College of Letters & Science
UNIVERSITY OF WISCONSIN–MADISON

LIMNOLOGY NEWS

News for Alumni and Friends of the Center for Limnology

Fall 2026

Sustaining Long-Term Ecological Research



UW-Madison Center for Limnology "David Buoy" in Lake Mendota. *Photo: Jeff Miller*



Photo: Jeff Miller



From the Director

In 1980, the U.S. National Science Foundation (NSF) launched the Long-Term Ecological Research (LTER) program. In contrast with the standard 3-year research grant cycle, the LTER program was designed to study ecological processes over decades—time spans far longer than standard research grants. Remarkably, former Center for Limnology (CFL) director John Magnuson and colleagues successfully secured one of six inaugural LTER sites in the U.S. - the North Temperate Lakes (NTL) site was focused on documenting and understanding long-term changes in a suite of Wisconsin lakes.

45 years later, the NTL-LTER program involves ~15 Principal Investigators, has trained hundreds of graduate students, and has published ~1500 peer-reviewed papers. The core data set is globally significant as one of the longest running and most complete datasets documenting how our lakes are changing over decades. Critically important insights about climate change, invasive species, and water quality have emerged from NTL-LTER research. And scores of other research projects have leveraged the the NTL-LTER program. If you've heard that Lake Mendota is the most studied lake in the world, it's because of the NTL-LTER program. And the data are critically important for informing lake management in Wisconsin and beyond, including ongoing efforts to clean up the Madison lakes.

As NTL-LTER completes its 45th year of data collection, the future of the program is uncertain, due to changes in federal research funding priorities over the last two years. The loss of NTL-LTER would be a devastating blow to limnological research and the science-based management of lakes. In light of the uncertainty, we are proactively seeking new ways of maintaining the continuity of this globally important dataset and the science that it enables.

The good news is that a generous gift from John Magnuson in 2024 allowed the CFL to establish the Long-Term Research on Lakes fund. We are pleased to announce that the CFL faculty/emeriti have committed to matching 1:1 all gifts to the Long-Term Research on Lakes fund, up to $60,000 before the end of the year. Please consider supporting this fund in your end-of-year giving. And please do not hesitate to reach out to me for more information about how you can support our long-term research.

NTL research has demonstrated that our lakes can undergo abrupt changes. The last two years remind us that the societal landscape in which we conduct research can also undergo abrupt changes, and we are called to adapt. On behalf of everyone at the CFL, we are deeply grateful for the ongoing support of so many friends and alumni.

Warmly,
Jake Vander Zanden

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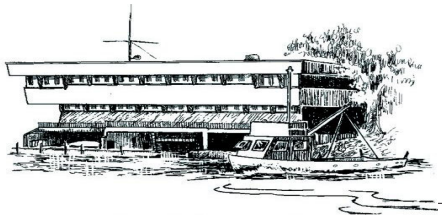


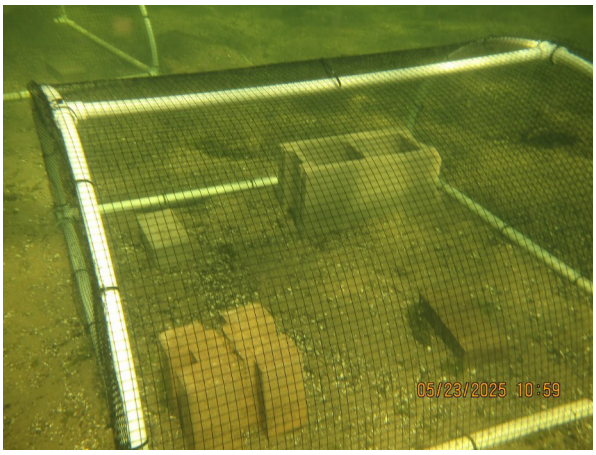
Revisiting the Zebra Mussel Mystery by Joseph Noeske and Helen Schlimm

The Center for Limnology (CFL) is no stranger to zebra mussel research and has led some thought-provoking studies on their suitability to various lake environments and their ecological impacts. Today new research on this invasive species is underway.



Joseph Noeske poses next to one of his zebra mussel exclosures in Lake Mendota. Photo: J. Noeske

Lake Mendota was shaken up in 2015 when invasive zebra mussels were first spotted. By 2018, their numbers had exploded to a peak density of over 40,000 mussels per square meter. But by 2024, they were peaking around 4,000 mussels per square meter, showing a decline of about 90%. But why? Joseph Noeske, a master's student in Jake Vander Zanden's lab, has been trying to unravel the reason behind this decline. His research is examining whether fishes in Lake Mendota are consuming zebra mussels, and whether this explains the population decline.



A close-up of one of Noeske's exclosure cages on the bottom of Lake Mendota. Photo: J. Noeske

Noeske constructed cages to keep fish out, to see if there would be more mussels inside after six months. These cages were installed at five sites all around Lake Mendota nearshore areas from early spring to late fall in 2025. Noeske visited them with SCUBA throughout the year to monitor mussel growth. In the end, the differences in mussel density and size showed that bottom-roving fish, primarily freshwater drum (sheepshead), had a significant impact at some sites. Noeske currently believes that fish predation is not a suitable explanation for the lakewide decline in mussel populations, but it may be a contributor. It is fascinating to see an invasive species decline so dramatically, but better understanding why could be the ticket to helping other lakes recover faster in the future.

So one more piece of a complex puzzle has been explored, but the mystery of what has caused the massive decline in Lake Mendota still remains to be answered. In an additional twist, zebra mussels did not just stick to Lake Mendota. They have since moved downstream to the other Yahara lakes. CFL researchers needed more help tracking these mussels, so they launched a community-based monitoring program.



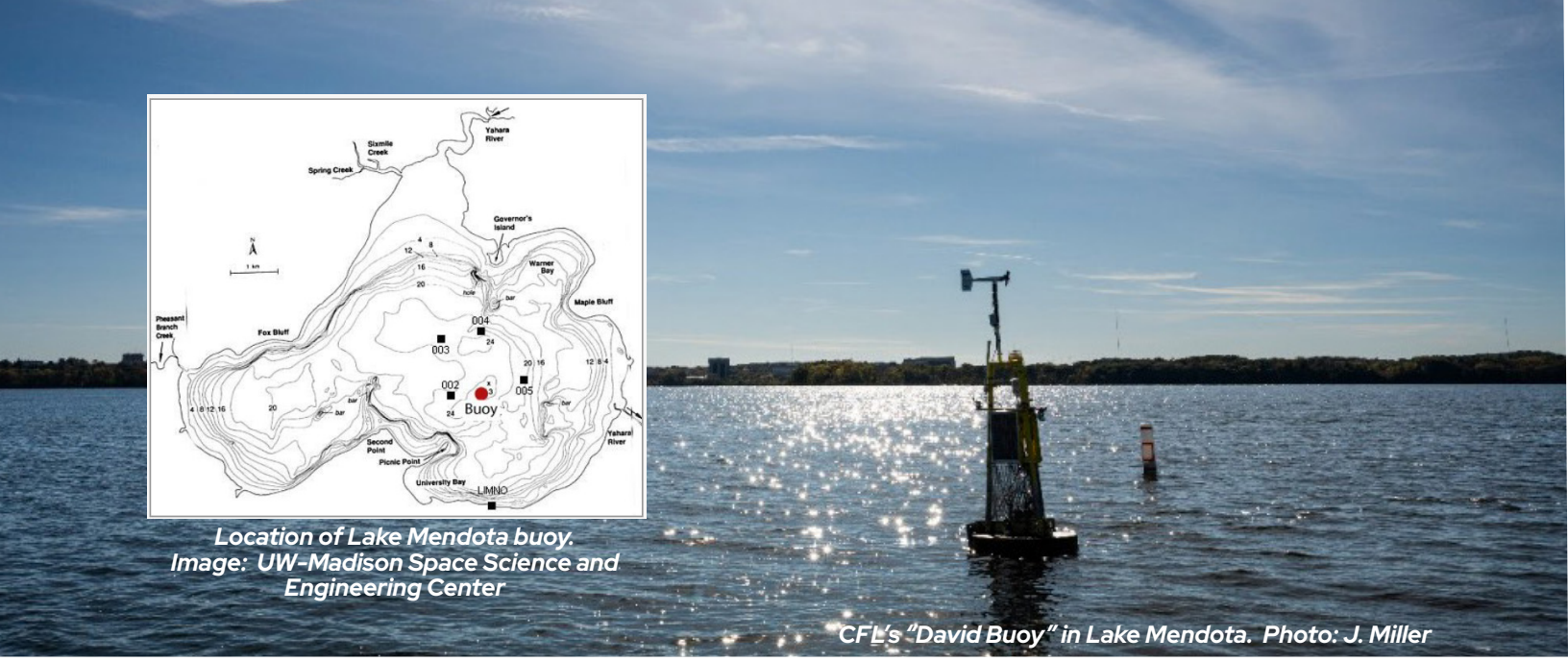
A brick covered in zebra mussels after spending a summer suspended from a volunteer's pier in Lake Mendota. Photo: H. Schlimm.

The Yahara Lakes Zebra Mussel Monitoring Program is a collaborative effort among the CFL, the Clean Lakes Alliance, and a committed group of volunteer monitors in the greater Madison area. Since 2024, community members have monitored the spread and abundance of zebra mussels on all five lakes by deploying bricks from piers throughout the summer. CFL researchers count the mussels to create a yearly status report. They have found a noticeable lack of large adult mussels at most sites across the lakes and the first zebra mussel attached to a brick in Lake Wingra in 2024. Thank you to all the volunteers for participating in this ongoing program. The CFL will share further findings about this invasive species as the research progresses.



CFL undergraduate interns, Abigail Rajala and Isabel Nathan, counting zebra mussels from volunteer bricks. Photo: H. Schlimm





Location of Lake Mendota buoy. Image: UW-Madison Space Science and Engineering Center

CFL's "David Buoy" in Lake Mendota. Photo: J. Miller

Celebrating 20 Years of "David Buoy" by Dela Anderson

As the autumn leaves turn yellow, a similar hue can be seen in the middle of Lake Mendota – our meteorological and water quality monitoring buoy. This limnological instrument, affectionately known as "David Buoy", is deployed over the deepest point of the lake (25m or 83ft). This year, join us in taking a look at the buoy's past, present, and future as we approach its 20th anniversary.

From "Someday" to Sapelo

Before David Buoy bobbed in the waters of Lake Mendota, it was an idea floating in then-PhD student, now CFL Distinguished Research Professor, Paul Hanson's head. He'd been working on a floating device that measured variables like carbon dioxide and temperature. When one of his courses required him to test a field project on Sapelo Island, Georgia, Hanson knew just what to bring.

"He put it in a tidal creek and called it the S.S. Mummichog, after the Georgian fish," says CFL Professor Emily Stanley as she recounts the history. "After a few days of tinkering, it worked."

Inspired by this success, Hanson brought the device back to Wisconsin where he teamed up with researchers from the UW–Madison Department of Atmospheric and Oceanic Sciences to bring a water quality monitoring buoy to Lake Mendota. On a balmy day in June of 2008, it was deployed and began taking measurements. Today, it measures roughly 15 water quality variables.

"It felt like taking a huge step forward in terms of our sophistication and what we were measuring on the lake", adds Stanley, who became the lead of the North Temperate Lakes Long-Term Ecological Research (NTL-LTER) program which now operates the buoy. "There were certainly a lot of fits and starts and gaps in the data that first year getting it going, but it was really cool to see it come to life."

Golden Years

As David Buoy came to life, so did the team of people stewarding it. Collaborators across the NTL-LTER program and the UW-Madison Space Science and Engineering Center (SSEC) worked hard to make its data reliable and accessible through various web-based apps and platforms.

SSEC Research Associate Jonathan Thom became the instrument's technician, joined by former NTL-LTER Information Manager Mark Gahler in 2014. In 2015, the two developed a system that allowed for the buoy to be deployed and removed each year without the use of divers, widening the window for data collection.

"One fall, we tried an experiment to see how late we could keep it deployed before winter. We made it to mid-December, on the absolute last possible day, and with the help of NTL Researcher Paul Schramm, barely got it off in time. Nearly the entire shoreline of Mendota had too much ice to tow the buoy off," says Gahler.

As freshwater research at UW-Madison soared, so did the possibilities of David Buoy. In 2019, a YSI sonde was added to the buoy to provide more detailed measurements, such as the algal pigments chlorophyll and phycocyanin. These variables can be indicative of harmful algal blooms (HABs). In 2022, CFL researchers published a study highlighting critical insights on the connection between the rise in extreme precipitation events and extreme nutrient inputs (which contribute to HABs), using data from David Buoy.

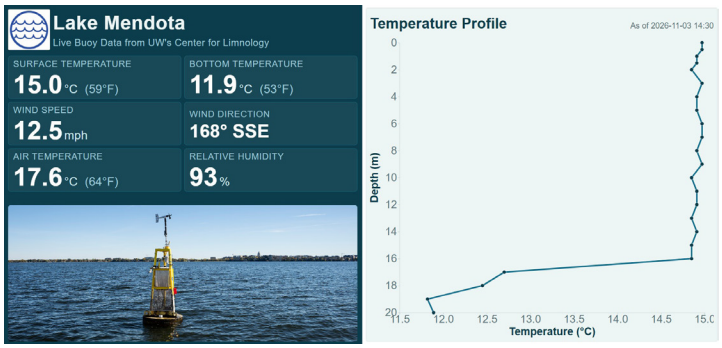
In 2026, researchers continue to investigate issues at the nexus of human and ecological health at Lake Mendota's deep hole. Combining the buoy with cutting-edge technology such as hanging nitrate sensors which provide a fine-grained look at nutrient cycling or the Fast Limnological Automated Measurements (FLAMe)

which provides detailed spatial measurements across the lake surface lets them ask pressing questions. "Mendota is not fundamentally different from other lakes in the area," says Stanley. "But since we know so much more about it, we can ask more questions and actually be able to answer them."

Supporting Madison's Many Lake Users

All of this information not only helps generate insights into how lakes function, but also supports the broader Madison community. David Buoy's landing site draws ~20,000 unique monthly visitors, as well as countless more to various second-party apps and platforms.

Since the buoy features a weather station, UW-Madison Police Department Lake Rescue and Safety (LRAS) relies on it for real-time information on specific conditions on the lake, such as wind direction, wind velocity, and water temperature. "Before the buoy, we had to dispatch one of our rescue boats to gather wind information via a handheld anemometer," says LRAS Director Sean Geib."This took significant time and resources."



Live Lake Mendota conditions from David Buoy landing site.

Outdoor UW Director David Elsmo echoes the buoy's importance for lake users, calling it a beacon of information. "Having a very current data point for us to look at in our neighborhood, not sixty feet in the air but right where all our users are going to be experiencing the weather is huge," says Elsmo. "We make a tremendous amount of decisions based on the data that's feeding us."

While many rely on the data to make sailing and boating decisions, it proves useful for the fishing community as well. "The Lake Mendota buoy provides critical information to local anglers and is an invaluable resource for folks getting out on the lake to fish," says D&S Bait Shop owner Pat Hasburgh. "Water temperature and wind speed are the information we use most, and the thermocline data is especially critical in the fall while waiting for turnover."

In addition to recreation, David Buoy plays an important role in community education. "It has proved to be more than a research tool," says Clean Lakes Alliance Deputy Director Paul Dearlove. "We see it as complementing our citizen monitoring program, providing a wealth of real-time water quality information we can share through LakeForecast.org."

It's also a popular stop on Lake Mendota educational field trips through the CFL, adds Research Specialist & Outreach Coordinator Helen Schlimm. "People have often never seen a research buoy before and get to view it up close. I talk about the value of high frequency data, the various users of the information, how to access live data, and why it's positioned there."

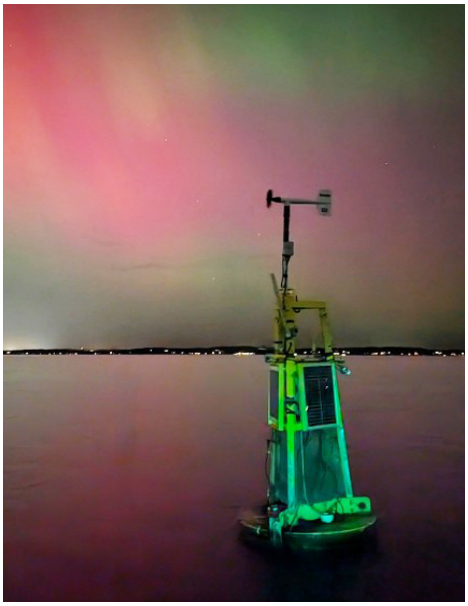
Future Directions

As we look towards the next 20 years of David Buoy, making its data even more accessible is a top priority. NTL-LTER Information Manager Sam Blackburn has helped achieve this through two new data visualizations. One lets users explore the most recent observations for a select group of variables, while the other lets them view time series of all buoy data from the most recent observations back to the first deployment of the current year.

"These viewers are already adding a new dynamic to teaching and outreach activities," says Blackburn. "In the future, being able to show off additional aspects of our research could draw excitement and lead to partnerships that could make it possible to put buoys on other lakes in the Yahara Chain."

David Buoy has provided so much more to the Madison community and the science of limnology over nearly two decades than anyone could have imagined two decades ago. But because the buoy is part of the North Temperate Lakes Long-Term Ecological Research Program, unfortunately its future remains uncertain (see page 11). Our goal is to ensure that we can keep David Buoy afloat through philanthropic support, and possibly even with support from the community of users.

Please consider supporting our 'Long-Term Research on Lakes' fund to help ensure the future of David Buoy.


David Buoy during the Aurora Borealis, October 2024. Photo: G. Wilkinson

Does Forward-facing Sonar Help You Catch More Fish? Well, It Depends... by Max Wilkinson and Zach Feiner

Angling technology has gotten increasingly powerful in recent years. Newly developed forward-facing sonar (FFS) units now give anglers the ability to pinpoint the location and watch the behavior of fish in real time, a seemingly massive advantage. This has led to considerable concerns that new technology could provide an unfair advantage to anglers and make overfishing more likely. However, there has been little research on what the actual effects of FFS are on angler catches, and no true experiments trying to isolate those effects.



The research team working up the first smallmouth bass of the 2025 experiment. From left: Adam Pickhardt, Bridger Wilson, Olaf Jensen, John Duvall, Max Wilkinson, and Kaden Ball. Photo: Z. Feiner

Researchers at the CFL set out to answer this question during a summer-long angling experiment led by incoming PhD student Max Wilkinson, WDNR scientist Greg Sass, CFL Assistant Professor Zach Feiner,* and former CFL faculty Olaf Jensen in 2025. Two teams of two undergraduate anglers fished for smallmouth bass on Nebish Lake in Vilas County nearly every day from the end of May through August. During the first half of the summer, one team used FFS while the other fished without technology, and teams swapped halfway through the summer, tracking their catch rates and fishing locations via GPS.

After fishing for a combined 512 hours (equivalent to fishing 24 hours a day for three weeks straight) and catching 1,722 smallmouth bass, the results came in – using FFS actually lowered catch rates. On average, teams caught about 2.5 fewer fish per day after using FFS compared to fishing without it. Using FFS did allow anglers to catch slightly larger fish, by slightly less than 1 inch, although we will let readers decide whether that tradeoff is worth it.

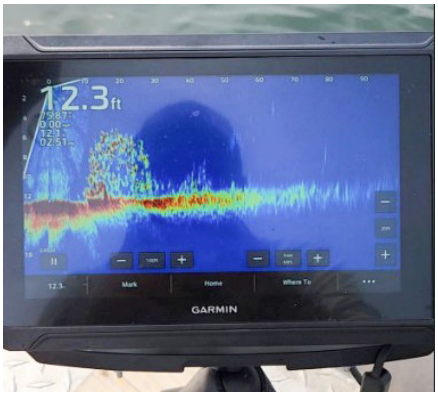
Why did FFS affect catch and size? It seems that it influenced angler behavior. While using FFS, anglers covered less distance, moved slower, and turned at sharper angles, consistent with using the technology to actively search for and target individual fish. They also fished in different places. With FFS, anglers targeted potentially larger fish in deep, mid-lake areas, while without it, anglers tended to target more easily visible habitats along the shoreline. That extra time spent searching seems to have led to fewer chances of catching fish than if anglers had just kept their lines in the water.



Example tracks from July 2, 2025 for the team fishing without (left) and with (right) forward-facing sonar highlighting differences in angler behavior. (Reproduced from M. Wilkinson et al. 2026.)

After these unexpected results, the next question the research team wanted to answer was whether the influence of FFS on angler behavior and catch changed depending on the species of fish or type of lake being fished. So, Wilkinson, Feiner, Sass, and Jensen decided to repeat the experiment in the summer of 2026 on Bearskin Lake in Vilas County, this time targeting two culturally and recreationally important Wisconsin fish species – yellow perch and muskellunge (aka muskies). Bearskin Lake hosts a diverse fish community and contains high densities of muskies and yellow perch, making it a great study system to address these questions. Like the 2025 study, two teams of two anglers fished Bearskin Lake four days a week from May through August, with one team having access to the technology for the start of the summer and later switching to the other team halfway through the summer.

The team only caught 14 muskies all summer, potentially putting some truth to the "fish of 10,000 casts" and preventing strong conclusions about the effects of FFS. However, after catching 2,731 yellow perch throughout the course of the summer, early results suggest FFS may have increased catch rates for that species, although this effect may have changed as the anglers continued to use the technology. For every additional day the teams had access to FFS, they caught approximately five more perch than they did the previous day. Interestingly, the technology had no effect on the size of yellow perch caught, unlike the smallmouth bass study.



Anglers used a forward-facing sonar unit to find fish, which are visible as red marks on the left side of the screen. Photo: M. Wilkinson

In addition, although it may seem that FFS had a positive effect on yellow perch catch rates, it is also likely that the teams were able to "learn" where the good fishing spots were and when to fish them, making it difficult to untangle whether the increase in catch rates was due to the technology or simply due to the anglers learning the lake. Thankfully, the team of researchers completed a creel survey of other recreational anglers on Bearskin Lake over the course of the summer, so they will be able to compare their catch rates with those of the study teams to better isolate the effects of the technology from other learning effects.

Overall, the results of these studies indicate that the effect of FFS may be specific to the species of fish being targeted, the type of lake being fished, or even the anglers themselves. There is plenty more work to be done to understand the influence of emerging technologies on angler catch rates and behavior, and the researchers intend to pursue more questions related to how these new technologies may influence fisheries at a broader scale. Read the paper.



Undergraduate researcher Adam Jasensky holds a yellow perch caught in Bearskin Lake during the 2026 experiment.

**Zach Feiner was recently appointed Assistant Professor in the Department of Biology and Center for Limnology as part of the RISE-EARTH hiring initiative. Zach started working with CFL in 2020 as a Research Scientist focusing on fisheries ecology, and we're thrilled to continue working with Zach in his new UW faculty position. Congratulations, Zach!*

Summer Fieldwork Spotlight 2026: Mongolia

Graduate students Quinn Smith and Joey Munoz and undergraduate student Kallen Wank traveled across the globe to Mongolia for 6 weeks this summer to conduct field research through the National Science Foundation's International Research Experiences for Students program. They were part of a 14-16 person crew consisting of faculty (including former CFL Professor Olaf Jensen), graduate, and undergraduate students from around the US, Mongolian scientists, and an amazing Mongolian support crew who assisted with overland travel and provided food for the camp. The team's research was split between Lake Hovsgol, Mongolia's largest freshwater lake by volume, and the Eg-Uur River Basin, which is home to multiple culturally and economically important fish species like the Siberian taimen. Taimen are a highly prized and endangered salmonid (a family of fishes including trout and salmon) that can grow up to six feet long.



Quinn Smith with a taimen (Hucho Taimen) on the Uur River in Mongolia as part of a project to study salmonids using facial recognition methods. Photo: Tsogbayar Erdenekuu

Quinn studied temperature differences, or thermal heterogeneity, in the Eg-Uur Rivers by mapping out around 300 river kilometers. He classified different habitats available for imperiled native fishes (including taimen) to identify bright spots of thermal habitat given a changing climate. Joey and Kallen studied the acute thermal tolerance of lenok and grayling, two salmonid fishes that inhabit freshwaters in northern Mongolia. They tracked the movement of these species in and out of a spring-fed cold-water refuge in the Eg River to better understand the behavioral strategies fish use to handle thermal stress as temperatures warm. Everyone agrees that the opportunity to do research in a breathtaking place with wonderful people was an experience of a lifetime, one they will hold close to their hearts throughout their careers.



Joey Munoz (left) with a net pen for holding fish and Kallen Wank (right) with a fly rod standing in Lake Hovsgol, Mongolia. Photo: Eliana Nungaray

A Certificate For The Future: Freshwater and Marine Sciences

by Dela Anderson



Jake Vander Zanden on Lake Mendota with a group of UW-Madison undergrads. Photo: Dan Cornelius

UW-Madison has a multitude of faculty whose research and teaching focus on freshwater and marine ecosystems and water resources broadly. As of fall 2025, undergraduate students can tap into this weatlth of experience by declaring the undergraduate Freshwater and Marine Sciences (FMS) certificate.

The program requires 15 credits of coursework combining the physical and biological sciences in freshwater and marine environments. "Addressing the complex water challenges of the next century will absolutely require interdisciplinary approaches – in both teaching and research", says Jake Vander Zanden, CFL Director and Professor of Biology. "The FMS certificate is a critical step in this direction, and further elevates water scholarship and teaching at UW-Madison."

Students seem to agree, with five enrolling the day it opened last fall and numbers rising to 22 within a month and 73 today. Courses with hands-on experiences such as Botany 330: Algae, which includes a field trip to a local lake or stream, and Zoology 320: Field Marine Biology, which includes a winter break trip to the Florida Keys, have proved to be popular with students.

Certificate advisor Ginny Jackson sees these applicable skills as crucial to the future of water. "Complex water challenges like water quality and safety, watershed management and restoration, and agricultural water management need well-rounded solutions," says Jackson. "The program gives students the practical tools needed to make a real-world impact."

The Freshwater Collaborative of Wisconsin - a statewide effort connecting 13 Universities of Wisconsin campuses with government, industry, and local communities working together to make Wisconsin a global leader in water science - provided initial support for the development and launch of the FMS certificate, and helps students build on their coursework to do just that. Jackson adds that the statewide initiative brings "water science to life" for students through undergraduate research and partner-hosted internships.



UW-Madison undergrads working from CFL dock on Lake Mendota. Photo: T. Wolfram



UW-Madison undergrad uses a Van Dorn sampler to collect water at depth on Lake Mendota. Photo: T. Wolfram

The CFL is proud to support this legacy of cross-campus collaboration as Wisconsin leads the way in aquatic science education. The FMS certificate students will become our future leaders, scientists, policy-makers, and stewards of our freshwater resources. Providing a foundation of knowledge about freshwater science will help them, in turn, serve our local and global community in the spirit of the Wisconsin Idea.

Field Samples: Graduate Students



Emma Marchisin (PhD, Hanson)

Emma grew up on the Jersey Shore, between the Atlantic Ocean and freshwater rivers. After earning her BS in Environmental Science from Univ of Rochester, she moved to Montana for an AmeriCorps term, conducting water quality monitoring on the Gallatin River. This experience inspired her to pursue graduate school, completing her MS at UW-Madison in summer 2026. She continues at the CFL as a PhD student, building on her research at the intersection of limnology and computer science. Her research focuses on how machine learning can help us better capture the complex dynamics of lake ecosystems.



Joseph Noeske (MS, Vander Zanden)

Joseph grew up in Milwaukee and earned his BS in Biology at UW-Madison in 2024. Being obsessed with aquatic sciences from a young age, limnology was an inevitable path for him. He worked as the lab manager for the Vander Zanden lab from 2024-2025, and is pursuing his MS in the same lab. His research focuses on the impacts of fish predation on invasive zebra mussel population. He is a trained rescue SCUBA diver, and uses this skill for much of his Lake Mendota mussel research. He hopes to pursue a career that involves both aquatic invasive species research and science diving.



Aubrey Wendorff (MS, Dugan)

Aubrey grew up in Lombard, IL and earned her BS in Ecology, Evolution, and Behavior from the Univ of MN. Despite her broad scientific interests, she always found herself drawn to aquatic ecosystems. Working in a limnology lab in undergrad only furthered her love for water (and disdain of road salt). Now, she is pursuing her MS at the CFL, studying the impact of road salt pollution on internal phosphorus loading in northern temperate lakes. She also helps monitor chloride in the Yahara Chain of Lakes and their tributaries in collaboration with the United States Geological Survey.

Catching Up With Alum Shelley Arnott



Where are you now and what are you up to? I'm at Queen's Univ in Kingston, Ontario - on the shores of Lake Ontario. I'm a professor in the Biology Dept and Director of the Queen's Univ Biological Station (QUBS). Most of my research focuses on understanding how zooplankton responds to environmental change - especially co-occurring stressors.
What led you to study at he CFL back in your grad school days? Any fond memories? The people! I worked with Mike Vanni for my MS (1992) and we did field work at Univ of Notre Dame Environmental Research Center (UNDERC.) I lived at CFL Trout Lake Station (TLS) for one summer and UNDERC for another summer so I got to know a lot of people at the CFL and loved being in the Northwoods during the summer. I was really interested in exploring how dispersal impacted communities and John Magnuson and Tom Frost were willing to guide me in that journey during my PhD (1998). I loved the close-knit community at CFL (and continue to be in touch with and collaborate with many alumni) and there were so many opportunities to learn from other students, post-docs, and visiting scientists. Summers at TLS were equally amazing. It was great to have an opportunity to go in the field with other researchers and learn from them. I have very fond memories of going on 'plant walks' with Susan Knight. She has a wonderful ability to bring a forest floor to life with her enthusiasm about plants.
Are there any new research projects, life developments, hobbies, etc. we should know about? I'm continuing to do research on road salt and have students exploring winter ecology. The biggest change/challenge in my life was becoming Director of QUBS in July 2025. I'm loving the opportunity to find new ways to build community around field work and new research projects and provide opportunities for students to become immersed in science and nature at a field station. For hobbies, I'm obsessed with being on the water. I'm on Lake Ontario 2-3 days a week at 6:30am (kayak, paddle board, or canoe) before I go into work and often explore lakes inland with my dog, Birch.

Fall Creature Feature by Jackie Lemaire and Carrie Kissman



Jackie Lemaire collecting a water sample on Lake Mendota.

This summer, in a CFL blog post, we highlighted some of our notable Lake Mendota residents: Cyanobacteria (aka blue-green algae). Now, as we move into the autumn season, we might not think about these lake microbes still lurking around… yet they are still thriving in Madison's waters. To determine what species are present through time, we sequence the DNA of the organisms in the water (like a forensic science investigation). However, to get a glimpse of who is currently present, we can do microscopy to identify, count, and image the organisms present in the sample.

Every year, as expected, we see a similar succession of greenness overtake the lake. However, it can be hard to predict the exact timing and the exact culprits.

Jackie Lemaire, PhD candidate at UW-Madison, conducts research under lead investigators Trina (Katherine) McMahon and Jake Vander Zanden. Jackie continues the long-term surveillance of Lake Mendota, as numerous graduate students have done before her. She collects water samples twice a week to study the microorganisms in the water to track long-term trends of who is there, how they are interacting (ecology), and how they are changing (evolution). The lab now has 20 years of microbiome data published (Rohwer, PNAS, 2023) that they continue to build upon.

Many of the cyanobacteria in Lake Mendota are familiar to us from the two-decade long time series and some even have distinct shapes and sizes.

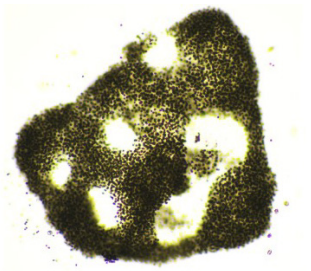
Let's meet some of our usual cohort of cyanobacteria!



Aphanizomenon (center) & Dolichospermum (spirals). Toxic, nitrogen fixers.

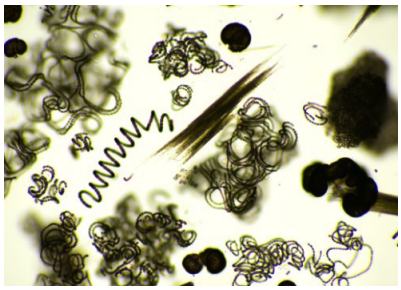
Aphanizomenon is the first cyanobacteria to grow, forming bright green surface blooms when the waters are still cool in late May. As the season progresses, we begin to see *Dolichospermum, Microcystis, Gloeotrichia*, and *Limnoraphis*. Each has its own unique characteristics. Some can take nitrogen from the atmosphere and turn it into more available forms for themselves or other organisms in the water (aka nitrogen fixing).

Many produce toxins (e.g. microcystin, cylindrospermopsin, anatoxin-a) that impact the health of the ecosystem as well as the humans and animals who use it. *Dolichospermum* and *Gloeotrichia* produce a volatile taste and odor compound (geosmin) that has a very strong smell, noticeable in the air far and wide during these blooms.



Microcystis. Toxic.

In October, we still see a number of diverse species. On October 22nd, there was a significant bloom that looked as if someone spilled a large volume of green paint across the surface of the lake. Cyanobacteria are not inherently bad. They are one of the most ancient organisms on Earth. They are fascinating in their ability to do oxygenic photosynthesis, meaning that they can use sunlight for energy and convert sunlight, water, and carbon dioxide into oxygen which other aquatic organisms rely on.



Lake Mendota under the scope, a Cyanobacteria soup. Oct 22, 2026



Gloeotrichia. Non-toxic, geosmin producer.

Climate and land-use change are altering ecosystems and degrading the services they provide. Warming temperatures, changing precipitation patterns, and increasing nutrient inputs are exacerbating the problem of toxic cyanobacterial blooms in freshwater lakes. Nutrient runoff has led to the eutrophication of many bodies of water, and an overgrowth of bloom-forming organisms. The resulting poor water quality is a disruptive consequence which is highly visible to the public.

Our 20-year time series dataset presents a unique opportunity to study the community dynamics to better understand the factors that lead to cyanobacteria blooms and the ecological and evolutionary interactions that drive their success.

(All microscopy images by Jackie Lemaire.)

Sustaining Long-Term Science in a Time of Rapid Change

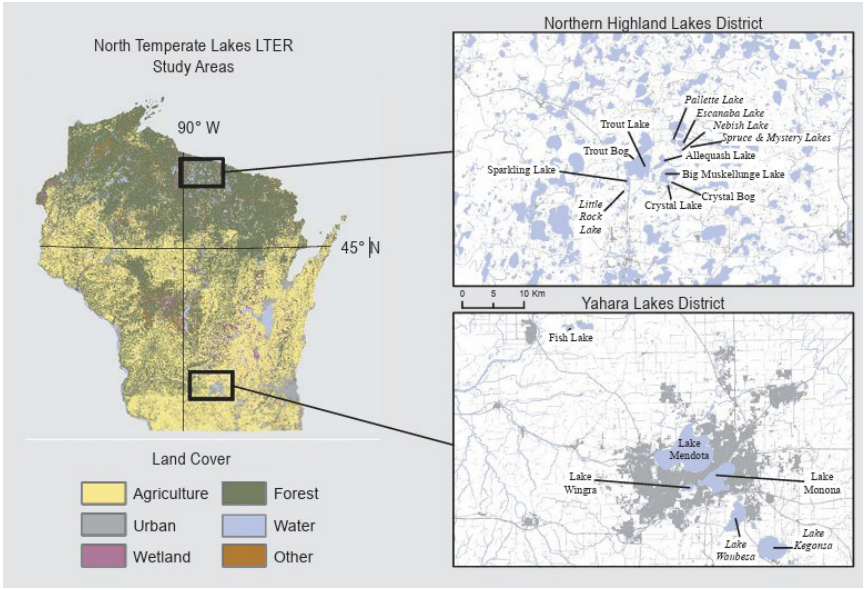
by Grace Wilkinson

Lakes are always changing. Some changes are part of the seasonal rhythm of a lake, others unfold gradually over many years, and still others happen abruptly, pushing ecosystems in surprising directions. The consequences can emerge slowly or lag far behind their causes, often making ecological shifts difficult to recognize as they happen. Former CFL director John Magnuson referred to this challenge as the "invisible present": environmental change surrounds us but can be difficult to perceive without sustained observation. That idea lies at the heart of the National Science Foundation's Long Term Ecological Research (LTER) Network, whose sites study ecological change over decades. The North Temperate Lakes (NTL) LTER program, based at UW–Madison's CFL, is one of those sites. Since 1981, NTL researchers have worked not only to document change in Wisconsin lakes, but to understand why lakes change, what those changes mean, and what may come next.



Susan Knight teaching about bogs during weekend field trip at Trout Lake Station.

Today, NTL researchers couple decades of observations across eleven Wisconsin lakes with experiments and modeling to turn long-term data into ecological understanding. This combination is what makes NTL especially powerful as a scientific program. Across 58 datasets, NTL has amassed hundreds of thousands of observations spanning the physical, chemical, and biological components of lakes. Together, these records form one of the most comprehensive long-term lake datasets in the world, providing an unparalleled resource for scientists at UW–Madison and across the globe. Using these datasets, NTL researchers have produced more than 1,500 scholarly works and trained hundreds of students. This scientific foundation also enables NTL to support state and federal agencies, Tribal Nations, local governments, and lake organizations in tackling some of the most difficult challenges facing Wisconsin's lakes, while our education and outreach programs connect more than 3,000 people each year with lakes and our lake science. Ultimately, though, NTL is not just about samples, publications, or spreadsheets. It is about people: the expert staff who collect the data, the researchers who turn data into understanding, the agency partners who put that knowledge to work, and the communities that benefit from science that helps them understand and respond to change.



The NTL LTER study areas in the Northern Highland Lake District (NHLD) and the Yahara Lake District (YLD), WI. Locations of the 7 core NHLD and 4 core YLD lakes along with selected secondary study lakes (italics font) are indicated in the inset maps on the rght.
(From 2020 NTL Proposal: lter.limnology.wisc.edu/proposals.)

The future of NTL is now unusually uncertain. For nearly five decades, the National Science Foundation has supported NTL through successive six-year grants. We are now nearing the end of our current award and seeking support for the next cycle, but this renewal comes during a period unlike any in the program's history. The typical LTER renewal pathway was no longer available when we submitted our proposal this spring, and changes at NSF have significantly constrained new grant funding. We do not yet know what that means for NTL or what the path forward will look like. But the program has always been sustained by more than a grant; it is sustained by people. Whatever comes next, we will find a way forward.

THANK YOU FOR SUPPORTING THE CFL

The generosity of our supporters allows the Center for Limnology to continue to train the next generation of limnologists, generate new knowledge about inland waters, and share this knowledge with diverse audiences. Please consider making a gift to the Center for Limnology.

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Farewell Adam Hinterthuer and Olaf Jensen



Adam during Open House 2025

Maybe you noticed that the articles in this issue no longer have Adam Hinterthuer in the byline. We are very proud to share that earlier this year, Adam became the Associate Director of the Institute for Journalism & Natural Resources. Adam made an incredible contribution to the CFL's mission for over 15 years as our Communications Director - sharing knowledge about our invaluable freshwaters with local communities, Wisconsin, and the wider world. Adam led all communications – writing newsletter articles, press releases, digital media content, fundraising messaging, and handling media relations. Congratulations, Adam!



Olaf in his natural habitat

Olaf Jensen recently became Director of the Cornell Biological Field Station and an Associate Professor in the Ashley School of Global Development and the Environment at Cornell University. Olaf joined the faculty at the CFL in 2019. Olaf is one of the world's leading fisheries researcher and has made many important contributions to our understanding of marine and inland fisheries, including pioneering the study of fisheries as social-ecological systems. At UW-Madison, he also led field research experiences for students in Japan, Mongolia, and Florida. Olaf - you will be missed!