



Wisconsin Sea Grant: Great Lakes Science For Our Future

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

Aquatic Sciences Chronicle

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

608-263-3259

Email: chronicle@aqua.wisc.edu

Web: seagrant.wisc.edu, wri.wisc.edu

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

ASSISTANT DIRECTOR FOR COMMUNICATIONS

Moira Harrington

EDITOR

Elizabeth A. White

WRITERS

Dea Larsen Converse, Moira Harrington, Jennifer Hauxwell, Anne Moser, Maya Reinfeldt, Eva Ryan, Jennifer A. Smith, Elizabeth A. White and Marie Zhuikov

ART DIRECTOR

Yael Gen

DESIGNER

Kristen Rost

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Road Salt's Year-Round Impact

LETTER FROM SEA GRANT DIRECTOR

Weddings, hiring dates, cultural events ... anniversaries come and go. Are they so common as to seem meaningless? If you ask our partners and stakeholders—freshwater scientists, community leaders, educators, students, resource managers and coastal residents—you're going to get a resounding "no" to that question.

Here at Wisconsin Sea Grant, we are particularly motivated to celebrate our anniversary because all that we do is based on the wonder of the world's largest freshwater system, the Great Lakes. Throughout 2022 and with this special double issue of the Aquatic Sciences Chronicle, we celebrate 50 years of Great Lakes science for our future.

While we'll never fully capture the entirety of the spirit and history of our program on these pages, we're offering a sample of the people and projects that have shaped our work, which is the embodiment of the Wisconsin Idea.

We also share stories about current Sea Grant research on emerging contaminants, a flooding resilience initiative and our staff's contributions to a state-wide blueprint for how to adapt to climate change in Wisconsin. Another story details research about road salt and waterways, a project of Sea Grant's sister organization, the University of Wisconsin Water Resources Institute.

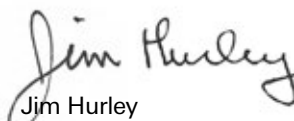
If you are holding a hard copy of this newsletter, we know you will appreciate the insert featuring the commemorative 50th anniversary mural installed on the Sturgeon Bay City Hall, thanks to our partners in that coastal community.

The mural was created and installed this year by a talented group, Erin LaBonte, Jody Henseler and Don Krumpas. If you are reading this in an electronic format, you will not have received this stunning hard-copy rendering of the life cycles integral to the ecosystems of Lake Michigan, which also includes interactions with humans. To receive a copy of the artwork, send a request along with your mailing address to moira@aqua.wisc.edu.

You can also step beyond these pages and dive into the Internet to review a long list of the ways in which Wisconsin Sea Grant has furthered science and helped people. It's a collection of hundreds of our impacts collected by the National Sea Grant College Program and stored on its website, accessible through go.wisc.edu/89zq0l.

Whether you explore our past through this newsletter or that National Sea Grant website, be assured that we are honored to have you as a part of our history and excited to share with you the promise of the future as we work toward the continued health and understanding of the Great Lakes.

Best regards,


Jim Hurley

Director of Wisconsin Sea Grant and the
University of Wisconsin Water Resources Institute



Climate change research is a special call in Sea Grant's 2024-26 request for proposals.

Learn more at: seagrant.wisc.edu/research

2012



Sea Grant Experts Contribute to Statewide Climate Report

Six members of the Sea Grant staff contributed to the 2021 Wisconsin Initiative on Climate Change Impacts report. Contributing writer Dea Larsen Converse, WICCI communications director, shared updates based on two portions of the report — fisheries and coastal processes.

A focus on climate impacts to Wisconsin's Great Lakes in the most recent assessment from the Wisconsin Initiative on Climate Change Impacts (WICCI) wicci.wisc.edu shows Great Lakes water level fluctuations and changes to water temperature, lake mixing and ice cover are affecting Great Lakes water quality and habitats. The last two decades have been the warmest on record in Wisconsin and the past decade has been the wettest.

"Climate change is stressing all ecosystems. Protecting coastal habitats and thinking about future conditions when planning habitat restorations can build climate resiliency into our ecosystems," said Titus Seilheimer, WICCI Great Lakes Working Group co-chair and Sea Grant fisheries specialist.

The Great Lakes basin is home to more than 3,500 species of fish and wildlife and provides drinking water, recreation and livelihood to more than 34 million people. Rapid changes in Great Lakes water levels, extreme storms and longer wet periods are affecting the coastal wetlands, beaches and dunes that provide habitat in the basin and protect water

quality and shorelines. In addition, more frequent extreme precipitation events and warming waters are increasing the risk of microbial contamination on beaches and toxic blue-green algal blooms in lakes. For example, in 2018, extreme storm events elevated nutrient levels along the South Shore of Lake Superior for months and fueled major algal blooms along the shoreline. While Green Bay has been experiencing algal blooms for decades, it is a concerning new phenomenon in Lake Superior. Extreme storms also bring contaminants that have the potential to move through the food web into fish that are important for subsistence fishers.

Changes in air temperature also influence the amount of ice cover, water levels, clarity and chemistry associated with fish habitat. For example, the decreasing extent and duration of Great Lakes ice cover increases erosion and impacts fall and winter fish spawning beds. Warming Great Lakes water temperatures mean cold-water fish will likely move north into deeper parts of the lakes and more thermal habitat for cool-water fish like walleye will open up in Lake



2020

Adam Bechle | Wisconsin Sea Grant

Superior. However, changing precipitation patterns could potentially lower their growth rates and damage spawning habitat.

Further specifics can be examined with regard to coastal communities. These large fluctuations in Great Lakes water levels along with flooding and bluff erosion from extreme storms are affecting lakes Michigan and Superior coastlines and causing uncertainty for coastal communities.

“Coastal communities and businesses will need to adapt to more volatile lake level fluctuations, with frequent fluctuations between extreme high and low lake levels, as the climate continues to warm,” said Adam Bechle, WICCI coastal resilience co-chair and Sea Grant coastal engineer.

All of Wisconsin’s Lake Michigan and Lake Superior coasts experienced extreme lake level fluctuations in the past decade. Along Lake Michigan, record high water levels in 2020 followed record low water levels in 2013. At low water levels, coastal-dependent industries are at risk for insufficient water depths for navigation. At high water levels, concerns include increased erosion, flooding, bluff failure and infrastructure damage. Both high and low water level extremes are anticipated under a changing climate along the Great Lakes coastline. This could include potentially higher highs, lower lows and more rapid

fluctuations than seen in the historical record. The high variability in water levels combined with bigger waves and storm surge from extreme storms will continue to increase erosion and decrease the stability of coastal bluffs.

Wave energy reaching Great Lakes coasts is expected to increase in the future, in part due to anticipated decreases in ice cover extent and duration. Nine of the top 10 lowest ice cover years have occurred since 2002. Projections show that ice cover duration on Lake Superior will decrease by one to two months by the end of the century as the climate continues to warm. Greater wave energy reaching the coast will lead to increased erosion and flooding of the shoreline. During times of higher water levels, these large waves will be able to reach further inland and cause greater coastline erosion and flooding. In some coastal communities, the areas with the highest risk of coastal flooding are also home to low-income and other vulnerable populations.

The Wisconsin Initiative on Climate Change Impacts (WICCI) is a statewide collaboration of scientists and stakeholders formed as a partnership between UW–Madison’s Nelson Institute for Environmental Studies and the Wisconsin Department of Natural Resources. WICCI’s goals are to evaluate climate change impacts on Wisconsin and foster solutions. —DLC

Photos from 2012, 2017, 2019 and 2020 show a house in the village of Somers, Wisconsin, as it succumbs to the rising waters of Lake Michigan. The house was dangling over the water when it was demolished and removed.

For more about Sea Grant-published research, see “It’s About the Science” on page 33.

50 Years At the Beginning



Above, the original home of Wisconsin Sea Grant, also known as "the Sea Coop." (See "Uncountable Contribution" on page 34 for an explanation.) Below, Sea Grant's first director, Robert Ragotzkie. Facing page, Wisconsin Sea Grant became an official college program in 1972.



2 oceanog
DRAFT

A PROPOSAL
to the
NATIONAL SCIENCE FOUNDATION
for
PARTICIPATION IN THE SEA GRANT
COLLEGE PROGRAM BY THE
UNIVERSITY OF WISCONSIN

*This document
was distributed
to BOR 7 Apr 67
w presentation
by Ragotzkie f
Mortimer
CAR*

Writer Marie Zbuikov had the chance to speak with Wisconsin Sea Grant's first director, Robert Ragotzkie, in November 2018 when he was 94 years old.

Ragotzkie died Nov. 4, 2021.

The Birth of Wisconsin Sea Grant

The Wisconsin Sea Grant Program was formed in 1968 at the University of Wisconsin, but it did not fund any research projects for the first few years. It was awarded official college program status by the federal government in 1972, after certain criteria were met, including demonstrating excellence in fields related to ocean, coastal and Great Lakes resources.

Sea Grant's first director played a major role in forming not only the Wisconsin program but also the national system.

Bob, as he likes to be known, was involved in ensuring that the Great Lakes were included when Sea Grant itself was coming into being. He said, "I went to an early Sea Grant conference in 1967 or '68. Athelstan Spilhaus conceived of Sea Grant and the focus was on university programs located on the oceans. I went to this conference at Rhode Island along with a Michigan representative. We pointed out to him (Spilhaus) at this conference that the Great Lakes were like the oceans and should be part of the program. There was a lot of give and take but ultimately, we agreed that the Great Lakes should be part of the Sea Grant program. We were included then in the first awards for Sea Grant programs to universities. That was the beginning. From then on, we were part of the program."

By the early 1980s, the program was active throughout the full university system. "That was a unique part of it as far as we were concerned," Bob said. "It wasn't just University of Wisconsin-Madison or University of Wisconsin-Milwaukee. It was seven different campuses in the UW System plus two private universities were included. That's what made it different from all of the other proposals/projects."

The early scope of the program was broader than it is now. "The program initially concentrated efforts and research on all five Great Lakes. We had a Great Lakes Program (at the university already) but it was not very well organized. This sort of pulled it all together. Michigan Sea Grant was also Great Lakes-wide and we had close cooperation with the University of Michigan Sea Grant Program," he said.

Bob also put in a plug for the UW-Madison Go Big Read book, "The Death and Life of the Great Lakes" by Dan Egan.

"If you look in the back of that book in the bibliography, I'm pretty sure that an awful lot of those research papers came from Sea Grant. If you read that book, you realize how different the Great Lakes are from the oceans. In the past 100 years, the Great Lakes have changed enormously. The oceans are also changing but not as much or as fast because the oceans are bigger. That book is a classic in how the Great Lakes work. I think it represents how we look at science now (in a more holistic manner) than how we looked at it 50 years ago and how research was done then. Dan Egan did a beautiful job writing that book ... It epitomizes how Sea Grant works. It doesn't concentrate on one particular species or harbor but on the Great Lakes as a whole and how they function."

Bob is still keeping track of who is conducting research in the Great Lakes. He knows the people even though he has been retired for 38 years. However, the main way he monitors the health of the ecosystem is via a much more concrete way.

"I'm a sports fisherman and that's how I keep track of things. Anything I can catch on flies I like – from speckled trout all the way up to tuna and swordfish. You name it, I'll fish for it." —MEZ



Building Preparedness to Protect Communities

Floods can be devastating for anyone. The impacts can be even more intense, however, for vulnerable populations. That includes people who live in poor housing conditions, lack transportation options or possess limited English skills that would hamper their understanding of emergency messages.

Through funding from the National Sea Grant Office (NSGO), Wisconsin Sea Grant is working with nine communities in northeastern Wisconsin to strengthen their resilience to flooding events by looking at who lives in the most flood-prone areas of a city. Wisconsin Sea Grant is partnering with the Bay-Lake Regional Planning Commission and Wisconsin Emergency Management on this effort.

Work on the project, which began in June and continues through summer 2024, builds upon earlier Sea Grant-supported work using the Flood Resilience Scorecard. The scorecard is a comprehensive tool that helps communities look at their level of flood preparedness through a variety of dimensions.

Jackson Parr, a Sea Grant staff member who served as the J. Philip Keillor Flood Resilience-Wisconsin Sea Grant Fellow from April 2021 to May 2022, will be a key player in this new effort. He worked extensively with the Flood Resilience Scorecard and Wisconsin communities during his fellowship, drawing on his dual master's degrees in public affairs and water resources management.

While Parr's fellowship work included both coastal and inland communities around the state, the new project will focus more specifically on the Lake Michigan coast from Sheboygan County northwards.

Parr will work with Wisconsin Sea Grant Assistant Director for Extension David A. Hart and Coastal Engineering Specialist Adam Bechle, as well as staff at the Bay-Lake Regional Planning Commission, including Environmental Planner Adam Christensen.

Said Parr of his fellowship period, "Over the last year, I've worked with 16 communities ... and we've identified some common gaps across all communities in terms of flood preparedness and flood resilience." He found that no community had used spatial GIS technology to pinpoint where priority populations — those most vulnerable to flooding — live.

This kind of detailed, granular analysis can lay the groundwork for keeping people safer, especially because two places very close to one another can have very different flood risk. Yet doing this GIS work can be challenging to communities for a variety of reasons, such as a lack of resources or administrative capacity.

Said Parr, "These communities are doing a lot of good work in addressing some disparities, just not related to flooding specifically, because that gets into a narrower area than most communities have the capacity to do." That makes the technical assistance offered by the newly funded project a welcome addition to what communities are already doing.

In addition to the GIS work, other aspects of the funded project include running the Extreme Event game in the communities. The game was developed by the National Academy of Sciences. Explained Parr, "It's a scenario of a storm event, and random things happen throughout the scenario, and participants



Above, spring 2008 flooding in Wisconsin. Below, participants in an East River Collaborative field trip learn about nature-based agricultural practices that slow down runoff and can help lessen flooding and improve water quality in downstream communities like the city of Green Bay.

have to think how they'd respond. Then they do back-end reflection on that process."

Game participants will include local officials and emergency management staff, but can also include residents who want to learn more about disaster preparedness and resilience in their community.

Said Christensen of the Bay-Lake Regional Planning Commission, "We'll assist in outreach efforts to communities about participating in the game, screen for underrepresented communities in those areas, contact necessary stakeholders, attain Extreme Event Facilitator Certification to facilitate the games and provide local knowledge and mapping services for the team."

Staff from Wisconsin Emergency Management will also get training in running the games, so they can do them in any Wisconsin community, giving the project a reach beyond the nine cities that are its main focus.

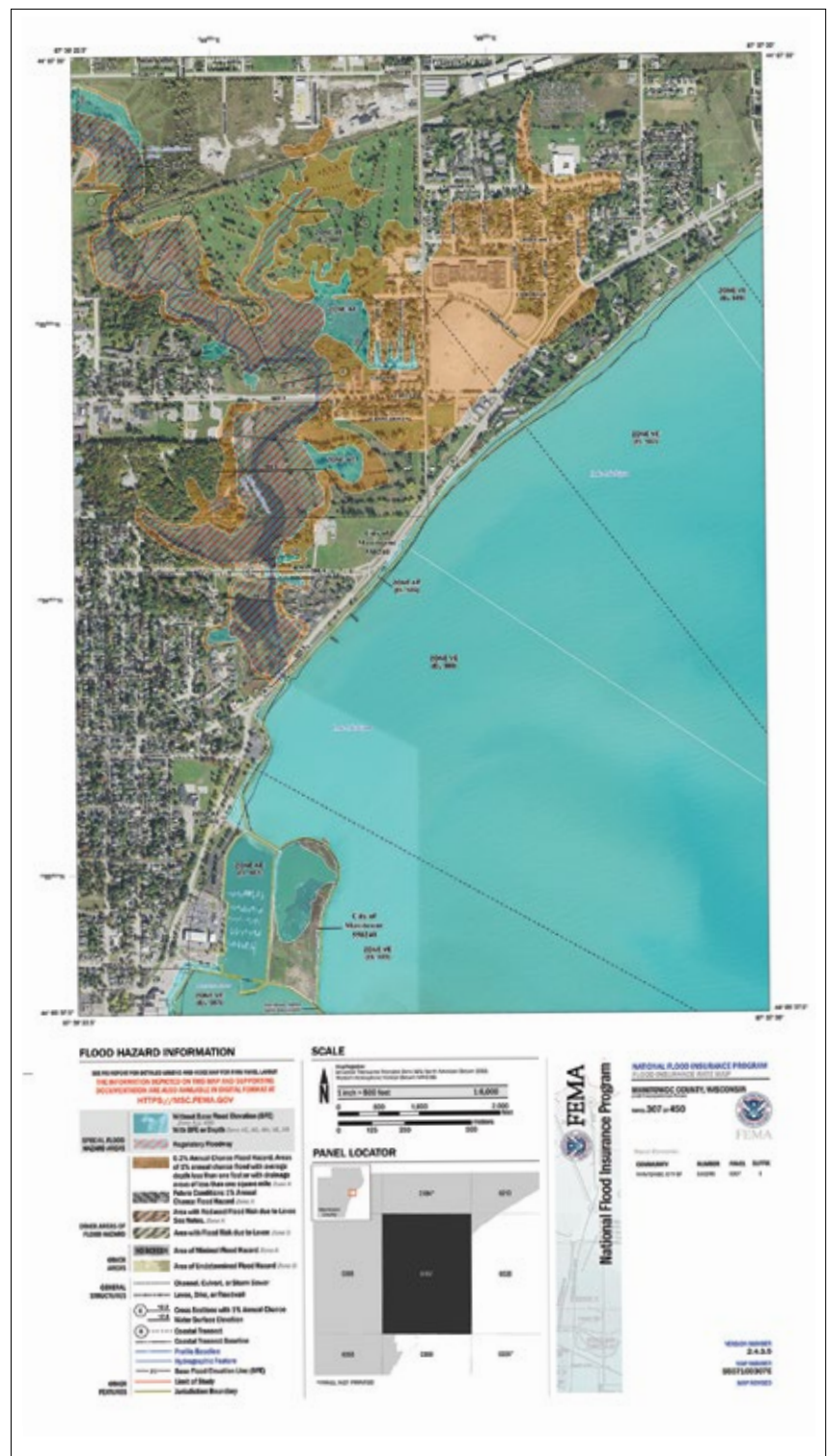
A third outcome of the project will be implementing what's known as the Plan Integration for Resilience Scorecard for participating communities. That assessment analyzes the variety of plans a community might have — from transportation to downtown revitalization to parks and recreation, for example — and helps them create consistent recommendations for floodplain management and disaster preparedness.

That helps avoid situations such as having one plan saying an emergency shelter should be located in a particular neighborhood, while another document prohibits that from a zoning angle, offered Parr as an example.

Taken together, the three main components of the project will help northeastern Wisconsin communities be better prepared to face challenges that may come their way, especially in a "perfect storm" event in which high Great Lakes water levels and extreme precipitation combine to cause significant flooding.

When asked about the biggest benefit of this project, said Christensen, "To me, the biggest benefit is the word 'preparedness' — preparedness so that, when an extreme event occurs, the participating communities will be ready to react in an effective and efficient manner that saves lives."

For more information about the project, contact Jackson Parr at jgparr@wisc.edu. —JAS



The project is taking advantage of new Digital Flood Insurance Rate Maps (DFIRM) from the Great Lakes Coastal Flood Study, which in some areas is the first update to flood maps since the 1970s. These maps show the areas likely to be flooded during a 100-year rainfall (blue), 500-year rainfall (orange), as well as coastal storm surge due to wave action on Lake Michigan.

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THEN & NOW This issue of the Chronicle is devoted to celebrating the history of Wisconsin Sea Grant and looking forward to the future. To that end we asked each of our outreach specialists to share some of the changes they've seen so far in their fields and what they're hoping to see in the future. Some of their reflections are included in the following pages.

Timeline Offers a Stroll Through Great Lakes' Goods and Ills

"1963: In a speech at an annual meeting of the American Fisheries Society, University of Minnesota College of Engineering Dean Athelstan Spilhaus recommends the formation of a Sea Grant College system, akin to the Land Grant College system."

"2022: Celebration of 50 years of Wisconsin Sea Grant fostering the sustainable use and conservation of Great Lakes resources in Wisconsin, with a vision of achieving thriving coastal communities and a Great Lakes ecosystem."

These two statements anchor both ends of a timeline that spans a portion of the history of the Great Lakes, other waters and Wisconsin Sea Grant through decades that were equally turbulent and optimistic.

Other points along the trajectory peg the dates of significant goods and ills visited upon the Great Lakes:

1969, one of at least 12 times the Cuyahoga River, a tributary of Lake Erie, catches on fire due to pollutants.

1972, passage of the federal Clean Water Act.

1993, completion of a five-year, \$12 million Environmental Protection Agency PCB mass balance study in the Green Bay ecosystem, which set the stage for cleanup.

2008, ratification of the binational Great Lakes-St. Lawrence River Basin Water Resources Compact.

2020, a Sea Grant-funded researcher determined that the class of contaminants known as per- and polyfluoroalkyl (PFAS) can be spread by rainfall.

Cultural touchstones are also reflected along the way:

Hum "The legend lives on from the Chippewa on down to the big lake they call Gitchie Gumee." Gordon Lightfoot released the classic Lake Superior song, "The Wreck of the Edmund Fitzgerald," in 1976.

Recall the buoyancy you felt the first time you climbed aboard a flimsy core of foam, the swim noodle, invented in 1986.

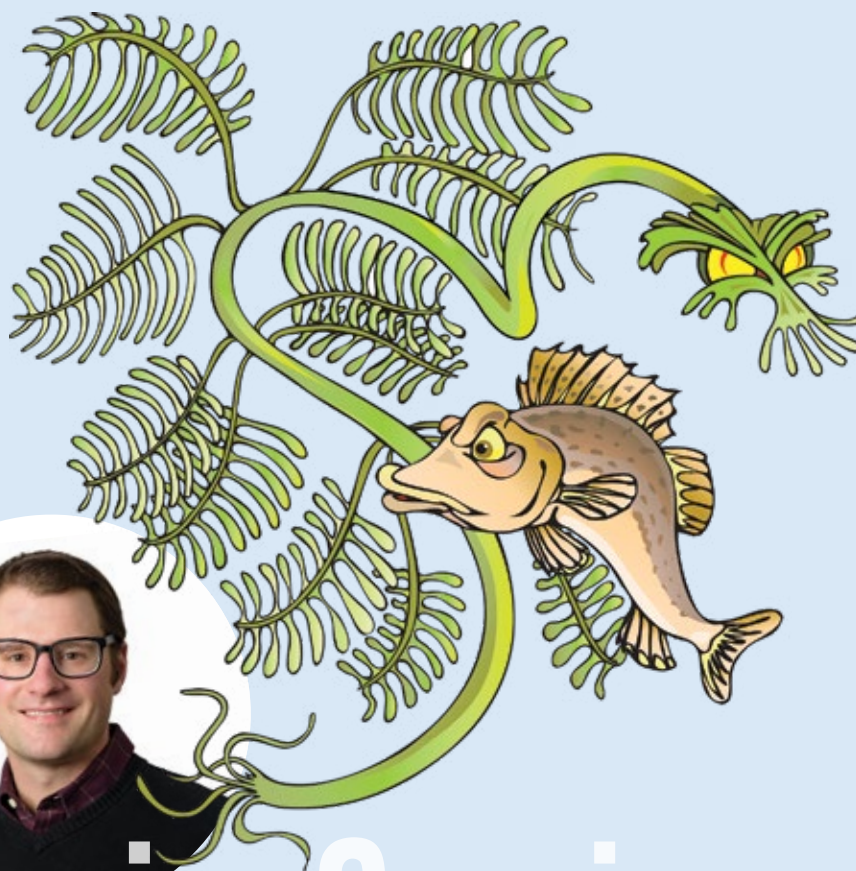
Wax that surfboard and revel in the fact that catching a wave isn't just for those in California or Hawaii. In 1988, the Lake Michigan city of Sheboygan hosted its first Dairyland Classic surfing competition.

This timeline and its dozens of other entries, at go.wisc.edu/l4uk39, could prove one of the most efficient ways to take in the 20,000-year history of the Great Lakes in only a 50-year snippet.



See the full timeline at:

go.wisc.edu/l4uk39



Invasive Species

Tim Campbell, aquatic invasive species (AIS) outreach specialist

The history of invasive species in the Great Lakes starts with the creation of the Welland Canal, a human-made waterway that linked Lake Ontario to Lake Erie in the mid-1800s. Sea lampreys and alewives were able to travel through the canal into the Great Lakes, with massive effects on both people and fish.

While Great Lakes invasion science used to be primarily focused on managing sea lamprey and alewives for the benefit of commercial and recreational fisheries, Campbell noted that “now, what we think about in terms of invasive species in the Great Lakes and the Great Lakes region is so much more broad than just alewives and sea lamprey.” New invasive species like zebra and quagga mussels have expanded the challenge, with more nonnative species arriving all the time. Improvements in control programs have given AIS managers alternatives, and new prevention programs have helped reach wider audiences.

While advancements in science and technology have bolstered our understanding of invasive species and the pathways they use to breach new areas, new pathways are continuously arising. Campbell cited online marketplaces as an example. These marketplaces, which allow customers to

purchase species from anywhere in the world, have complicated AIS management in the past 10 years. Additionally, new segments of existing pathways — like recreational watercraft with ballast tanks — keep AIS managers readdressing pathways they thought were already sufficiently covered by their management plans.

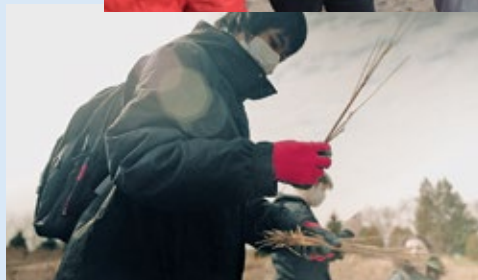
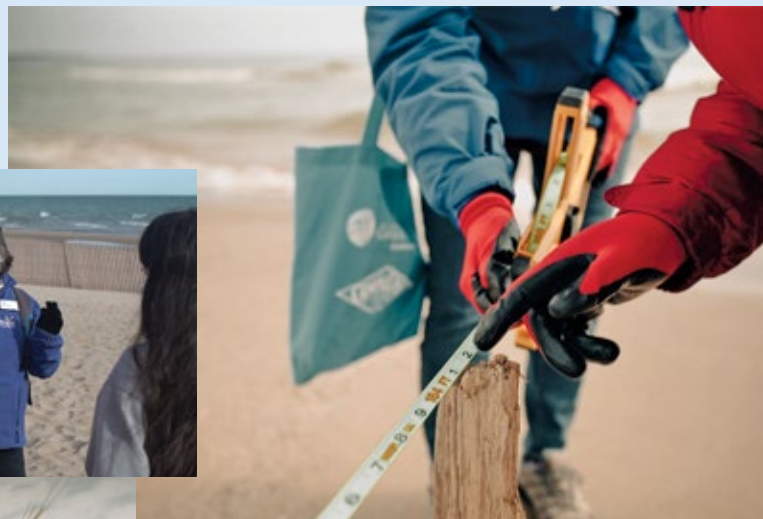
So where does invasion science go from here?

“I think we’re starting to get more specific with pathways and how we can focus less on the actual invasive species and more on the people using the pathways — how we can work with them to stop unintentionally moving plants and animals around,” Campbell said.

Through the eyes of Campbell, the limiting factor of his field is often not new biological facts about invasive species, but rather getting people to understand the impacts of their actions and getting them to take action. In terms of progressing the field of invasion science, Campbell has high hopes that the approach of shifting toward social science and trying to incorporate more of it into invasive species management will prove effective.

Campbell has taken this approach in his own work and has worked with teams that have been creating new ways to reach the public and change behavior using video and social media. The teams have been evaluating those efforts to help optimize AIS prevention messaging, including a recent study that helped determine that positive and fact-based message frames can perform as well as nativist and militaristic frames, which may have unintended consequences.

“In the next 50 years, I hope we keep going down this track of interdisciplinary work and trying to use all of the different scientific disciplines to address our problems” in order to “leave no stone unturned for potential improvements,” Campbell said. “It [the Sea and Land Grant College approach] has historically been very important in managing our agricultural problems and natural resource issues, and I think we will be even more important in the future because of where we sit between science and communities. Especially in this age of finding anything on the internet, no matter the accuracy, I think that it’s important to have this trusted source of scientific information to help communities make the best decisions possible.” —ER



Carlton working with seventh graders from Jerstad Agerholm K8 school in Racine, Wisconsin. The students visited North Beach on Lake Michigan and learned about erosion control, the importance of native beach plants, breakwall construction and more.



Ginny Carlton, education outreach specialist

Education Programs

Ginny Carlton provides learning opportunities to an array of different people, including K-12 students and teachers, and other audiences through programs like Grandparents University uwalumni.com/grandparents-university. When providing these opportunities, Carlton works with many other individuals and groups to produce programming in a variety of formats.

"I think that's one of the really wonderful things about Sea Grant; the education isn't just left to me," Carlton said. "As the education outreach specialist, I have the opportunity to work with a lot of our other colleagues at Sea Grant." For example, Anne Moser (senior special librarian), Adam Bechle (coastal engineering specialist) and Carlton are collaborating on a NOAA-funded grant project that provides seventh grade students in the Racine Unified School District with educational opportunities related to coastal engineering concepts. Moser often

collaborates with Carlton on projects; see more about her work in the story about the Wisconsin Water Library.

Carlton also mentioned commonly working with other Sea Grant programs and the Center for Great Lakes Literacy (CGLL). CGLL allows Sea Grant education specialists from across the Great Lakes basin to collaborate and produce educational products and programs. Carlton shared her efforts to lead a team of educators in the creation of the Trash Trunk, which is an educational kit that explores what marine debris is, its impacts and what can be done about it. Similarly, Carlton highlighted programming sponsored in collaboration with Minnesota Sea Grant. A recent example includes a webinar series entitled Trimming Our Sails, which connected the work of Tamara Thomsen, a maritime archaeologist who works with Great Lakes shipwrecks, with the work

of Ashley Elgin, a benthic ecologist who presented on zebra mussels.

Though Carlton started her position at Sea Grant in 2019, she has observed several changes within the education field from the past 50 years. One change in the education field is a greater focus on place-based education. While early educational movements, such as nature study and conservation education, acknowledged ecological differences between one location and another, place-based education expands the concept of place beyond just geography. Place-based education uses aspects of the students' environment like culture, ecology and economy to make connections between their education and local community.

Though the education field has made strides in becoming more inclusive and optimal for student learning, there are always improvements to be made.



"We have to work collaboratively to meet the needs of as many people as we possibly can. In this way, we advance our mission to promote the sustainable use of Great Lakes resources and reach our vision of thriving coastal ecosystems and communities."



"I hope we find ways to more fully open learning opportunities to everybody," Carlton said. She noted that the COVID-19 pandemic has highlighted disparities in opportunity.

"At Sea Grant, we're very fortunate because we have wonderful partners who can, and do, help with the work," Carlton said. Sea Grant works with a variety of partners to design, promote, deliver and evaluate diverse educational offerings and products, which in turn helps all of us to reach a larger audience with important educational messages about the Great Lakes and people's relationships to them. For example, a recent project, ROVe the Great Lakes, created in partnership with the Wisconsin Historical Society, features the work of maritime archaeologists who use remotely operated vehicles in their work.

Carlton has her sights set on further improving her field. —ER

Take your
class on a
maritime
adventure

ROVe
the GREAT LAKES





Encouraging Fish Consumption

Sharon Moen, Eat Wisconsin Fish outreach specialist

Moen's work largely focuses on supporting food-fish aquaculture and fisheries in Wisconsin, which includes improving consumer awareness and acceptance. She explores topics of fish production, consumer demographics and how to connect local fish growers with people throughout the state.

"I'm having fun with the position because I get to use my science communication skills to help American food-fish aquaculture and fisheries succeed against a challenging and changing global backdrop," Moen said. "It feels like meaningful, important work."

Moen reports that commercial fishers were hampered by labor shortages last year and would like help navigating changes to state regulations. Her conversations with Wisconsin's growing aquaculture industry indicate they could use technical help in the form of research on specific topics, finding fish processors and marketing.

"So many good things have happened in the last 50 years," said Moen, starting with the commercial fishing industry of the Great Lakes. "The state's commercial fishing industry was almost wiped out because of the invasion of sea lamprey, overfishing and changes to the ecosystem." But due to progressive sustainable fishery management decisions, the fisheries have recovered, maintaining opportunities for people to make a living from plying the Great Lakes for food.

"It's interesting to see how the industry has changed and how generational fishing families have held on and retained optimism. This is most evident in the way that, during the worst of the pandemic in 2020, the Red Cliff Band of Lake Superior Chippewa opened a fish processing and marketing business to help their members. It is encouraging

The Piscovore's Week Dinner Rotation

Monday Cuisine

What tastes have you been craving? Explore the world with your palate (South American, Mediterranean, Asian, etc.).

Tuesday Tacos

Bake or sauté a fillet for easy tacos or quesadillas.

Wednesday Salad

Chomp into a hearty salad topped with seared or smoked fish.

Thursday Chowder

Soups, chowders and stews are a tasty way to use leftovers and try out new flavors.

Friday Fish Fry

We are talking about Wisconsin fish, after all!

Saturday Grill

Kick back and throw a fish steak or kabob on the fire.

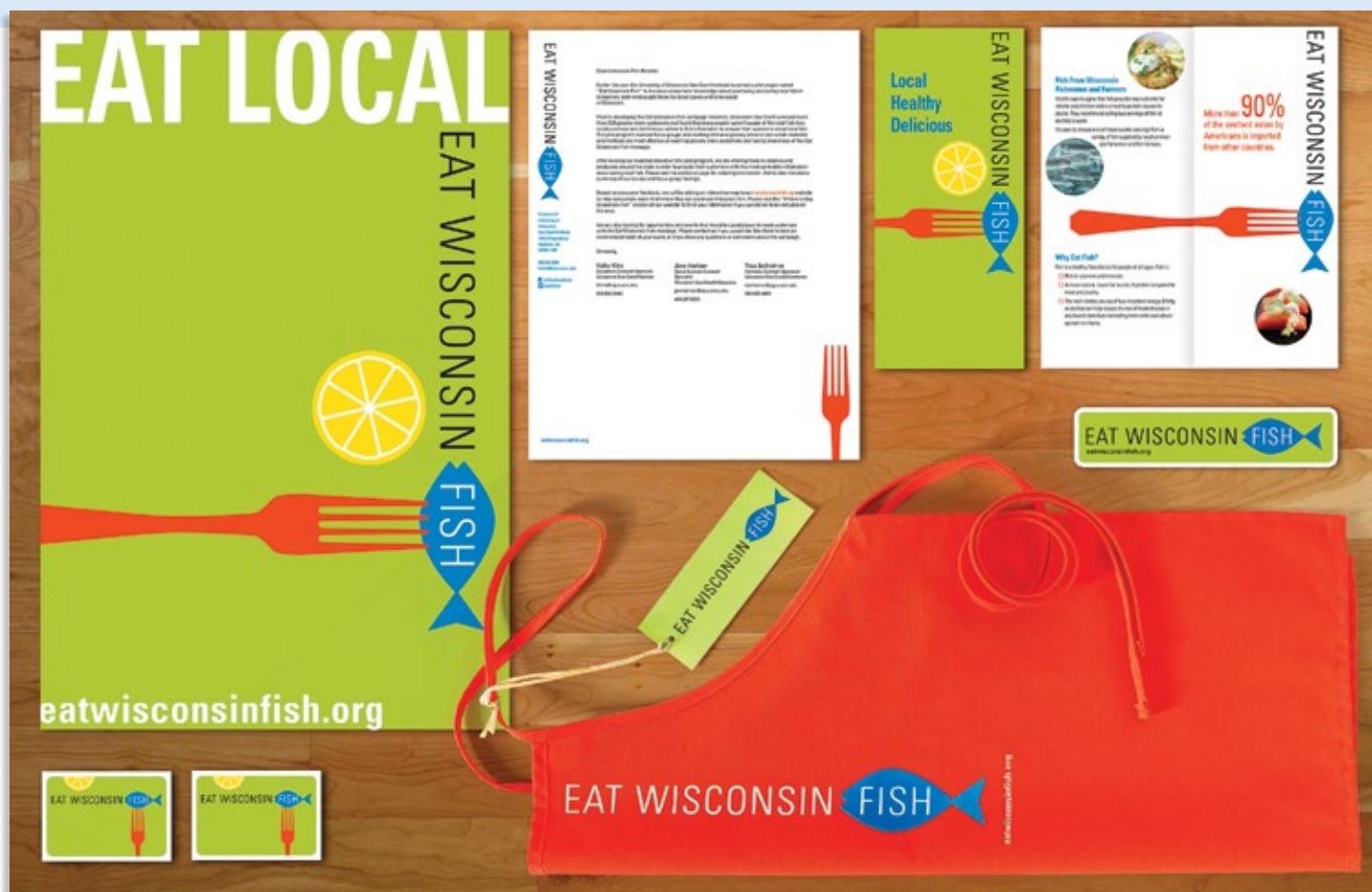
Sunday Casserole

Make something comforting! Tip: double the recipe for leftovers, or freeze an extra batch for later on.

to witness how the Great Lakes can still provide food and livelihoods for people."

Similar to Great Lakes fisheries, the Wisconsin aquaculture industry has experienced many advances in the past 50 years. "We grow shrimp on old dairy farms now," Moen said. "The largest on-land aquaponic facility for salmon is in Hixton, Wisconsin. Fifty years ago, people would think you were crazy if you said we were going to grow salmon on land and shrimp in old barns." Moen goes on to applaud the innovation of aquaculture specialists, noting how exciting it is to observe the industry changing.

As industries continue to change, it only makes sense to look forward. When asked about the future of food fish production in Wisconsin, Moen was sure to touch on climate change and aquaculture's role in improving food security and environmental resilience in the next 50 years.



Learn more and find recipes at: eatwisconsinfish.org

"Already about half of the seafood Americans consume is raised on farms," she said. "These farms could be, and maybe should be, down the road instead of halfway across the planet."

The meat industry is a known contributor to carbon emissions and Earth's changing climate. Moen specifically mentioned the feed conversion ratio of cows, pigs and chickens. Compared to these animals, the feed conversion ratio of fish is significantly lower, effectively saving resources while providing an impressive yield of protein and essential nutrients for brain development in children and heart health.

"I think fish are going to be one of our most important sources of protein in the near future, especially as we get better at growing them in contained facilities. As people are coming to terms with technology, where their seafood comes from

and climate change, these changes have to happen."

Further research on the food sources we use for feeding fish are being conducted each day. For example, scientists are trying to determine how we can grow algae containing omega-3 fatty acids and other beneficial nutrients to feed fish. That way, when we eat the fish that consume these algae, we also reap the benefits of those nutrients. All in all, the advancements taking place in the aquaculture industry are bountiful and exciting.

Considering the human health and environmental benefits of being a piscivore, Moen summed it up best when she said, "Eat fish, people!" —ER



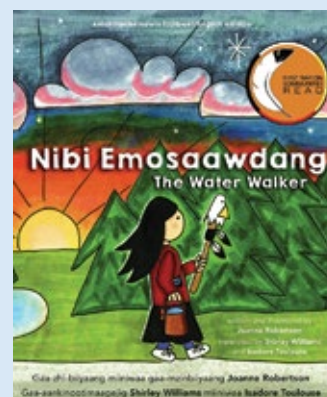
David Nevala



Moser showing library patrons at Rosemary Garfoot Public Library, Cross Plains, Wisconsin, how a maritime archaeologist uses photo mosaics to conduct research under water.



Anne Moser, senior special librarian and education coordinator



A book from the Maadagindan! book club.

Wisconsin Water Library

Books and So Much More

Established in 1964 by the University of Wisconsin Water Resources Institute (WRI), the Wisconsin Water Library (formerly known as the Water Resources Library) focuses on the water resources of Wisconsin and the Great Lakes and houses more than 35,000 volumes. The library's mission is to collect, preserve and provide science-based resources and programs in support of Wisconsin Sea Grant (WSG) and its sister institute, the Water Resources Institute (WRI).

Yesterday

In its early days, the library collection included technical reports, government documents, water science textbooks, maps and reference tools in print only. It was used primarily by faculty, staff and students at the University of Wisconsin-Madison in a traditional library model. Access to journals and gray literature was limited and publications

could be difficult to find. The library had a key role, however, in preserving the deep commitment to water science scholarship in Wisconsin by collecting the research findings of scientists funded by the WRI as well as other key water-related agencies such as the U.S. Geological Survey. This collection of print materials includes gray literature and many unique titles that were at risk of getting lost.

Since 1999, with the merger of the WRI and WSG, the library has held the unofficial title of "The Water Library for Wisconsin," opening its collection and providing programs to all residents of Wisconsin. The library was one of the first on the UW-Madison campus to lend its collection to the public, to freely answer reference and research questions across its many patron groups, and to provide education and outreach programming to audiences in learning environments such

as public libraries and Head Start programs. Senior Special Librarian and Education Coordinator Anne Moser has focused on the youngest learners, ages 3 through 12, bringing a multidisciplinary approach to Great Lakes and water science literacy.

The library's collection has also grown in recent years and reflects the changing challenges facing the Great Lakes, with titles on climate change, Traditional Ecological Knowledge, coastal engineering and social sciences. In the past few years, the library has paid special attention to the lack of diversity in its collections and has continued to expand the number of titles by Native authors and authors in marginalized and underrepresented groups. It has also focused efforts in finding and collecting titles on environmental justice and environmental racism. To support Moser's work with young learners, the library has grown its collection



Chelsea Mamott for the Chazen Museum of Art

Moser emceeding a science café at the Chazen Museum of Art on the topic of plastics.



Albi Schroeder

Moser and Sigrid Peterson taking water samples with the elementary school children at Shorewood Elementary School in Madison, Wisconsin.

STEM

bits



of children's books on a variety of subjects as well as updated educational kits and story hour lesson plans.

In recent years, the library has also expanded its digital collections about the Great Lakes and Wisconsin water resources. It's easy to think "everything can be found in Google," but without curation and indexing, everything cannot be found in Google. Two projects of special note are digitizing the WRI groundwater repository and creating a digital collection of the oral history recordings about lake sturgeon conservation. The groundwater repository contains close to 500 project reports that reflect the investment in groundwater research since 1985. By digitizing and cataloging the full run of research findings, a full picture of the health of our groundwater resources emerges and is discoverable for generations to come. The second digital collection focused on

the conservation story of lake sturgeon in Lake Winnebago and includes sixty-nine oral history recordings of the voices behind the science, culture, history and art of this beloved dinosaur fish. digital.library.wisc.edu/1711.dl/SturgeonPrj

Moser has dramatically expanded the library's reach in a different direction with collaborations focusing on the intersections of art, science and the humanities. Bringing photography, music or performing arts into conversations about the problems facing the Great Lakes provides opportunities for new collaborators and audiences, and it brings new perspectives to difficult scientific concepts.

Today (and tomorrow)

Moser has spent the past summer traveling the state, meeting with public library patrons to talk about the Great Lakes and Wisconsin

water topics – shipwrecks are always a favorite – and offering story hours for children. She's also involved in a project teaching middle schoolers in Racine, Wisconsin, about coastal engineering. Diversity in children's literature is a focus of the library, and the Maadagindan! book group offers the opportunity to read and discuss works by Ojibwe authors. go.wisc.edu/Maadagindan

Looking ahead, Moser said, "Libraries today do not look like libraries in 1964. Our reach now extends to the state boundaries, and what we do provides access to research, resources and programs. We ensure unique objects and knowledge aren't lost. And as a librarian and education coordinator, I am honored to teach the next generation of Great Lakes leaders that will care of the basin. Start 'em young I say ..." —ER

Climate and Tourism

Natalie Chin, climate and tourism outreach specialist

Natalie Chin connects science regarding climate and tourism with key audiences not only in Wisconsin, but also nationally. “With my work, I hope to improve lives while also protecting the environment,” said Chin.

When asked about changes in the fields of climate and tourism, information was something that stuck out to Chin. “I feel like the amount of data we have is growing exponentially,” she said, “and also our understanding of the environment and how processes work, how things fit together and general advancements of science.”

Chin works to navigate the most pertinent and accurate climate information to pass along to the tourism industry. This process isn’t always straightforward because of long-term and short-term uncertainties in climate data. Nevertheless, it is important to sort through misinformation and dated information so she can provide the most accurate facts.

Chin also touched on the intersection of scientific discovery coupled with people and policymaking. While scientific fact is objective, the way in which we implement that information into society can be influenced by our values. There is a continuous

need for balance between making good scientific decisions and thinking about the impacts those decisions have on people. In addition to changing societal values, “this desire to keep advancing and gaining knowledge is something that’s driving science and discovery,” Chin said.

Looking into the next 50 years of her specialty, Chin focused on social and environmental justice. “I hope that we continue to value the voices of the most vulnerable or marginalized, especially when it comes to climate change. Those are the people who are going to be impacted the most,” Chin said. Bringing her own values to the table, Chin expressed the wish that no one should feel disposable, forgotten or unseen.

Chin noted a project focused on climate migration that she had been working on, related to people who live on coasts. These are people who will be disproportionately affected by sea-level rise but perhaps have neither the ability nor the desire to move because of a deep connection to place. This is just one example of how climate change and environmental justice intersect. Environmental racism in America and across the world is one perspective on the issue, which has economic and health implications. —ER

“I hope that we continue to value the voices of the most vulnerable or marginalized, especially when it comes to climate change. Those are the people who are going to be impacted the most.”



Alyssa Johnson | St. Louis River Alliance



Emma Hauser, aquaculture and education outreach specialist

Aquaculture

Wiermaa is stationed at the University of Wisconsin-Stevens Point Northern Aquaculture Demonstration Facility (NADF). go.wisc.edu/51c94s Her position is in collaboration between Wisconsin Sea Grant and the University of Wisconsin-Stevens Point. NADF is a research and demonstration facility for freshwater finfish that may be used for a variety of food fish, baitfish or conservation species projects. The facility also partners with various organizations, private, public and tribal, looking to engage in sustainable aquaculture.

"My job is to take the research that we're doing and convert it into a way that's understandable and usable for various groups," said Wiermaa. One of Wiermaa's key audiences is K-12 students. Her position involves effectively engaging with and teaching these children what aquaculture is and why it is important, not only for their general knowledge but also as a career pathway.

Though Wiermaa has only been working for the aquaculture industry for eight years, she said, "In the past 50 years from what I've seen, there seems to be a lot more interest in the growth of recirculating aquaculture systems (RAS)." Essentially, RAS have the potential to create the best possible circumstances to optimize fish growth throughout the year. This includes control of various environmental factors such as temperature, flow rates, lighting, water quality and biosecurity.

She said that temperature control is especially important in our Midwest climate for species that require warmer temperatures for optimum growth, such as the walleye. "We're part of these national groups that want to see this (RAS) succeed, and they're (the NADF) doing it in a sustainable way. They're thinking about water reuse, effluent

(water leaving the site) and optimum control of the fish-rearing environment."

In looking forward to the next 50 years of aquaculture, Wiermaa expressed her hope to continue supporting local and sustainable aquaculture, not only aquaculture research but also the farmers working hard to support local communities while providing fresh and local fish. "It is important for consumers to know that purchasing fish and seafood raised in the U.S. ensures a safe, healthy and tastefully fresh option that supports local jobs and communities," she said.

To help achieve this, Wiermaa notes that misconceptions about the aquaculture industry need to be addressed to erase any stigma. "We need the trust, we need the support, and we need the research," Wiermaa said.

Wiermaa mentioned one specific detail: farmers know better than anyone that fish are sensitive animals that require a healthy environment with good water quality in order to survive on a daily basis. Farmers must ensure clean living conditions for these fish because otherwise, the fish would not survive. She stressed that maintaining honesty in research and information is essential in eliminating misconceptions.

Wiermaa also stressed the value of partnerships going forward. She said, "I think that's why everyone who works at the facility is so passionate about it because we're doing cutting-edge research that really helps our partners. It's all about partnerships and helping to advance sustainable aquaculture." —ER



Though Titus Seilheimer is based in Manitowoc, his work extends from Lake Superior to Lake Michigan, covering about 1,000 miles of coastline. “I look at fisheries in terms of the whole Great Lakes ecosystem,” Seilheimer said. His position requires interacting with many different people and understanding the changing ecology of the lakes. These practices are necessary because his work sometimes covers much more than commercial and recreational fishing.

The field of fishing has certainly not been stagnant for the past 50 years. “Being in Wisconsin, we have two really interesting lakes and stories to look at,” said Seilheimer. “Of all the five Great Lakes, Lake Superior is by far the most natural in terms of food webs and water quality. In contrast, Lake Michigan 50 years ago is a totally different lake than the lake we have now.”

Fifty years ago, the Clean Water Act (1972) had yet to be passed, meaning there were far fewer policies in place to maintain healthy water quality and monitor pollution. There were large amounts of nutrient loading and unbalanced food webs. For example, mid-twentieth century Lake Michigan contained no lake trout, few planktivores and high numbers of non-native alewives.

However, as time went by, changes were made to the lakes. “We see the successful control of various invasive species benefiting the fish in Lake Michigan,” said Seilheimer.

Today, Lake Michigan has clearer water due to the decline of nutrient loading as well

as changes in zebra and quagga mussel populations that have “totally changed the ecology of the lake.”

Conversely, in Lake Superior we see more success in restoring native species and fewer issues surrounding invasive species (alewives, zebra and quagga mussels, etc.) compared with Lake Michigan. Because of this, the two lakes show contrast in how they have changed: a more natural food web (Lake Superior) versus a more altered food web (Lake Michigan).

“People have gotten a lot better at addressing invasive species pathways,” said Seilheimer. He noted that education about ways to prevent the spread of non-native species and policy changes are paying off.

Seilheimer continued to touch on all the good that has been achieved, like the management of nutrients and the cleanup of polychlorinated biphenyls (PCBs), but also stated there will always be something new to address, like the rise of per- and polyfluoroalkyl substances (PFAS) in our water sources. As we further invest in prevention, we are constantly gathering new scientific data to learn more about the changing lakes.

“I think where we’re at with all the Great Lakes is that it’s not necessarily about what we want out of the lakes, it’s what the lakes can support.”

Looking into the next 50 years, Seilheimer speculates that a changing climate combined with invasive species are going to further change the lakes. In response to this prediction and in the spirit of looking forward to a brighter future, Seilheimer said,

“One of the things we advocate for is science-based decision making and ecosystem-based management, and I believe that that’s going to be increasingly important to better manage our resources.”

—ER

Great Lakes Ecosystems

Titus Seilheimer, fisheries specialist



John Karl | Wisconsin Sea Grant



Clark leading a field trip at the St. Louis River Estuary in 2016.

Hard work, joy and more than a bit of luck add up to an accomplished coastal engineering career

Gene Clark knew early on that he would work as a chemist in a lab. He loved chemistry class, experiments and even failed experiments. He said, “I just loved testing things out. When they didn’t work, why didn’t they work?”

Then he attended a high school career talk discouraging pure chemistry in favor of chemical engineering. The speaker focused more on the downsides of chemistry than the positive aspects of chemical engineering, leaving Clark disheartened and confused — and questioning his career choice.

Fortunately, his advisor was able to explain how a chemical engineering degree uses science-based processes and test results to solve real-world problems, and requires plenty of those chemistry classes Clark enjoyed. He realized, “No one had ever told me about what a career in the engineering field was or could do.”

Newly informed, Clark decided to pursue chemical engineering. The result was a 35-year, award-winning career that contributed to many engineering issues, benefiting diverse groups such as homeowners, kayakers, the Great Lakes shipping industry and marina operators. For some career highlights, see “A Career Solving Wicked, Sticky and Humongous Coastal Engineering Problems” seagrant.wisc.edu/news/a-career-solving-wicked-sticky-and-humongous-coastal-engineering-problems Clark began at the University of Wisconsin-Madison’s chemical engineering program. In his junior year, he discovered a love for the oceans and scuba diving

on a vacation with a fellow mechanical engineer. A Wisconsin native, Clark had never been diving before, and the experience left him awestruck.

Shortly after his return, Clark was studying in a student lounge and noticed a poster on the wall promoting ocean engineering at Texas A & M. He kept thinking about it, and after his next study session, took the poster with him.

Despite being only vaguely familiar with Texas A & M, Clark transferred. He said, “I assumed it was in Texas, I knew they had a good football team, and I hoped it was near the Gulf of Mexico — two out of three wasn’t bad.”

The course of study was similar to a civil engineering program but was a bachelor’s degree in ocean engineering. He was having fun and landing on the dean’s list, so upon graduation, Clark decided to continue with a master’s degree at the University of Florida.

During that time, Clark connected with a group from the U.S. Army Corps of Engineers office in Vicksburg, Mississippi, that was taking classes for one semester. He was offered a job there upon graduation and stayed for three years. By then, he had a young family and wanted to move back to Wisconsin. The only catch: He didn’t have any job leads in the state, or even any ideas about where to start.

“I didn’t know who was doing coastal engineering in the Great Lakes. I had no clue,” he said.

Continued on page 35 >>



Top right, Eurasian watermilfoil is an invasive water plant that grows so densely it can make boating, fishing and swimming unpleasant and difficult. Bottom photos, Dehnert evaluating samples.

Herbicide study finds good news, bad news for use of fluridone in lakes

In a study recently published in the journal, "Aquatic Toxicology," [sciencedirect.com/science/article/abs/pii/S0166445X2200025X?via%3Dihub](https://www.sciencedirect.com/science/article/abs/pii/S0166445X2200025X?via%3Dihub), researchers found that while concentrations of the herbicide fluridone similar to those used to control Eurasian watermilfoil and hydrilla in lakes did not kill fathead minnows, it can affect fish health in more subtle ways.

"The good news for fluridone is that it didn't really have any impacts on survivorship or even on fish growth, which was to be expected. But when we looked at some of the more sensitive endpoints, particularly prey capture and endocrine disruption, we see that at certain concentrations there seems to be an impact," said Gavin Dehnert, research team member and Wisconsin Sea Grant's emerging contaminants scientist.

Fluridone is one of the major active ingredients in commercial aquatic herbicides. It affects the entire plant by inhibiting its ability to photosynthesize, which eventually leads to death. The Wisconsin Department of Natural Resources (DNR) is interested in using herbicides containing fluridone as an alternative to those containing 2,4-D, which preliminary research has found can be toxic to fish. seagrant.wisc.edu/news/treating-lakes-for-eurasian-watermilfoil-with-herbicides-can-harm-young-fish

Dehnert said that before commercial use, the Environmental Protection Agency (EPA) mandates testing of fluridone to ensure it does not impact fish survival and growth parameters such as length and weight. This testing is done with very high concentrations and recommendations are derived.

"The problem is, they (the EPA) rarely test the actual lower concentrations that they say are safe for the lake," Dehnert said. "That's usually a big question mark. It's like, well, they just said it was safe, but is it actually?"

The research team, led by William Karasov with the Department of Forest and Wildlife Ecology at the University of Wisconsin-Madison, exposed fathead minnows (*Pimephales promelas*) to concentrations of fluridone that would be found in a lake during treatment. Unlike 2,4-D, which only needs to be applied once, fluridone herbicides could require several applications to a lake to be effective over a minimum of 45 days but usually 90 days. The minnows were exposed to the chemical in the lab for 35 days and then a subsequent generation of larval minnows from the original test group was exposed for 65 days.

After 30 days of fluridone exposure, the adult male fish showed an increased number of nuptial tubercles, which can indicate endocrine disruption. Dehnert explained that some herbicides, especially when they are used at low concentrations, can mimic fish hormones. The tubercles are found near the minnows' noses and increase or decrease in number depending on how much androgen and estrogen a fish produces. "That's really important because it could have major impacts on reproduction," Dehnert said.

The researchers also found that the fishes' livers were enlarged and that their ability to catch prey decreased significantly when exposed to fluridone, which could be because it impairs their ability to move. Previous studies suggest fluridone can act as a neurotoxin.

The DNR funded the study because, as Dehnert said, "In the state of Wisconsin, everybody likes to fish. So, we're trying to make sure we protect them as much as possible."

Other members of the team included Angelo Cozzola and Amber White, all with UW-Madison. —MEZ

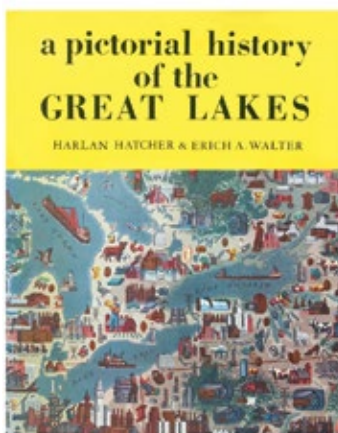


"In the state of Wisconsin, everybody likes to fish. So, we're trying to make sure we protect them as much as possible."



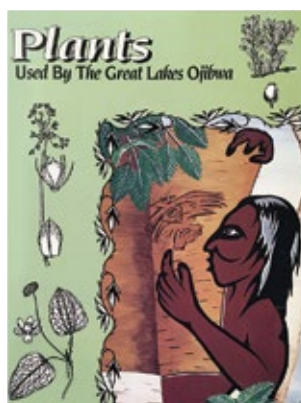
The Great Lakes Over Time

As we celebrate the 50th anniversary of Wisconsin Sea Grant and reflect upon the countless milestones and achievements reached by the program towards the sustainable stewardship of the Great Lakes, it is also important to consider the ways in which the lakes and their watersheds themselves have — or haven't — changed over time. What were the Great Lakes like hundreds of years ago? How have human activity and climate change affected the lakes? Who has historically made use of the Great Lakes, and who are its stakeholders now? The books below provide insight into the history, development and present of Great Lakes ecology, resources and society.

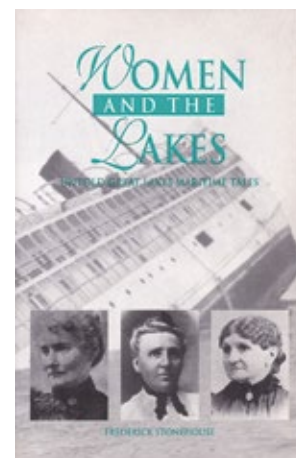


A Pictorial History of the Great Lakes
by Harlan Hatcher and Erich A. Walter.
New York: Bonanza Books, 1963.
A stunningly rare, almost encyclopedic, visual history of the Great Lakes. Contains maps, drawings, paintings, historic photographs and more.

Tales of the Great Lakes: Stories from Illinois, Michigan, Minnesota and Wisconsin by Secaucus,
New Jersey: Castle, 1986.
A multi-author collection about formative events and people in Great Lakes history between 1875 and 1909.

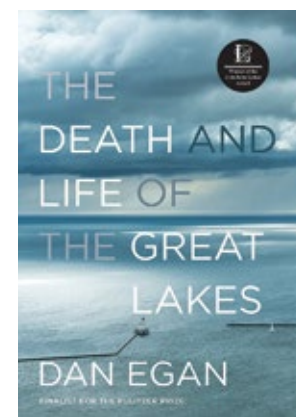


Plants Used by the Great Lakes Ojibwa by James E. Meeker, Joan E. Elias and John A. Heim. Odanah, Wisconsin: Great Lakes Indian Fish and Wildlife Commission, 1993.
A thorough and comprehensive guide to the plants known to the Ojibwe, or Anishinaabe, people, created in the hopes that the Anishinaabe language can live on.



Women and the Lakes: Untold Great Lakes Maritime Tales by Frederick Stonehouse. Gwinn, Michigan: Avery Color Studios, Inc. 2001.

This book introduces the reader to some of the women in history who impacted the Great Lakes, whether by heroic acts or by performing the mundane yet invaluable jobs that supported Great Lakes activity.



Death and Life of the Great Lakes
by Dan Egan. New York: W.W. Norton & Company, Inc. 2017.
A harrowing look into the numerous man-made issues that threaten the health of the Great Lakes; a powerful call to action to save and protect one of mankind's most precious resources.

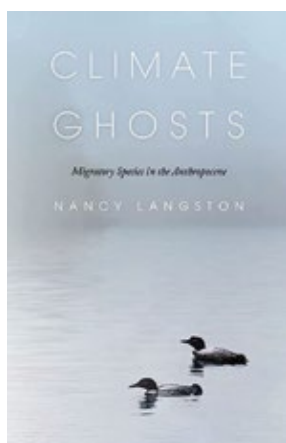


Indigenous Literature and Knowledge in Libraries

In summer of 2022, the Wisconsin Water Library (WWL) hosted Maya Reinfeldt as a Sea Grant Community Engaged Intern. Reinfeldt's goal was titled "Expanding Voices Heard in the Wisconsin Water Library." Through a partnership with the Great Lakes Indian Fish and Wildlife Commission, Reinfeldt narrowed her focus to expanding the presence of Wisconsin Indigenous voices at the WWL. Throughout her work and research, Reinfeldt came to understand that there still existed a lack of sufficient Indigenous representation in many Wisconsin libraries, but that a desire to fill this gap was developing among librarians.

The Great Lakes: The Natural History of a Changing Region by Wayne Grady. Vancouver, BC, Canada: Greystone Books, 2007.

An ecological overview of the Great Lakes region which highlights both the beauty and complexity of its natural world while also explaining the challenges it faces as the climate changes.



Climate Ghosts: Migratory Species in the Anthropocene by Nancy Langston. Waltham, Massachusetts: Brandeis UP, 2021. A touching exploration of "ghost species," animals whose species' survival is hanging on by a mere thread in an increasingly hostile landscape, in the Great Lakes watershed and what we can do to help them survive.

"So few Native nations are actually holders of their own histories."

— Katrina Phillips

To that end, Reinfeldt created a webpage on the WWL website where she compiled resources on topics such as holding Indigenous literature and Indigenous Knowledge in libraries, tribal and Indigenous librarianship, and the ethics of research and archives where they concern Indigenous peoples. The resources included on the webpage range from guidance documents, scholarly articles, other libraries' existing pages on the topics, blogs, maps, wikis and more.

During the project, Reinfeldt collaborated with Katrina Phillips, an associate professor of history at Macalester College and a citizen of the Red Cliff Band of Lake Superior Ojibwe, whose advice and insight is quoted several times on the webpage. Reinfeldt's hope is that libraries in Wisconsin, and elsewhere, can use this webpage as a beginning touchpoint in their endeavors to increase Indigenous representation and ethical collaboration with their Indigenous communities.

Reinfeldt would also like to emphasize that while this webpage provides an excellent introductory overview to the topics it covers, it is non-exhaustive, and true allyship to Indigenous communities will involve constant learning, listening, research, open communication, honesty and humility. —MR

Learn more at go.wisc.edu/a3ohz6.

Anyone in Wisconsin can borrow these books. Just email askwater@aquawisc.edu.



Initially, he spent much of his time getting to know people along the shore. This naturally led to projects. "I started doing an annual economic survey of business activity along the shoreline," Hoven said. "I found that very interesting for two reasons. One, it gave me a sense of what was happening economically on Lake Superior. Secondly, it got me into everybody's store!"

At first, business owners were reluctant to provide Hoven with their financial information, but as they got to know him they began to trust him. Hoven also credits help from former Barker's Island Marina manager Jack Culley for their cooperation.

"He was a real dynamic guy and a hard-driven guy. He didn't trust me at first, but after a while, we got to know each other quite well and he opened up his records to me. I think he maybe pushed the word up and down the shore that when I came around to talk about who's doing what, they'd better sit down and talk to me so that their information would get into the survey and report, as well," Hoven said.

He conducted the economic survey for about 10 years, comparing growth sectors and where new developments were happening.

Hoven also teamed with Sea Grant aquaculture specialist Fred Binkowski to develop business models for prospective aquaculture operations. "I was kind of in the middle again," Hoven said. "I relied on Fred for the economic data for producing fish, but I also went the next step, which was telling them what they could expect when they market it and how to go about marketing it."

Hoven presented his business model at several national aquaculture meetings and developed an aquaculture directory for the Midwest. For that, he visited every aquaculture facility, which took him a year.

His last project was perhaps Hoven's most noteworthy. He chaired the group that developed the first Remedial Action Plan (RAP), directing restoration efforts for the St. Louis River after it had been designated an Area of Concern by the U.S. Environmental Protection Agency. It also led to the founding of the St. Louis River Alliance, a nonprofit working to protect the river.

Hoven chaired the board, a consortium of 25 people representing different businesses and organizations around the river, for five or six years.

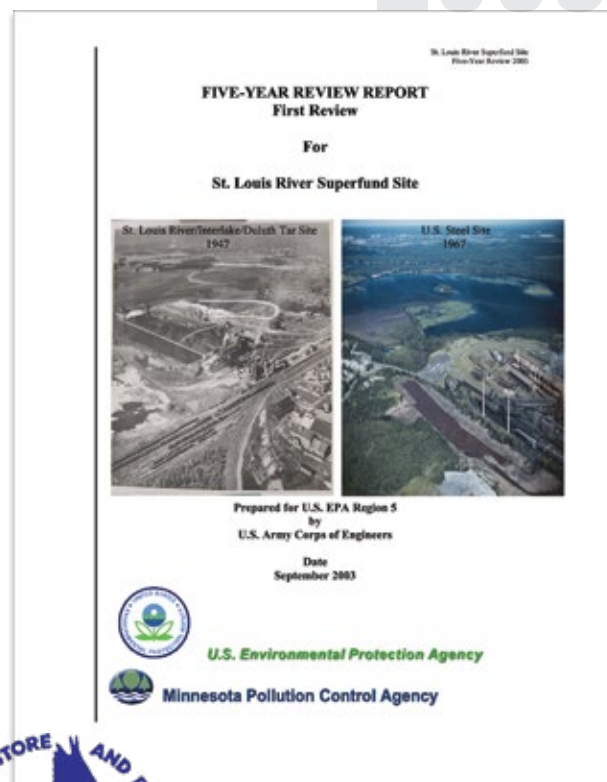
"At first, it was contentious because nothing was getting done. The businesses only could see dollar signs in the millions in front of them. We used to argue and yell at each other. Eventually, things got resolved and we published the first report, coordinating it with the National Oceanic and Atmospheric Administration's RAP efforts across the country," Hoven said.

That report provided an important blueprint for restoration efforts and has been updated over the years. "The river really was a mess, I'll tell ya. But little by little, it's getting cleaned up now," Hoven said. —MEZ



Rick Evans

2003



An aerial photograph showing a snow-covered landscape. A road with a yellow center line runs horizontally across the middle of the frame. The road is flanked by snow-covered fields. The sky is a pale, overcast blue. The overall scene is wintry and desolate.

UW-Milwaukee researchers examine road salt's year-round impact on Wisconsin rivers

One of two study sites along the Root River, pictured in the summer.



CHARLES PARADIS

Winter in Wisconsin is road salt season, as workers try to ensure our roadways are as safe and non-slippery as possible during bouts of snow and ice.

Yet, as public information campaigns like Wisconsin Salt Wise point out, the application of road salt comes with trade-offs. Salt, or sodium chloride, can harm freshwater ecosystems. According to Salt Wise, “It only takes one teaspoon of salt to pollute five gallons of water to a level that is toxic to native aquatic organisms.” It can also impact drinking water.

And, as research underway at the University of Wisconsin-Milwaukee (UWM) is uncovering, increased levels of chloride from road salt can persist in surface waters even in the summer — when no salt is being applied — because it appears to be stored in groundwater. There is also evidence that salt is stored in soils near those surface waters.

Said Paradis, “We suspect both groundwater and soil are potential long-term sources of road salt.”

The study, “Mass Discharge of Road Salt via Groundwater to Surface Waters in Southeastern Wisconsin,” is investigating two sites in Racine County along the Root River: one urban, the other rural. Led by Assistant Professor Charles Paradis, this work is being funded by the University of Wisconsin Water Resources Institute in its 2021–23 cycle.

Working with Paradis are graduate student Leah Dechant and, through UWM’s Support for Undergraduate Research Fellows (SURF) program, several undergraduate students.

Ultimately, the work that Paradis and his student team are doing can help policy makers make the best possible decisions when it comes to road salting practices. Said Paradis, “Clearly, road salt is good for public safety, but it may not be so good for environmental health, so where’s that balance? If we give this information to those who set that policy and practice road salt application, maybe they can do so in way that is best suited to balance public safety and environmental health.”

Paradis first became interested in the issue after a 2019 talk given by Cheryl Nenn of Milwaukee Riverkeeper about her annual Milwaukee River basin quality report. Nenn also pointed Paradis to a report put out by the Southeastern Wisconsin Regional Planning Commission (SEWRPC). Laura Herrick, a SEWRPC environmental engineer, had written about road salt in river water and noted elevated chloride concentrations in the Root River during the summertime.

As Paradis recalled, “They proposed the hypothesis that road salt is being stored in the groundwater that is connected to the river, and the groundwater serves as a continuous, long-term source for chloride to enter the river.”

What the SEWRPC observation needed was better testing, and Paradis was eager to dig further. He needed high-frequency samples of chloride and flow measurements at multiple locations along the Root River in the summer. That’s where graduate student Dechant and the undergraduates have been a major asset.

Field sampling began in July 2021 with the collection of surface water samples. Half of the samples undergo high-level isotopic and chemical analysis by Timothy Wahl, an associate investigator on the project, at the UWM School of Freshwater Sciences. The other half of the samples are subject to benchtop pH and alkalinity low-level testing in the Paradis lab.

For Dylan Childs, one of the undergraduates who has worked on the project, the process has been rewarding. “I’ve really come to enjoy the scientific method and research in general,” he said. “This was probably the first research project where I got to go out in the field, and it was a lot of fun having that hands-on experience, as well as going in to the lab, too. I felt so much more involved.”

Added Childs, a senior geology major from Stoughton, “Having this additional research experience as an undergrad has definitely helped me home in on what I want to do with my future.” Undergraduates Riley Thomas, Autumn Routson and Samuel Sellars have also contributed to the project.

In addition to people power, the research is aided by technology. United States Geological Survey (USGS) gauging stations are located at the study sites. These stations beam publicly accessible data, including flow data, to the internet. Continuous monitoring devices on loan from SEWRPC have also helped; these record temperature, conductivity — a proxy for chloride — and depth round the clock.

Through data collected from the USGS gauging stations, the loaned monitoring devices and water samples collected in the field, the team is capturing a much richer picture of what’s actually happening in the Root River. Paradis has noted that chloride concentrations in the river water have remained relatively constant — even when flow has increased and one might expect to see dilution as a result. This lends credence to the hypothesis that chloride is being stored in groundwater, providing a continuous source. —JAS

50 Years
Retired
but not
retiring



Former Director, Anders Andren: Looking Back and Looking Forward

Wisconsin Sea Grant's second director, Anders Andren, retired in 2012 after 21 years with the program.

In an interview, he reflected on the beginning of the program and the significant power of the Great Lakes states in forming the National Sea Grant program when it was conceptualized in the 1960s. Andren said that the Great Lakes states held political sway over the process as well. Robert Ragotzkie, Wisconsin Sea Grant's first director, and University of Wisconsin System staff spoke with the Wisconsin congressional delegation at the time and got other Great Lakes delegations on board with the idea of including the Great Lakes in the Sea Grant legislation.

"The Great Lakes states provided a fairly powerful funding block," Andren said. "If they weren't for it, the legislation from Sen. Claiborne Pell would never have gone through, and it would never have gone through in the House."

A co-sponsor of the bill from Florida (Paul Rogers) agreed to add the Great Lakes to the legislation, and the bill passed.

Andren also said that when Sea Grant was first formed, its funding came from the National Science Foundation for a year or two, not the National Oceanic and Atmospheric Administration like it does now.

Andren is still busy helping Sea Grant on a national basis with site reviews (the process by which Sea Grant programs are evaluated every four or five years), and recently assisted with North Carolina Sea Grant's review process. He is on the National Sea Grant Science Advisory Board, which evaluates the evaluation process and makes recommendations for changes.

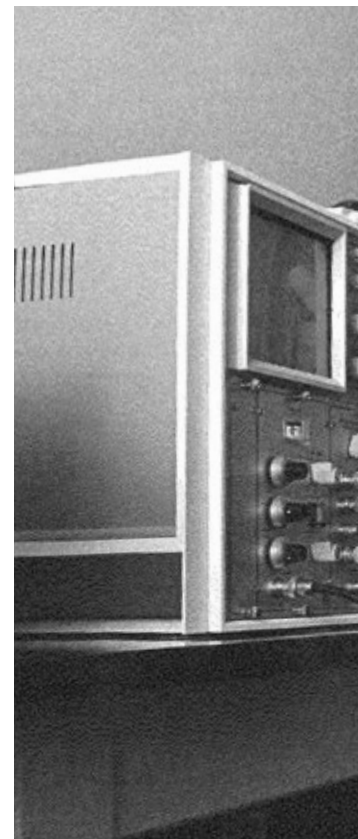
He's also been working in southeast Africa and Georgia with his son. The African project is at a resort in Mozambique, which features 20 miles of beach and an estuary that was in need of rehabilitation. Andren helped construct an artificial reef in the estuary. The Georgia project is an aquaculture operation that involves raising largemouth bass for sport fishing and for sale.

He enjoys recreational travel as well; he and his wife celebrated their 50th wedding anniversary in England recently.

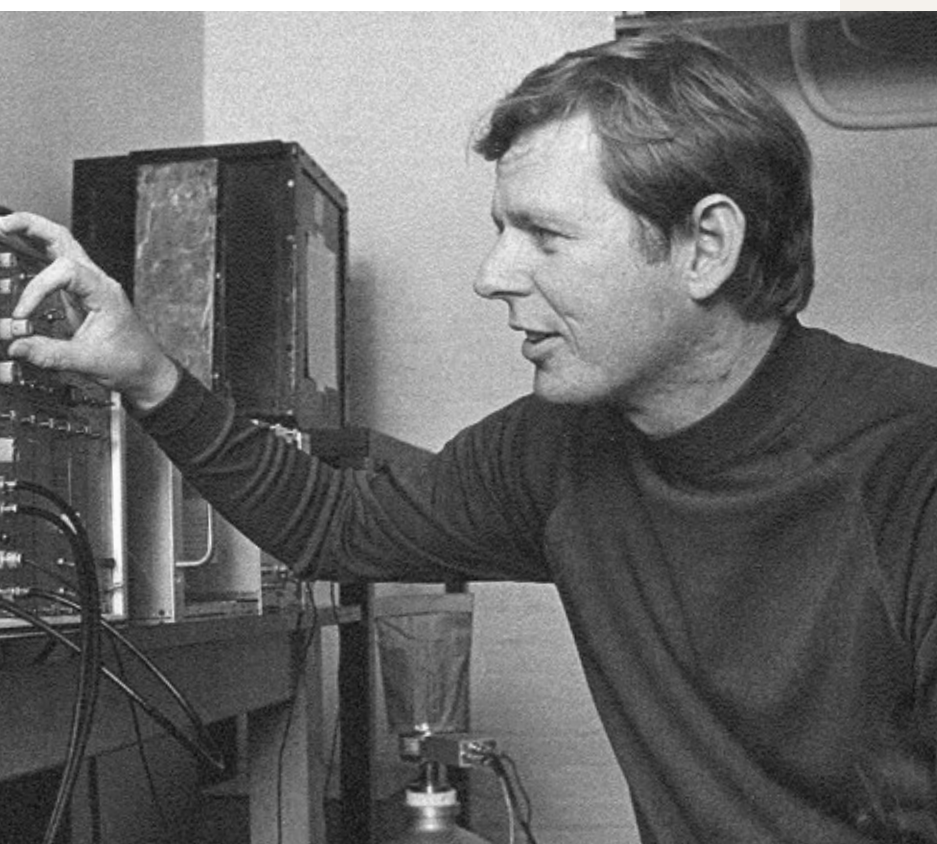
Andren hasn't formed his own band yet (an idea he considered for his retirement), but he does play guitar with a pianist during weekends at a local restaurant. "It's not really a band and I don't do it every weekend, but most weekends," he said. "I also play piano for our condo's parties and Christmas parties. We have singalongs."

His legacy at Wisconsin Sea Grant has spread to other Sea Grant programs. "It was a terrific 21-year span. I think we had an impact on the Great Lakes. That's something the program should be quite proud of. We were probably the first ones who really funded toxic substance research in the Great Lakes in a systematic way. Now, other Sea Grant programs are finally doing that 15 to 20 years later!" he said.

Despite his far-flung travels, Andren says Madison is still one of his favorite cities because of all his friends there. He's also an emeritus professor and visits campus periodically. He and his wife currently live in Florida. —MEZ



"We have been able to attract top-notch talent in outreach, communications and IT areas — I think we have the best and the brightest of the program."



For more reflections from Andren as he prepared for retirement in 2011, watch this video: youtube.com/watch?v=LgWgL78LyIA



It's About the Science

Throughout the history of its program, the science supported by Sea Grant has been integral to its existence. It's one of the core functions of Sea Grant along with education and outreach. Since the 1970s, Sea Grant researchers published more than 990 papers, which have been cited about 34,000 times.

"It's important for researchers to publish in peer-reviewed journals because it means their work is high quality,"

said Jennifer Hauxwell, Sea Grant's associate director. "It also means that the world has access to the details of their studies in perpetuity, and it lays the foundation for the next set of scientific questions. Over time, researchers can build off the work that came before them as they continue to explore how our world works and functions.

"We are proud of the scientific legacy associated with papers in a wide array of scientific journals. It means our researchers are conducting top-notch work on a number of different topics and getting their work out there for others to use. That is the foundation of our mission," she said.

An archive of Sea Grant-funded journal articles is available at go.wisc.edu/ie3ge9.

Uncountable Contribution

The one and only Linda Campbell retired from the Aquatic Sciences Center in July after 40 years at ASC and 49 total years working for the people of Wisconsin at the state and university level. Although we will never be able to quantify her immense contributions, we had to try.—JH and EAW

3,000 Number of scientific symbols available on a current iPad app	5 Sea Grant communications coordinators during this period [Linda Weimer, Peyton Smith, Susie Isaksen, Stephen Wittman, Moira Harrington]	4 Number of inexplicably huge cabinets at Sea Grant's first location [They were chicken coops; the building was previously the poultry research building.]
0 Number available on the Wang computer Campbell was hired to use for scientific manuscripts in 1982 [One of Campbell's main tasks was to insert scientific symbols into paper manuscripts.]	0 Average number of emails handled per week in Campbell's first few years [there was no email in 1982]	30 Days during which Sea Grant staff was forced to use a ladder to enter basement offices in the "old Sea Coop" because of a cracked staircase
3 Newsletter names over 40 years [from the "Chocolate Doorknob" to the "Littoral Drift" to the "ASC Chronicle"]	Hundreds Average number of emails handled per week recently	3,000 Quantity of doughnuts and other treats Campbell has offered to colleagues
± 400,000 Issues of newsletters mailed out	40,000 Flyers mailed in support of annual American Water Association-Wisconsin Chapter meetings	Uncountable Number of times Campbell's wonderful laugh has echoed through the halls, bringing joy to all who hear it
3 Billion Paperclips ordered [We did not count them.]	± 1,480 Documents submitted to the SG library between 1982 and 2019	



Number of times a UW chancellor has made a surprise visit to deliver an award to a Sea Grant staff member: 1 [Campbell received the Classified Staff Employee Recognition Award in 2008 and the current Chancellor John Wiley dropped by to deliver it in person.]

Clark visited the coastal engineering professor at UW-Madison's Civil and Environmental Engineering Department. He was impressed with Clark's experience and degrees and offered him a year's worth of funding on one of his current projects. (The project was funded by Sea Grant, but Clark wouldn't realize that until later.) From there, he earned a second master's degree and was offered a job at Warzyn Engineering. Warzyn transferred him to Minnesota to a division that did more dam work and less coastal work, so Clark went back to the job search. He landed a position as the Minnesota state lakeshore engineer in Duluth and stayed for 10 years.

He said, "That's where I really learned my education and outreach because I was getting grants from the coastal program or the Great Lakes Commission to do demonstration projects on Lake Superior or work with individual property owners, but yet still working with a state agency."

At this point, Clark was settled and enjoying his work. He was always skilled in working with teams and had formed close relationships with many colleagues, including Phil Keillor, who was the coastal engineer for Wisconsin Sea Grant. One day, he received a call from Keillor announcing his retirement and suggesting that Clark might want to apply for the position. Clark hesitated to leave Minnesota to take Keillor's position in Madison, but in a happy coincidence, another Sea Grant specialist announced his retirement at the same time. When Harvey Hoven retired from his position as the coastal business specialist in Superior, Wisconsin, Clark had the ability to take the new position without moving.

He said, "It just fell in my lap ... and it was the best move I ever made."

Clark went on to spend 15 years as Sea Grant's coastal engineering specialist. It was an ideal position for someone who loves both science and working with people.

He said, "The way that Wisconsin Sea Grant is set up and operates is just so ideal for providing information and assistance to communities and property owners and other states' programs. We could deliver a product that was honest, it was non-biased and it was science-based information."

Whether he was working with partners from the UW-Madison Civil and Environmental Engineering Department to develop a system to protect kayakers from unexpected high waves, harbor operators to identify causes and solutions for freshwater steel corrosion, port authorities to find beneficial uses for dredged sediment or homeowners facing eroding shorelines, Clark always enjoyed collaborations.

"And it didn't take long, whenever I would meet with people or groups of people, for them to realize I'm not selling a product, I'm trying to help them. And I point out pros and cons, and then let them make the difference," he said.

"It was all fulfilling. It wasn't work. It was a blessing to be part of that," he said.

After Clark's retirement in 2019, the pandemic limited his ability to meet with people, but he has been able to continue his work on two programs. One is reviewing two drafts of the U.S. Army Corps of Engineers' National Shoreline Management Study. The second is providing technical assistance to members of the rehab project team of the Natural Resources Foundation of Wisconsin. With partners at Sea Grant, Wisconsin Department of Natural Resources, Wisconsin Coastal Management Program and the UW-Madison Civil and Environmental Engineering Department, Clark has been working to improve beach quality on degraded beaches without disturbing natural coastal processes. The team started with the Kenosha Dunes and continued with other degraded beaches in southeast Wisconsin. seagrant.wisc.edu/news/breaking-new-ground-to-stop-kenosha-dunes-erosion

This project illustrates what Clark calls "a couple of very positive paradigm shifts," which are the movement toward nature-based shoreline designs and the beneficial use of dredged material. When he started his career, shoreline protection consisted primarily of concrete, large rocks and sheetpile – now nearly all projects are focused on greener, more natural designs that provide habitat and allow for natural coastal processes. Reusing clean dredged material has also become more and more accepted, saving landfill space and providing valuable fill material.

Clark also serves as a technical advisor to Wisconsin Sea Grant's current coastal engineer, Adam Bechle. Clark said, "I can't think of a better person to have in this position than Adam. He has the perfect mix of an excellent coastal engineering education and the ability to convey information to all levels of audiences. Wisconsin Sea Grant's future is bright with respect to coastal engineering." —EAW



Clark measuring corrosion pit sizes in a steel "coupon" that was placed in the Duluth harbor as part of his work on freshwater steel corrosion.



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

Aquatic Sciences Chronicle

a joint newsletter from UW Sea Grant and Water Resources Institutes

Add Your Support for Another 50 Years

As Sea Grant celebrates 50 years in 2022, you can play a role in supporting ground-breaking science, freshwater education and service to coastal communities for the next 50 years. Your gift will help make that possible and it's as simple as visiting this website:

go.wisc.edu/1msjt4



Julia Noordyk, water quality and coastal communities specialist

"I really believe that we need to talk about hope. We have to give people a strong vision of where we want things to go because as soon as we do that we start moving toward it rather than focusing on the negative things that have happened in the past."

For a different view of Wisconsin Sea Grant's past and future, please take a look at our brand-new 50 years video.

The six-minute video uses archival footage to revisit the early days of the program and then shifts, giving way to contemporary shots of Sea Grant-funded research, education and extension initiatives.

youtube.com/watch?v=UZa5YA8Dg1U