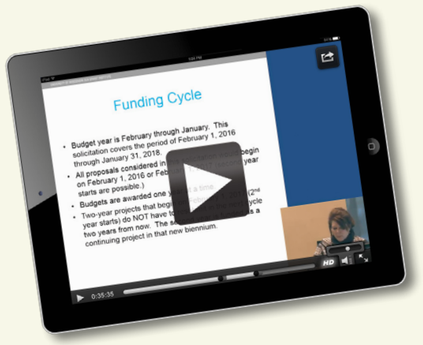
Video Offers Helpful Nuggets on Preparing and Submitting a Research Proposal

go.wisc.edu/v27rof

A punch list is always a helpful tool when approaching a task, such as assembling a Sea Grant research proposal that aligns with the 2018-20 call to address Great Lakes issues in the areas of restoring habitats, addressing the needs of the aquaculture industry or building resilience in coastal communities.

Although the current call for proposals has a slightly different cast than what the call for the 2016-18 cycle had, a video from that time frame could possibly make that punch list a bit more manageable. *"Prospective Investigators Meeting, 2016-18 Omnibus Proposal,"* found at **go.wisc.edu/v27rof**, offers more than an hour's worth of helpful nuggets on crafting and submitting a proposal. That process has remained basically unchanged for several research cycles, and it's always helpful to have a refresher course on using the iPropose online submittal portal.

The video offers insights into what Sea Grant staff, as well as external reviewers and the technical review panel, are looking for in a research approach. There is also a section on how staff can support that research — through outreach and communications activities — once it's successfully underway.



John Karl

Pictured from left to right Alex Latzka; Adam Bechle; Carolyn Voter; Jake Thickman, associated with the Wisconsin Coastal Management Program; Danielle Cloutier; Shelby LaBuhn; Michael Polich; and Joseph Dwyer.

Fallow? When it Comes to Fellows, Quite the Opposite

When it comes to fellows, things are anything but fallow. In fact, given the talent and enthusiasm of graduate students and post-docs in a variety of state and federal fellowships through the Water Resources Institute (WRI) or Sea Grant, this year and the next could be viewed as a bumper crop.

There are six fellowships routinely available to graduate and post-graduate students. They offer placements to enhance a student's skills and interest in policy, coastal management, biology or planning.

An inaugural event to honor 2016 Wisconsin fellows, most with yearlong fellowships but two who will hold their positions for two years, was held in late September. It was a packed house in Milwaukee, not just because mentors and family members attended, but also simply due to the large class of varied fellows. It included:

Adam Bechle is the first J. Philip Keillor Wisconsin Coastal Management Fellow. One of his intial tasks is updating the Wisconsin Sea Grant Coastal Processes Manual, a critical resource and legacy work of longtime and former Wisconsin Sea Grant Coastal Engineer Phil Keillor, for whom the fellowship is named in honor of his highly regarded personal and professional attributes.

Danielle Cloutier is a 2017 finalist for the Dean John A. Knauss Fellowship. This program has a rich history and offers a prestigious placement in the nation's capital for one year — in either the executive or legislative branch. Students come from around the country. Cloutier's past research has been on microbial communities in lakes and on beaches. She awaits word on her placement.

Joseph Dwyer is a NOAA Coastal Management Fellow. This program offers two-year experiences in states that successfully compete for a fellow from a small pool of finalists. Wisconsin, and its partner organization the Wisconsin Coastal Management Program, will benefit from Dwyer's assistance during 2016-18 as he explores ways to enhance coastal tourism. He'll complete an inventory of Wisconsin's coastal public lands and Great Lakes public access locations, which will inform future land acquisition and access development decisions.

Shelby LaBuhn is another Dean John A. Knauss Fellowship finalist who has been awaiting word on her final placement. The Ph.D. candidate's most recent research has been on Lake Michigan habitat changes caused by climate shifts and the invasion of zebra and quagga mussels. Such changes have caused a lack of oxygen in the water, endangering fish.

Alex Latzka is Wisconsin's first full-time postgraduate Water Resources Policy Fellow. His fellowship is funded by the WRI and the Wisconsin Department of Natural Resources. At the completion of his fellowship, which will be in September 2017, he will be able to hand the department guidance on the amount of sediment in the state's streams, as well as regarding the health of the streams' physical habitat.

Michael Polich is the Great Lakes Commission Fellow, and he will wrap up his year next spring. Before that time, he will have contributed in many ways to ongoing basin-wide issues such as harmful algal blooms and nonpoint source pollution. Polich is a University of Wisconsin-Madison graduate with a degree in environmental law.

Carolyn Voter recently completed a year in support of the Wisconsin Groundwater Coordinating Committee, of which WRI is a member. The committee submits a report to the legislature on its efforts to study the state's groundwater quantity, quality and management. As a 2015-16 fellow, Voter was instrumental in completing that report, as well as a revising Buried Treasure, a Wisconsin Department of Natural Resources publication about groundwater.

Cristal Sanchez-Estrada is not a fellow but definitely deserved the fete as the recipient of the 2016 Carl J. Weston Scholarship. She is an undergraduate student who is helping to build a genetic sequence library of Lake Michigan zooplankton as part of a University of Wisconsin-Milwaukee-based Sea Grant project.

wisconsinwaterlibrary

Art + Science

Collaborations between artists and scientists continue to grow as both disciplines struggle to communicate complex scientific concepts. The library has several books that illustrate this interdisciplinary approach to our favorite topic — water. If you know of other titles to include in our collection, we would love to hear from you. Just email askwater@aqua.wisc.edu.

ARTSCIENCE: CREATIVITY IN THE POST-GOOGLE GENERATION

By David Edwards. Cambridge, Mass.: Harvard University Press, 2008.

This book shows how innovation in the "post-Google generation" is often catalyzed by those who cross the conventional line between the arts and sciences.

search.library.wisc.edu/catalog/9910047485502121

FISH IN ART

By Christine E. Jackson. London: Reaktion Books, 2012.

"Fish in Art" examines the diverse ways fishes have been presented by artists and what these images tell us about the catching, storing and cooking of fish over the centuries. The author analyses the economic, political and religious factors that engaged these artists, such as the rise and fall of ports across the world, the legacy of the Cod Wars and the various sacred decrees on the eating of fish.

search.library.wisc.edu/catalog/9910135478102121

THE MAP AS ART: CONTEMPORARY ARTISTS EXPLORE CARTOGRAPHY

By Katharine Harmon; with essays by Gayle Clemans. New York: Princeton Architectural Press, 2009.

Harmon collects 360 colorful, map-related artistic visions by well-known artists—such as Ed Ruscha, Julian Schnabel and Vik Muniz—and many more less-familiar artists inspired by maps.

search.library.wisc.edu/catalog/9910081356502121

PERIMETER: A CONTEMPORARY PORTRAIT OF LAKE MICHIGAN

By Kevin J. Miyazaki; foreword by Mary Louise Schumacher. Madison, Wis.: Wisconsin Historical Society Press, 2014.

Milwaukee-based photographer Kevin Miyazaki embarked on an 1,800-mile drive around the perimeter of Lake Michigan to produce his contemporary portrait of Lake Michigan.

search.library.wisc.edu/catalog/9910207536802121

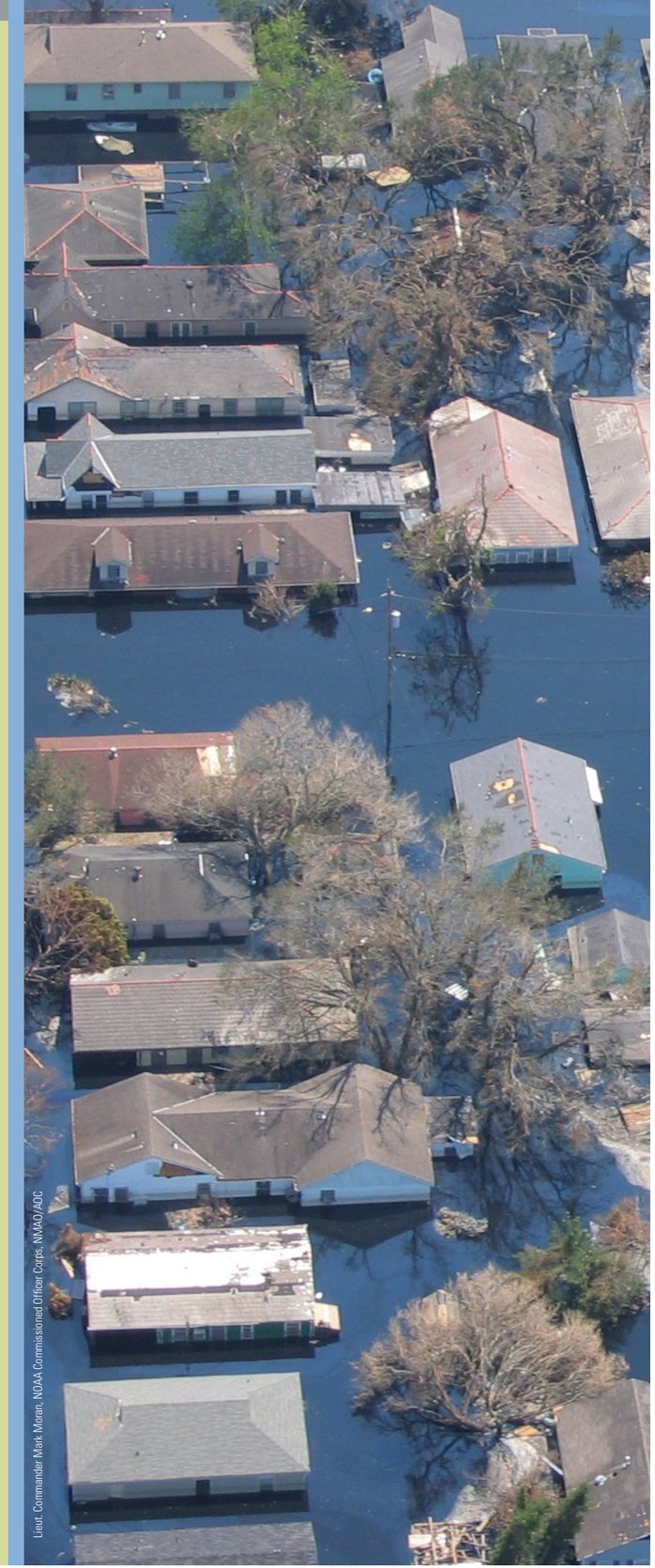
RADIOACTIVE: MARIE & PIERRE CURIE, A TALE OF LOVE & FALLOUT

By Lauren Redniss. New York: !t Books, 2011.

Presents the professional and private lives of Marie and Pierre Curie, examining their personal struggles, the advancements they made in the world of science and the issue of radiation in the modern world. UW-Madison's Go Big Read selection for 2012-13.

search.library.wisc.edu/catalog/9910109835402121

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



Lieut. Commander Mark Moran, NOAA Commissioned Officer Corps, NMAO/AOC

Sea Grant Social Scientist to Explore Influence of Severe Weather on the Economically Disadvantaged

Images from New Orleans's Lower Ninth Ward during Hurricane Katrina are indelible in the nation's consciousness. The 20-by-25-block area was home to some of the city's more economically disadvantaged people, is located in a low-lying area and bore significant losses of life and property.

"The question is, why are the economically disadvantaged more likely to be affected by severe weather? Think about Katrina or other disasters and anecdotally there could be answers, but we want to get at the root of that question by using new communication and other tools to save lives and livelihoods," said Deidre Peroff, Sea Grant's social scientist, who joined the staff earlier this year.

She was describing a new project she's engaged with along with Tim Halbach, the warning coordination meteorologist with the National Weather Service (NWS) in Sullivan, Wis. They are exploring how those who are in lower income brackets and live in Milwaukee get weather forecasts and warnings. They also want to track how this population responds to the news.

Halbach said, "Weather affects everyone, probably more so those who are in difficult situations. We, the National Weather Service, have a lot of ways to communicate to the high-end technical users who have computers, iPads and smartphones in front of them, but we don't spend a lot of time assuring that everyone is getting the information that they need."

Part of that assurance will begin with a review of U.S. census data on income by ZIP code to determine areas of the city ripe for further scrutiny and possible outreach and education. Within the larger context of Milwaukee's economically disadvantaged community, Peroff and Halbach are considering whether or not they will narrow it more, perhaps to the elderly, homeless or certain ethnic clusters — reaching out to some or all of those groups.

The project's approach is likely to combine both focus groups and surveys. There are, however, many hours of further planning before any kind of definitive path forward is set — the pair said they are in the "brainstorming phase right now." Because the findings could likely be broadly applied, the researchers hope their work can prevent future tragedies such as what happened in the Lower Ninth Ward. —MFH

"What's exciting is that the implications of this project could actually be saving lives."

Actinorhodopsin image by Katrina Forest/UW Environmental Engineering

A model of the actinorhodopsin found in the freshwater actinobacteria. The protein is represented by green ribbons. The retinal, "first" light-absorbing small molecule, is brick red. The putative second light-absorbing small molecule that expands the wavelengths that can be used is shown in yellow.

Nobody knows more about freshwater actinobacteria than University of Wisconsin-Madison Professor of Environmental Engineering Trina McMahon. With the support of Wisconsin Sea Grant, McMahon's laboratory members have spent the last five years studying the little critters from every imaginable angle — and in the process have become the pre-eminent experts on the topic. What they've found has enlarged our understanding of how freshwater lakes function and exist.

"If you think of the lake as an entity, a living breathing thing that cycles nutrients, these bacteria are responsible for half of it," said McMahon. "They're very, very tiny, but because of their numbers and their level of activity, they're driving huge amounts of the carbon cycling and nutrient regeneration," said McMahon. "We've had a special place in our heart for a long time for the freshwater actinobacteria."

The relationship began back in 2007, with Ryan Newton, one of McMahon's first Ph.D. students. Newton, who's now an assistant professor with the UW-Milwaukee School of Freshwater Sciences, developed a baseline bar code of actinobacterial RNA sequences that allows researchers to track, classify and enumerate bacteria in lakes. Using that code, Newton and McMahon demonstrated that actinobacteria are the predominant species in inland lakes.

In 2012, McMahon's lab used a cutting-edge method to take a single cell of the actinobacteria and sequence its genome. What they found was that the actinobacteria have a rhodopsin protein similar to the protein in the human eye that allows it to sense light. In the actinobacteria, however, the rhodopsin almost certainly does more — converting the light into energy. (Those findings published in the *Journal of the International Society for Microbial Ecology* in 2014.)

In a 2014-16 funded project with Sea Grant, McMahon and UW-Madison structural biologist Katrina Forest took it further, revealing something even more surprising about freshwater actinobacteria.

"Actinobacteria have the retinal found in most opsin proteins that allows them to harvest light, but we think they also have another light-harvesting structural molecule that allows harvesting of a different wavelength of light, amplifying the energy that gets harvested in a way that not many other bacteria have."

That extra method of acquiring energy helps explain why they've shot to the top of the ecosystem ladder like a supercharged bullet. Currently, a graduate student in Forest's lab is charting the actinobacterial cell's biochemical machinery to definitively identify the structure of this second light-capturing molecule. McMahon suggests it might be possible that different groups of actinobacteria harvest different wavelengths of light.

In addition to the light-harvesting mechanism, McMahon's lab has noted that the actinobacteria also interact extensively with the gunky-green cyanobacteria and algae that often overtake freshwater lakes during the summer months.

"They have in their cell wall/membrane all this machinery to suck up other dead organisms' parts," McMahon explained. "We think of them as vultures or scavengers — they wait for other organisms to die and then they eat up their parts. Then they recycle the atoms into carbon dioxide and also into new cell material. They are the foundational recyclers of the lake."

McMahon said the interactions take a variety of forms — everything from the actinobacteria eating the dead cyanobacteria to sucking up molecules excreted by the cyanobacteria during periods of rapid growth.

"They're super in one sense but they're also crippled in another in that they depend on being able to scavenge what they can't make themselves," she said. "What's fascinating is that we haven't figured out if the actinobacteria help fuel the cyanobacteria blooms or keep them in check," said McMahon. "There's some early evidence that maybe they're actually partners with the cyanobacteria in certain roles, which would mean that understanding actinobacteria might help us control cyanobacteria blooms better."

McMahon's well aware that she faces a strong eww factor associated with her research — who wants to talk about gross bacteria and smelly, potentially poisonous blue-green algae in our lakes? To get around that, McMahon has begun talking about actinobacteria using the same language people use to talk about the bacteria that live in humans' guts, performing helpful tasks like digesting our food and bolstering our immune systems.

"People start to feel a little less scared about the bacteria when they think about it that way," she said. "If we can understand how the actinobacteria function, and all the different ways they get energy and support the ecosystem, then we have that much deeper an understanding of the lake system. Then we can either do some kind of intervention to improve lake quality or at least make a prediction about what's going to happen if we do make an intervention."

McMahon's research focus will now shift to determining how special each of the strains of actinobacteria are.

> **Armed with genome sequences from the Great Lakes, Lake Mendota, lakes in Sweden and other countries around the world, McMahon's working to determine whether the bacterial strain she's studied in Madison's Lake Mendota is endemic to all lakes or has adapted to its specific environments.**

"Maybe the cell in Lake Mendota gets carried to a lake in northern Wisconsin, but maybe it can't live there because it depends on its friends who are in Lake Mendota," she said. "We would actually prefer if they weren't too endemic, because we'd like to take what we've learned and apply it to all lakes." —ARC

Aaron R. Conklin

On the right is Jeff Dwulit-Smith, a biotech grad student who's worked with McMahon (left) and Forest (middle) on actinobacteria.

Deidre Peroff

Sea Grant Wades Into Rising Water Levels-Bluff Stability Issue

This year, Sea Grant has been leading an integrated assessment of changing Lake Michigan water levels and their impacts on the stability of coastal bluffs and shorelines. Water levels in the world's fifth largest lake were below the long-term average from 1999 to 2013, but began to rise, and rise rapidly.

David Hart, assistant director for extension, has led the project. "The integrated assessment approach is well suited for complex and challenging issues such as bluff erosion. It embraces extensive public engagement and bridges natural science, social science and policy."

The approach has involved public meetings in three of Wisconsin's Lake Michigan communities, attracting more than 140 people. Major themes that emerged at these very interactive meetings included the role of government regarding lake levels, collective action for bluff management, ravines, water diversion, industry interests and lake health.

Next up: the development and refinement of a list of potential policy alternatives and actions that property owners can take to address the integrity of coastal bluffs, ravines and shorelines. The list will reflect what was learned at the public meetings. It will also draw from local and regional experts on coastal engineering, geology, urban and regional planning, law, policy studies, ecology, landscape architecture and social science. The list was reviewed by local officials and the public at meetings in late October. That final report will be collated with three other regional integrated assessments on variable water levels as funded by the Graham Institute at the University of Michigan.

They hover, existing at the very edge of existence, waiting for nutrients to arrive and spring them to life.

When they activate, a universe of possibilities emerges.

University of Wisconsin-Milwaukee

Tim Grundl
associate dean, University of Wisconsin-Milwaukee's School of Freshwater Sciences

Scientists have long known that bacteria are the driving force in the chemical reactions that occur in an aquifer — everything from remediation to nutrient cycling and mobilization of heavy metals. But even with that basic knowledge in hand, there's much, much more to unravel.

"The question is what bacterial consortium is actually there, and what drives any changes to the bacteria when nutrients are added," said Tim Grundl, associate dean of the University of Wisconsin-Milwaukee's School of Freshwater Sciences.

Grundl and his UW-M colleague, Assistant Professor Ryan Newton, now have a powerful tool to answer those questions in jaw-dropping genomic detail. Backed by funding from the University of Wisconsin Water Resources Institute, the pair will apply metagenomics, the study of genetic material from an environmental sample, to get an incredibly diverse view of the bacterial assemblages in three municipal wells in Waukesha.

On its own, the ability to map this largely uncharted territory would be an appealing prospect. This particular project carries an extra attraction because it offers the unique opportunity for Grundl and Newton to compare microbial communities in a well containing unaltered groundwater with two adjacent wells that draw up to 40 percent of their water from the Fox River, water that's impacted by treated municipal effluent.

Newton's not a groundwater expert — his specialty is microbiology. Working with UW-Madison's Trina McMahon, he helped characterize the bacterial communities in Madison's Lake Mendota (see story on page 6), and now works to do the same with Lake Michigan. He'll rely on Grundl's groundwater expertise, while Grundl will rely on Newton's bacterial acumen.

"We know what bacteria are capable of in terms of reactivity," said Grundl. "I can ascertain which reactions are feasible, and he can say which organisms are likely to be involved. Together, we'll be able to say exactly what's going on in these aquifers."

According to Newton, the project has at least two key aspects: The first is gaining a better understanding of whether allowing nutrient infiltrations into an aquifer — for instance, in the form of agricultural runoff — changes the bacterial community's dominant biochemical pathways.

Secondly, it's also possible Grundl and Newton may be able to identify genes in the bacterial community that may act as a pollution signal. When the specific genes are abundant, for instance, it may indicate that an excess of phosphorus is present in the aquifer. That signal could prove a much simpler — and cheaper — way to determine when an aquifer requires remediation or intervention.

"That's the direction we're headed," said Newton. "We're headed toward identifying changes indicative of pollution."

While a sizable chunk of the project will consist of field sampling — sampling on the two-year project began this fall — Grundl and Newton also plan to incorporate a lab element to their study. Using the same environmental samples, they plan to apply nutrients in an amount increased by a factor of five and reduced by a factor of one-fifth to get a sense of the range of outcomes.

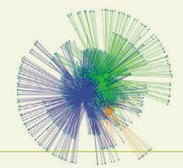
The applications of Grundl and Newton's research could be expansive. As a possible example, Grundl points to wastewater treatment systems that manage waste in communities throughout southeast Wisconsin. Metagenomics could help water managers balance the system's microbial communities, ensuring proper treatment. Similarly, metagenomics could give large agricultural operations a sense of how much phosphorus-based fertilizer is affecting bacterial reactivity within the aquifer.

"It's fleshing out the whole idea," Grundl said.

Interestingly, the biggest challenge Grundl and Newton face may be managing the sheer amount of data they're likely to generate.

"Visualizing and interpreting everything is a huge task," said Newton. "You're really just limited by your own imagination — and the time it takes to analyze it all." —ARC

Mapping With Metagenomics



Blue = rivers
Green = wastewater treatment plant effluent
Orange = the groundwater well

A graphic depiction of bacterial communities associated with each of the three sample sites. Each line indicates that taxon was present in a particular sample.

Sea Grant Photography Project Focuses Kids on Water

An underwater photography project designed to engage troubled children in freshwater science is showing such success that the founders are working to expand its reach to youths in coastal communities and the classroom.

About four years ago, Toben LaFrancois, an aquatic scientist at Northland College in Ashland, Wis., came across outdoor photos taken by clients of a northern Wisconsin residential treatment program called Northwest Passage. The photos were better than any he had seen taken professionally.

So he called Ben Thwaits at Northwest Passage and said, "You don't know me, but I want to take your photography program under water."

Thwaits agreed and "In a New Light: Under the Surface" was born. This therapeutic underwater photography program gets kids outside in wet suits and snorkels with cameras, and into northland lakes and rivers. *(See a video about the program here: go.wisc.edu/5lnbu5.)*

"When you give a kid a camera, they start seeing things they normally wouldn't see," LaFrancois said. "It calms them down and gives them something to focus on. It also gives them a sense of extreme pride and accomplishment because the work they produce is very personal but it's also something that other people can easily relate to and praise."

"People who see the pictures are amazed by the underwater world. They are immediately drawn in and feel the awe and wonder. Then they see the stories of these kids, and they are double amazed at the hope these kids are finding in the natural world. They begin to care for our waters, and also for our most at-risk children," LaFrancois said.

The institution staff and teachers noticed changes in the children's behavior and classroom interest.

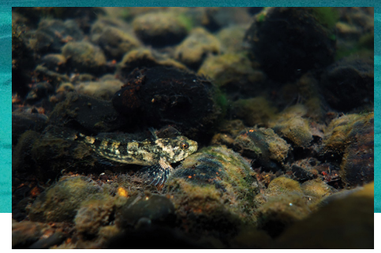
"A kid will have a great day and be all smiley," LaFrancois said. "Then the staff will come to me and say, 'You know, that young lady doesn't smile, and she just smiled all day.' And the kids will ask graduate-level questions like, what would happen to the ecosystem if all the bryozoans died out? What would happen to a river if all the trees were cut down — things we can guess about but honestly just don't always have an answer for. As a society, we really should be looking for those answers if we value fresh water."

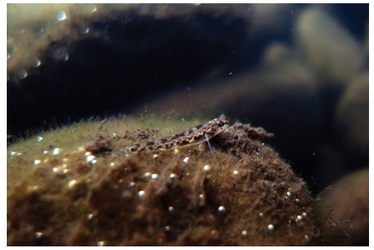
With two years of Sea Grant funding (2016-18), LaFrancois and Thwaits are taking the students' questions and photographs into the classroom to teach topics like basic biology, watershed processes and sedimentation.

"The next generation of science standards are all about student-driven inquiry," LaFrancois said.

> **"We're using immersive experience and exploration to get kids to learn about aquatic science, and it's really fun. They own the questions, so they pay attention to what they need to learn to answer those questions."**

They are expanding the program to the Lac Court Orielles and Red Cliff reservations, and to Bayfield High School. LaFrancois is working with Bayfield High School students on underwater photography in Lake Superior and plans to have more students involved in 2017. He is letting the students choose what to photograph and said they want to capture the lake, including special coastal areas and sea caves, the wild rice harvest, fish spawning runs, a local polar plunge and a swimming race. —MEZ





Northwest Passage clients

Boat Landings Become a Base for Spreading the Gospel of Clean, Drain and Dry

Summers along the Great Lakes are popular for recreating, including fishing and boating. In summer 2016 Sea Grant, in partnership with the Wisconsin Department of Natural Resources, deployed eight Great Lakes watercraft inspectors to spread the word about preventing the spread of aquatic invasive species. Inspectors stressed the importance of cleaning, draining and drying boats before going into the water again.

Sea Grant contacted more than 6,000 people at Great Lakes boating ramps and inspected 3,073 boats. In addition to sharing messages, the educators demonstrated boat-cleaning techniques, providing visual reinforcement about how to remove plants and animals that could be transported and cause a lot of trouble in a new setting as they compete with native species for food and territory.

"This program provides education and positive reinforcement about the proper steps to prevent the spread of aquatic invasive species," said Titus Seilheimer, fisheries specialist. "Stopping invasive species from reaching other waters is much more efficient and cost effective than trying to deal with them when they arrive."

Additionally, Sea Grant participated in the eighth annual 4th of July Landing Blitz, which resulted in the inspection of more than 10,000 boats and outreach to nearly 23,000 people. The blitz was possible due to the participation of citizen volunteers and staff from dozens of lake associations and lake districts; local, county and tribal governments; nonprofit groups; scout troops; and businesses.

Sea Grant inspectors also assisted with a special study using an app on tablets to better gauge boater behavior in relation to invasive species. This innovative new approach could increase the efficiency of the overall inspection program by not relying on manual data entry from paper forms.

Whitney Passint

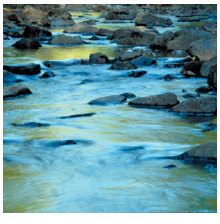
A Manitowoc-based college student, one of eight seasonal boat-landing inspectors, shared messages about how to prevent the spread of aquatic invasive species and demonstrated boat-cleaning techniques.

ASC

University of Wisconsin Aquatic Sciences Center
1975 Willow Drive
Madison, WI 53706-1177

Aquatic Sciences Chronicle

a joint newsletter from UW Sea Grant and UW Water Resources



CALENDAR OF EVENTS

FEB. 19 – 22, 2017
Aquaculture America 2017
San Antonio, Texas
was.org/meetings/Default.aspx?code=AA2017

FEB. 22 – MARCH 3, 2017
Association for the Sciences of Limnology and Oceanography, Aquatic Sciences
Honolulu, Hawaii
aslo.org/meetings/index.html

FEB. 28 – MARCH 2, 2017
Wisconsin Association for Floodplain, Stormwater and Coastal Management Conference
La Crosse, Wis.
wafscm.org/annual-conference

MARCH 9 – 10, 2017
American Water Resources Association – Wisconsin Section
Elkhart Lake, Wis.
awra.org/state/Wisconsin

KNOW A STUDENT SEARCHING FOR A FELLOWSHIP?

Wisconsin students have traditionally fared well in national and regional competitions for professional fellowships. Continue that track record by encouraging students you know to consider these opportunities, all with various January and February deadlines.

Dean John A. Knauss Marine Policy Fellowship, based for a year in Washington, D.C., in either the executive or legislative branch.

NOAA Coastal Management Fellowship, which offers experience with a state coastal zone management program.

Sea Grant-NOAA Fisheries Graduate Fellowship, a summer placement to learn more about population dynamics or marine resources economics.

Great Lakes Commission-Sea Grant Fellowship, exploring Great Lakes-related policy issues and based in Ann Arbor, Mich.

Visit the "students" tab at **seagrant.wisc.edu** to learn more.