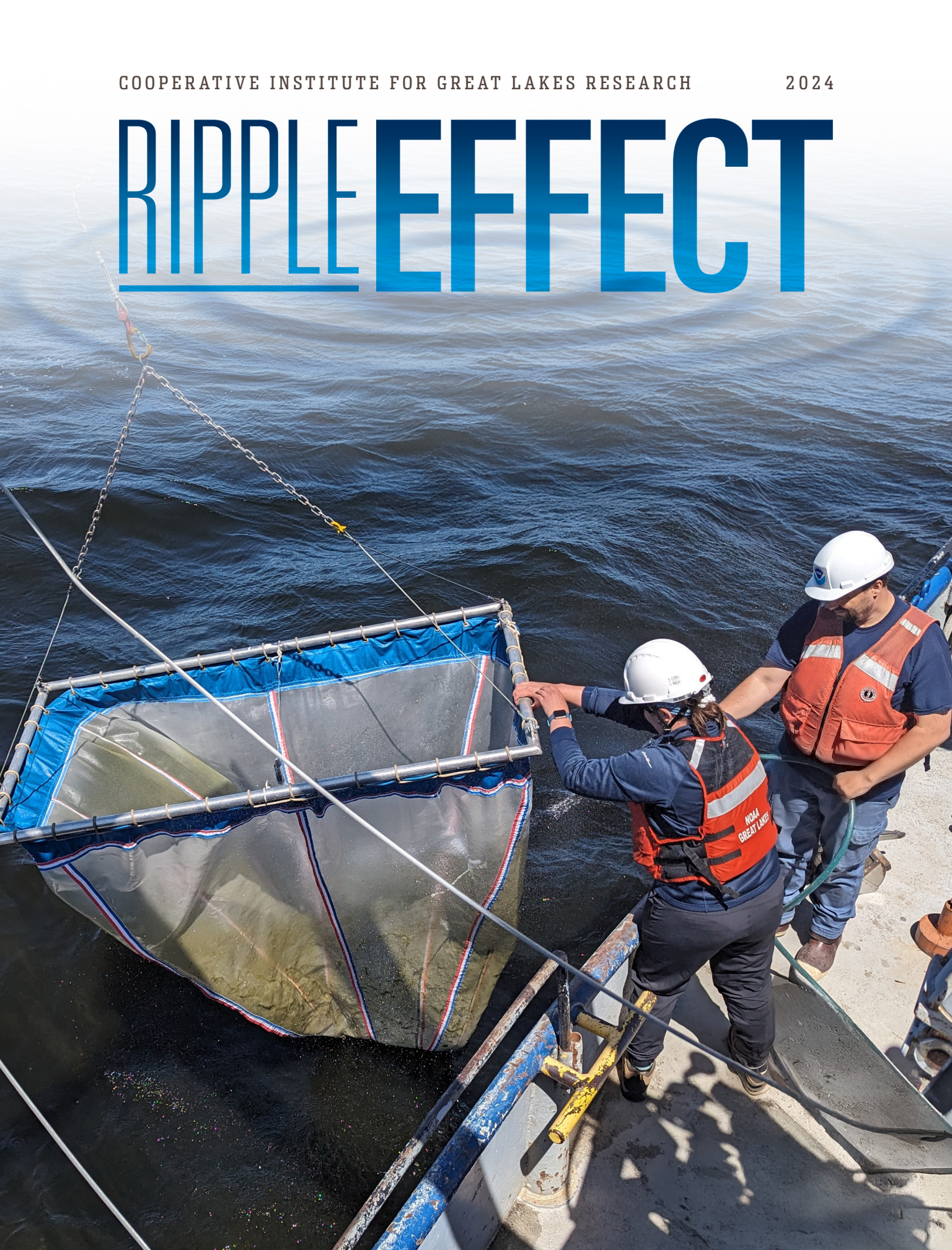


# RIPPLE EFFECT



# What's Inside

## Mission Statement

As a NOAA Cooperative Institute, CIGLR helps NOAA accomplish its goals for research and management of the Laurentian Great Lakes by leading exciting new research efforts, training the next generation of Great Lakes scientists, expanding NOAA research in the Great Lakes through our Consortium, and translating research into actionable science to meet societal needs. The Great Lakes Environmental Research Laboratory (GLERL) is our primary NOAA sponsor and home of CIGLR research personnel.

## Director's Letter

**CIGLR Energizes Great Lakes Partnerships with seventh All Partners Meeting**  
**CIGLR Welcomes New Research Scientist, Abby Hutson**

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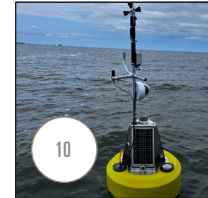
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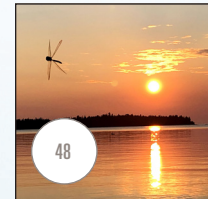
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**Predicting Algal Toxins**  
WITH ADVANCED BUOY SENSORS



**PHOTO CONTEST**  
**Winners**

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-  @CIGLR\_UM
-  @ciglr\_um
-  Cooperative Institute for Great Lakes Research
-  CIGLR um
-  Cooperative Institute for Great Lakes Research

Cover Photo: Aubrey Lashaway

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[ciglr.seas.umich.edu](http://ciglr.seas.umich.edu)

# Dear Friends and Colleagues,

The past year was full of celebration and collaboration, accomplishments and change. In April, the Cooperative Institute for Great Lakes Research (CIGLR) was delighted to host a gala to celebrate the 50th anniversary of the Great Lakes Environmental Research Laboratory (NOAA GLERL) (see p. 3). Current and former NOAA GLERL and CIGLR colleagues and partners were joined by leaders from the University of Michigan (U-M) and NOAA, including School for Environment and Sustainability (SEAS) Dean Jonathan Overpeck, NOAA Administrator and Undersecretary of Commerce Rick Spinrad, Assistant Administrator for NOAA Research Steve Thur, and Deputy Assistant Administrator for Science John Cortinas, underscoring the historic nature of this momentous occasion. Remarks by NOAA GLERL Director Debbie Lee and a talk by renowned Great Lakes author Peter Annin highlighted the important impacts of five decades of scientific excellence at NOAA GLERL. CIGLR is honored to have been an integral part of much of that history. We were also honored to be well-represented by speakers at the special NOAA GLERL 50th anniversary symposium at the International Association for Great Lakes Research meeting in Windsor, Ontario in May.



CIGLR Director,  
Dr. Gregory Dick


For the first time since before the pandemic, we held a CIGLR All Partners meeting in person. All members of the CIGLR Consortium participated — 10 universities, three companies, and two NGOs — and the power of partnerships between universities, NGOs, the private sector and NOAA was on full display. I was inspired to see new students, postdocs, and faculty engaging in Great Lakes research for the first time. It was exciting to hear about new technologies, such as the use of existing telecommunications cables on the lake bottoms for winter observations, and the use of artificial intelligence for designing observing systems and interpreting massive streams of data.

This was a banner year for us in terms of pursuing competitive, external grants from NOAA and other funding agencies. Research scientist Casey Godwin, PhD (U-M, CIGLR) landed a \$1.75 million NOAA grant to establish a Great Lakes Marine Biodiversity Observation Network. This project will integrate

multiple technologies to track shifts and losses in biodiversity under pressure from invasive species, climate change, hypoxia, and harmful algal blooms. Here we are partnering with NOAA GLERL, Oregon State University, the Great Lakes Fisheries Commission, and the Great Lakes Observing System to assess habitat and biodiversity across a range of spatial and temporal scales. Dr. Godwin is also a key player, along with me, on a new \$6.5 million grant from the National Science Foundation and National Institutes for Health to assess how climate change is affecting harmful cyanobacterial blooms and their impacts on human health. The Great Lakes Center for Freshwaters and Human Health brings together scientists from 11 universities, CIGLR, and NOAA GLERL to tackle this challenge.

CIGLR strives to develop the next generation of freshwater scientists, and the workforce needed to understand and protect the Great lakes. We invest in training and mentorship of people at

all career stages, from undergraduate students in our Great Lakes Summer Fellows program to graduate students, staff, and postdocs in our laboratories, to research faculty. Thus, it is a great pleasure to watch members of the CIGLR family learn, grow, earn recognition, and advance to new roles. This year, it was particularly gratifying to see two of our long-time staff be recognized with university-wide awards from the Office of the Vice President for Research (OVPR). Glenn Carter received the Research Associate Recognition Award for his extraordinary contributions to research on *Dreissena* mussels and the lower food web, and for improving our workplace through mentoring colleagues and promoting a culture of safety and respect in the lab and aboard vessels. Songzhi Liu received the Research Data Management and Analysis Staff Recognition Award for his outstanding and longstanding performance as the Operations Manager for NOAA's CoastWatch Great Lakes Node (since 1997!). Songzhi's work to obtain and deliver satellite observations



of the Great Lakes to data users, and to train students, scientists, and professionals across the Great Lakes region, exemplifies CIGLR's commitment to doing science in service of the public. How remarkable that among the thousands of wonderful staff that work at U-M, CIGLR received two of the 15 OVPR awards! Glenn and Songzhi embody the culture and values that we strive for at CIGLR and I could not be more proud to work with them.

Four of our staff were recognized with 2024 CIGLR Staff Awards. Jasmine Mancuso received the Research Excellence Award for her passionate and excellent work on harmful algal bloom research. Riley Ravary won the Science for Society award for building the CIGLR Research Engagement Team and taking it to new heights in engaging stakeholders, rightsholders, and end users of CIGLR research. Anna Boegehold and Madeline Tomczak earned the CIGLR Community Award for building community and supporting their colleagues. Mary Ogdahl was recognized by SEAS with the Most Valuable Player Award, "celebrating the employee who consistently delivers exceptional results, makes significant contributions to the team and goes above and beyond their role to support the SEAS community." That certainly describes Mary!

This year also saw a number of our team members advance through the ranks. Brianna Ellis, Erica Pillar, and Olivia Doty were promoted from their temporary positions to full staff as a Research Coordinator, Aquatic Chemistry Laboratory Technician, and Ice-Hydrodynamics Modeler, respectively. Casey Godwin was promoted to Associate Research Scientist, well-deserved based on the tireless and effective scientific leadership he has provided to CIGLR over the past six years. Lindsay Fitzpatrick was promoted in her track as an Environmental Data Scientist, recognizing her critical role as a leader of cutting-edge projects that integrate hydrological modeling, data science, and artificial intelligence.

Finally, Mary Ogdahl was promoted from Program Manager to Managing Director of CIGLR, reflecting Mary's leadership of so many facets of CIGLR's operations, from strategic planning to interfacing with our campus colleagues and external partners to managing budgets and personnel to leading our Engagement, Career Training, and Outreach program.

In some cases, advancement of our team members comes with their departure from CIGLR. This year, several cherished colleagues transitioned to new roles at other institutions and embraced retirement. Peter Alsip, Ashley Burtner, and Katy Frank took positions at NOAA GLERL, where they will continue to work closely with us but from the federal side. Research scientist Rao Chaganti, Associate Director Sara Hughes, Biogeochemical Laboratory Analyst Connor Gluck, Data Analyst Sophie Orendorf, and Research Engagement Specialist Aubrey Arnt moved on to new and exciting chapters in their careers. CIGLR Postdoctoral Fellows Kyla Semmendinger-Raney, Kristie Mitchell, and Jamie Ward also found permanent positions as a Research and Development Engineer, Senior Research Lab Specialist, and a Physical Scientist, respectively. Research Scientist Dmitry Beletsky and Research Associate Raisa Beletsky embarked on their well-deserved retirements; their invaluable contributions and unwavering dedication to advancing Great Lakes research will be deeply missed. Watching colleagues move on is hard but also a reminder of how the experience and skills they developed with us will be put to good use elsewhere. We thank these colleagues for their contributions to CIGLR and wish them all the best in their new endeavors.

The bittersweetness of those departures is eased by the influx of new colleagues and talent. SEAS Professor of Practice Mike Shriberg stepped into the role of Associate Director and will do double duty as he continues as Director for Engagement. We were delighted to welcome Hazem Abdelhady and

Meena Raju (postdocs), Patrick Kelly and Madeline Gorman (project managers), and Nhung Nguyen (Aquatic Ecology Laboratory Analyst) to CIGLR in the past year. Tait Algayer (research associate) and Paul Den Uyl (bioinformatics specialist) returned to CIGLR; Tait's second tour follows her time as a Great Lakes Summer Fellow and Paul is a returning staff member after completing a Master's degree at U-M. Finally, we are absolutely thrilled to welcome a new principal investigator, Abby Hutson, PhD (U-M, CIGLR) who joins us as an Assistant Research Scientist in Atmospheric Sciences. Abby spent two years as a CIGLR Postdoctoral Research Fellow collaborating with Ayumi Fujisaki-Manome and the climate modeling team at NOAA GLERL to improve the simulation of precipitation within the Great Lakes region and advance our understanding of its potential impact in a changing climate. She will continue to lead our climate modeling efforts to understand how climate change will affect extreme weather, hydrology, and biology in the lakes. Abby is the third CIGLR postdoc to transition to a CIGLR PI in the past two years — a testament to the strength of our postdoc program.

If there's one constant, it's change. As we monitor and model and understand changes in the Great Lakes system, we ourselves are evolving as an institute to meet the scientific needs of society. I hope you enjoy this edition of *Ripple Effect*.

Sincerely,



Gregory J. Dick, PhD

Director

Cooperative Institute for Great Lakes Research



## NOAA GLERL CELEBRATES 50 YEARS OF SCIENCE IN SERVICE TO SOCIETY!

NOAA GLERL turned 50 in 2024! In their golden anniversary year, NOAA GLERL celebrated five decades of achievements and dedicated individuals who maintain its status as a premier freshwater laboratory. Since 1974, NOAA GLERL's scientific advancements have changed what we know about our world and the Great Lakes environment. Thanks to the individuals who laid the foundation, NOAA GLERL has become a world-class laboratory that makes essential observations and conducts innovative research, enhancing our understanding of not only the Laurentian Great Lakes but also the global ocean and its connections with the Earth, atmosphere, ecosystems, and climate.

As the future unfolds, NOAA GLERL will continue to evolve and lead the next generation of scientists. NOAA GLERL researchers are developing innovative science and technology to protect lives and property, address challenging scientific questions, explore the unexplored, inspire new approaches to observing the world, and support the U.S. economy. The NOAA GLERL 50th anniversary is about remembering the rich history of research and the Great Lakes, but most importantly, it is about looking ahead to many more years of science in service to society.



**Learn more**

# CIGLR Energizes Great Lakes Partnerships

WITH SEVENTH ALL PARTNERS MEETING

# 7 SEVENTH



Seventh CIGLR All Partners Meeting poster session. Photo: Aubrey Lashaway

CIGLR's All Partners Meeting aims to coordinate research goals and foster new research partnerships between NOAA GLERL and members of the CIGLR Regional Consortium. The meeting was May 6–7, 2024 on U-M's campus and focused on climate impacts and resilience. More than 130 scientists from the CIGLR Research Institute, CIGLR Regional Consortium, and NOAA attended.

The meeting kicked off with welcome presentations by NOAA GLERL Director Deborah Lee and CIGLR Director Gregory Dick, providing overviews of NOAA GLERL/CIGLR and laying out pathways to collaboration. U.S. Representative for Michigan's 6th Congressional District Debbie Dingell shared a meaningful message with the group that opened a panel discussion focused on the future of Great Lakes research, education, and sustainability. Panelists included Ashley Moerke, PhD, Director of Lake Superior State University's Center for Freshwater Research and Education; Laura Rubin, Director of the Healing Our Waters – Great Lakes Coalition; and Jonathan Overpeck, PhD, Dean of U-M's School for Environment and Sustainability. Keynote presentations by Bob Sterner, PhD (University of

Minnesota Duluth) and Val Klump, PhD (University of Wisconsin-Milwaukee) set the stage for the meeting's climate impacts and resilience theme. Meeting sessions included presentations by CIGLR, NOAA GLERL, and Regional Consortium investigators on climate impacts on ecosystems and

ecosystem services; coastal flooding and other hazards; and predicting and preparing for changing water levels. A poster session and reception gave attendees the opportunity to showcase their research successes and engage in one-on-one discussions. During facilitated breakout sessions, participants identified and prioritized opportunities for collaboration, including strategies for pursuing new research directions.

"It was marvelous to host the All Partners Meeting in person for the first time since 2019!" said Gregory Dick, CIGLR Director.

"The power of partnerships between universities, NGOs, the private sector, and NOAA was on full display. I was inspired to see new students, postdocs, and faculty engaging in Great Lakes research for the first time. It was also exciting to hear about new technologies, such as the use of existing telecommunications cables on the lake bottoms for winter observations, and the use of artificial intelligence for designing and interpreting observing systems. We look forward to many new future collaborations!"

# CIGLR Welcomes

## ASSISTANT RESEARCH SCIENTIST, ABBY HUTSON



**Abby Hutson**, PhD, joined CIGLR as an Assistant Research Scientist in 2023, after two years as a CIGLR Postdoctoral Research Fellow collaborating with Ayumi Fujisaki-Manome, PhD (U-M, CIGLR), and the climate modeling team at NOAA GLERL. Her postdoc work improved the simulation of precipitation within the Great Lakes region and advanced our understanding of its potential impact in a changing climate.

“I am thrilled to continue working with the strong group of interdisciplinary researchers at CIGLR and NOAA GLERL!” said Hutson. “As an atmospheric scientist, it is rare to be able to work so closely with hydrologists, lake modelers, ecologists, and social scientists. I am excited to contribute to CIGLR’s goal of conducting comprehensive research within the Great Lakes through atmospheric modeling and look forward to strengthening the meteorology research community within the region.”

Prior to working with CIGLR, Hutson studied storm-scale dynamics within supercell thunderstorms, using both observations and numerical modeling to identify outflow

characteristics associated with tornado formation.

“I began my research journey studying small-scale storm dynamics in the Great Plains — a vastly different topic than what I am doing now,” said Hutson. “But, having grown up within the Great Lakes region, and learning about the pressing need for an increased understanding of how Great Lakes weather will evolve in our changing climate, I grew attached to the research.”

Hutson is working on multiple aspects of weather and climate in the Great Lakes, including providing downscaled future climate model data tuned for the Great Lakes region, improving the understanding of how lake-effect snow is simulated in operational

models, and analyzing trends in large-scale storm activity and how it may contribute to the Great Lakes hydroclimate.

“I am eager to model the Great Lakes weather and climate for projected future scenarios,” said Hutson. “The atmosphere plays a significant role in the lake dynamics (and vice versa), hydrology, and even biology of the Great Lakes. Although we may never know exactly how our environment will change in the future, it is our goal to understand the range of possibilities in which our climate will evolve. This, in turn, will allow us to prepare for the range of evolution we will see in important aspects of the Great Lakes system, like lake levels, ice cover, flooding, and harmful algal blooms.”

## LEVERAGING LONG-TERM RESEARCH TO

# Evaluate Impacts

## ON THE LOWER FOOD WEB IN LAKE MICHIGAN

### LAKE MICHIGAN'S LOWER FOOD

**WEB** is intricately linked, with each component playing a vital role in sustaining the overall ecosystem and maintaining the lake's ecological balance. Throughout its history, Lake Michigan has been subjected to numerous stressors such as nutrient loading, overfishing, pollution, invasive species, and climate change that generate intense ecosystem stress and interrupt important food web connections like larval fish populations. To understand, predict, and manage larval fish populations in an environment this large depends on long-term research, targeting ecological conditions and processes that are constantly changing over extended periods of time.

Gaining insights into larval fish development and dynamics helps researchers assess the health of Lake Michigan's ecosystem, as they support many important commercial and recreational fish species. CIGLR Food Web Laboratory Analyst Maddie Tomczak and Associate Research Scientist Casey Godwin, PhD (U-M, CIGLR), in collaboration with NOAA GLERL's



Madeline Tomczak preparing a neuston net to sample for larval fish in Lake Michigan. Photo: Aubrey Lashaway

Ecosystem Dynamics branch, are collecting ecological data as part of NOAA GLERL's Long-Term Research (LTR) program and conducting targeted fundamental research on Lake Michigan's larval fish populations. The LTR program provides a unique research opportunity that integrates a core set of long-term biological, chemical, and physical observations, with short-term process-based studies for understanding ecosystem change. Such information is essential for developing new concepts, models, and forecasting tools to explore impacts of various stressors on the ecosystem.

“Over the years, a range of research questions concerning larval fish species such as Alewife, Bloater, and Yellow Perch, have been investigated,” said Tomczak. “Data from the LTR program have proven to be a valuable resource, enabling us to examine historical information, such as water temperatures, and evaluate how larval fish recruitment indices may change in response to environmental fluctuations. Sampling larval fish provides valuable insights into spawning success, habitat use, and recruitment to the adult population. These fish are crucial not only as prey for other fish, but also hold

significant commercial and recreational value for the local economy.”

Through coordinated LTR field efforts, key ecosystem variables are routinely collected at stations along a nearshore-to-offshore transect near Muskegon, Michigan. “Our team uses lake water samples to gather information such as nutrients, temperature, chlorophyll, and light attenuation,” said Tomczak. “Additionally, our team uses an array of net sampling systems to collect larval fish and zooplankton from varying depths of the water column, as different species inhabit distinct areas.”

Sampling different sections of the water column reveals trends in the habitats each larval fish species uses for growth and development over time. “This sampling method helps us investigate habitat shifts, determine the potential causes for these shifts, and assess how different larval fish species are affected,” said Tomczak. “For example, if we sample at the offshore station in Lake Michigan and find nearshore larval fish species like Alewife (an invasive prey fish vital to the lake’s salmon fishery), we can look back at

the winds and currents and note if there was an upwelling event (when winds displace surface waters, enabling deeper, colder water to rise) or investigate other environmental changes that may have caused the larval fish to shift habitats.”

Coastal upwelling events can occur frequently along the southeastern shore of Lake Michigan. There is growing interest in understanding how these events might be influenced by climate change and how they impact the surrounding ecosystem, including larval fish populations. “One supplemental LTR study that our team is working on explores how larval fish respond to nearshore upwelling events,” said Tomczak. “Nearshore, cold water upwellings can affect larval fish transport and possibly survival. We are integrating past LTR data into models to help track and predict larval fish hatching sites and where larval fish are located following an upwelling event.”

During the 2023 and 2024 field seasons, data were also incorporated from subsurface drifters, autonomous underwater vehicles (AUVs) with acoustics,

and plankton nets to monitor distributions of larval Alewife, zooplankton prey, and environmental conditions before and after upwelling events, ultimately trying to forecast where larval fish are in real-time.

“Understanding how larval fish are affected by upwelling events is crucial due to their sensitivity to temperature fluctuations and their ability to survive in offshore areas that may lack the nutrient-rich, warm waters found nearshore,” said Tomczak.

Lake Michigan’s LTR program provides important data sets that highlight variations in the lower food web and offer a thorough perspective on ecological changes and trends over time, including shifts and gaps in larval fish communities. “By tracking larval fish populations, we gain valuable insights into spawning success, habitat use, and the impacts of environmental changes,” said Tomczak. “Our work is helping to ensure the long-term viability of fish populations and supports the ecological and economic benefits they provide, ultimately informing sustainable fisheries management.”

“Long-term Great Lakes research offers valuable, consistent data sets that can reveal variations in the lower food web, including larval fish communities, and provide a comprehensive view of ecological changes and trends over time.”

— Maddie Tomczak

## EXPLORING TRENDS IN

# Cold Season Extratropical Cyclones

## IN THE GREAT LAKES REGION



### Research Highlight



### Journal Article

**WINTER WEATHER PATTERNS** in the Great Lakes region are driven by large-scale weather systems known as “extratropical cyclones” or ETCs. ETCs form in areas where warm and cold air masses meet and interact, leading to the development of cyclonic air circulation around low-pressure systems in the atmosphere. In North America, these cyclones tend to follow predictable paths across the continent, known as “storm tracks,” and the Great Lakes region sits at the intersection of multiple tracks. ETCs can bring a variety of weather conditions, including rain, snow, strong winds, and sharp temperature gradients. They also play a significant role in redistributing heat and moisture in the atmosphere, influencing weather patterns and climate in mid-latitude regions. The severe weather conditions brought about by ETCs can also have significant socioeconomic impacts

on communities throughout the Great Lakes region, as their heavy precipitation and strong winds can lead to flooding, property damage, transportation disruptions, and other hazards. Additionally, the cold surges that frequently follow these cyclones contribute to increased ice formation on the Lakes, causing issues such as interruptions in shipping and infrastructure strain. Comprehending how winter extratropical cyclones have evolved with a warming climate is essential for formulating effective safety protocols, preparedness measures, and adaptation strategies in the Great Lakes region.


A research team led by Assistant Research Scientist Abby Hutson, PhD (U-M, CIGLR) in collaboration with Associate Research Scientist Ayumi Fujisaki-Manome, PhD (U-M, CIGLR) and former 2022 CIGLR Great Lakes Summer Fellow Ryan Glassman

(currently an Operational Meteorologist with Weathernet) used historical atmospheric data to identify and track ETCs that passed through the Great Lakes region. “We were curious about how winter storms have changed over time, since they

would impact the interannual variability of ice cover, lake effect snowstorms, and overall winter severity,” said Hutson. “We proposed our research idea to the CIGLR Great Lakes Summer Fellowship program, and we brought in Ryan, an undergraduate student at Valparaiso University just as enthusiastic about meteorology over the Great Lakes as we were.”

Ryan Glassman’s work as a 2022 CIGLR Great Lakes Summer Fellow focused on understanding the long-term trends of winter storm frequency and intensity over the Great Lakes. “As I worked with the team to compile a dataset of cyclone passages over the region, we began to see fascinating trends emerge, and we decided to pursue the question: how are Great Lakes cyclones changing with time?” said Glassman. “This work has provided insights into storm trends in a warming climate and their potential impacts on the Great Lakes region, which is essential because of the region’s critical role in commerce and agriculture.”

The team assembled a database of ETCs that have passed over the Great Lakes



region using a publicly-available cyclone tracking algorithm applied to historical atmospheric data, which reconstructed past weather by incorporating observations into a model. “By limiting our dataset to storms that exist for over 24 hours and that move over at least 150 km in space, we identified a total of 886 cold-season ETCs that passed through the Great Lakes region (including Michigan, Wisconsin, Minnesota, Illinois, Indiana, Ohio, Pennsylvania, New York, and Ontario) between late 1959 and early 2021,” said Hutson. “When first analyzing the results, we found large interannual variability in storm frequency, and that there were no substantial trends in frequency or strength.”

To account for the significant variability in storm frequency, the team generated storm composites to determine the typical characteristics of ETCs for each cold season. “We found that air masses within ETCs gained more moisture and warmed at a faster rate than the overall climate,” said Hutson. “Our team also

observed that cyclone tracks have shifted northward, which may lead to more frequent warm temperatures and heavy rainfall during winter in the lower portion of the Great Lakes.”

The Great Lakes region experiences numerous ETCs, and the fact that these cyclones are warming more rapidly than the background climate indicates an increase in extreme weather events for the region. “We will not just see a steady uptick of winter warming, but rather more surges of very warm air that have implications for snow and ice melt, flooding, and general winter recreation,” said Hutson. “Our next steps include addressing the large variability observed in cyclone data by analyzing global teleconnection patterns and exploring how extratropical cyclones in the Great Lakes region correlate with broader global trends. Studying ETCs in the Great Lakes region enhances our ability to predict and prepare for severe weather events, ultimately helping to protect public safety, manage flood risks, and support both our local communities and economies.”

This visible image of the Great Lakes low pressure area was taken from the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument on NASA's Aqua satellite. It was taken at 19:05 UTC (3:05 p.m. EDT) on Monday, Sept. 26, 2011. Photo: NASA Goddard MODIS Rapid Response Team

“Extratropical Cyclones are a common occurrence in the Great Lakes region, particularly during the colder half of the year. Historical trends show that these large storm systems are getting warmer and are holding more moisture, all at a rate faster than what we see in the background climate alone.”

— Abby Hutson, PhD

# Predicting Algal Toxins

## WITH ADVANCED BUOY SENSORS

**ADVANCED BUOY SENSORS** are at the forefront of predicting algal toxins and cyanobacterial harmful algal blooms (CHABs) around the Great Lakes region. Cutting-edge sensors provide real-time data on water quality and environmental conditions, enabling more precise forecasts of toxin concentrations. By integrating these data into sophisticated nowcast models, researchers can better understand the dynamics of CHABs and anticipate their impacts. This proactive approach is essential for safeguarding water quality, protecting public health, and preserving the ecological balance of CHAB-prone areas, such as Green Bay. Green Bay is the largest freshwater estuary in the world and a major transition zone between riverine input and the blue waters of Lake Michigan, draining over 15,000 square miles of land. Due to high levels of nutrient pollution and increased CHAB occurrence, the lower Green Bay and its principal tributary, Fox River, are designated as a Great Lakes Area of Concern.

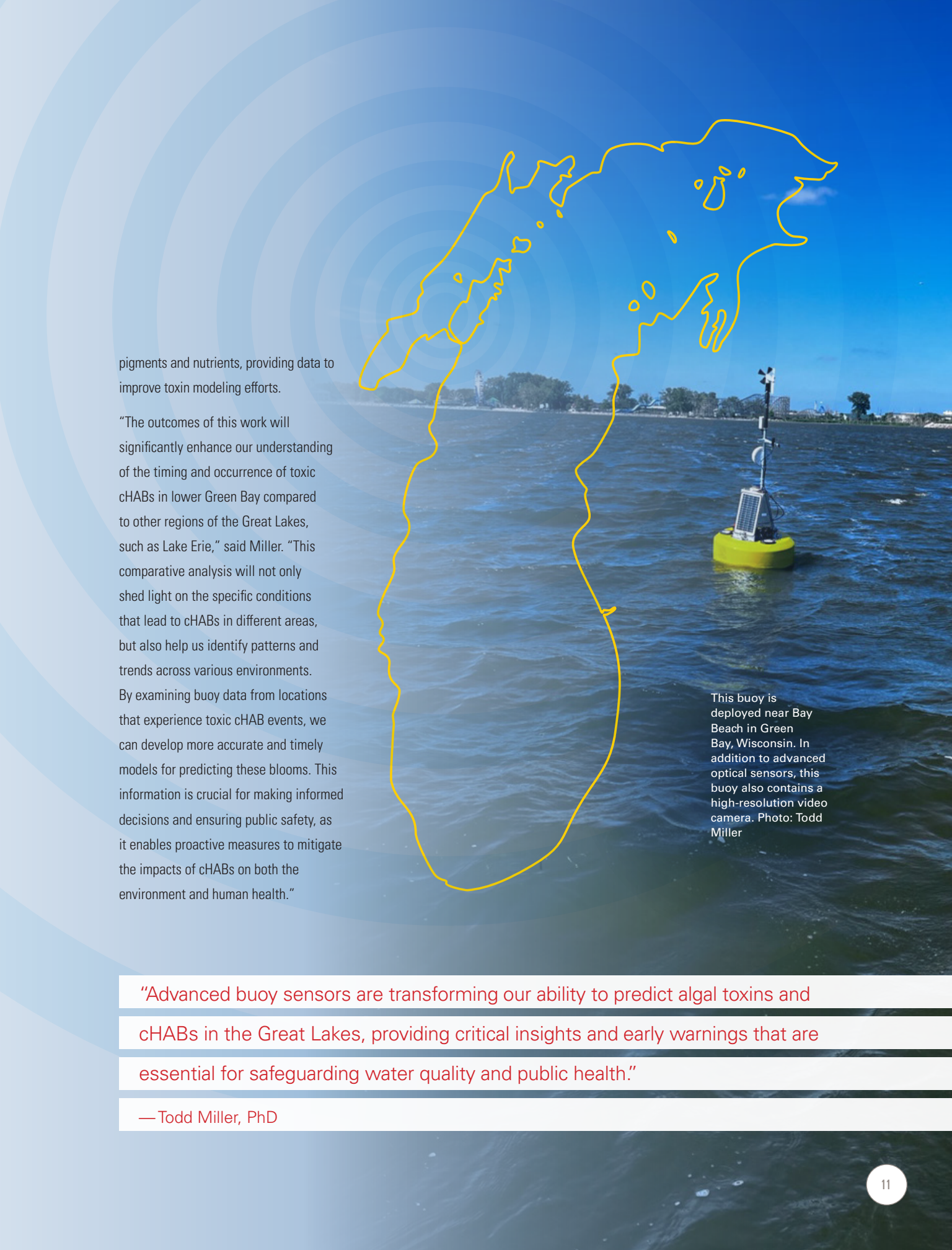
Most of the severe CHABs occur in lower Green Bay near the Fox River outlet and are dominated by *Microcystis* species that produce the microcystin toxin. Surprisingly, little research has been conducted on the drivers and constraints of CHAB and toxin formation in Green Bay and how they relate to other Great Lakes environments. Todd Miller, PhD, and his research team from the University of Wisconsin-Milwaukee are updating buoys with new equipment and high-resolution sensors to collect data on Green Bay CHABs, toxin concentrations, and other variables to compare the timing of bloom events in lower Green Bay with other areas of the Great Lakes. “For the past five years, buoys have been stationed in the southeastern part of lower Green Bay to gather a range of water quality

information,” said Miller. “However, these buoys were built on outdated platforms that do not contain proper dry wells for electronics, they are cumbersome to deploy, and are now aging. In addition, these buoys lack some of the more advanced instrumentation for water quality monitoring that are more commonplace in other systems (e.g., Lake Erie).”

Currently, the Green Bay buoys provide water quality and weather data measurements for scientists, the local parks, water quality and natural resource managers, weather modelers (National Weather Service), anglers, and other recreationalists. “We have found that CHABs and their toxins can increase in swimming areas in a matter of hours,”

said Miller. “With the recent interest in developing the lower Green Bay shoreline, including a new swimming beach, these buoys may provide early warning of toxic blooms that will help protect the public. Our research group is working to replace the buoy platforms with more modern, appropriate systems. We are also upgrading the sensor suite to include fluoroprobe pigment sensors for quantifying major classes of algae and *in situ* nitrate sensors to monitor for nutrient pollution. The improved buoys will be deployed in lower Green Bay from May until October.”

“If we hope to compare and contrast drivers of blooms across the Great Lakes, then adequate comparable measurements of water quality need to be collected,” said Miller. “Our team is utilizing the buoy data to enhance nowcast models for estimating near-future levels of CHABs, toxin concentrations, pollutants, and other environmental factors.” Unlike traditional forecasting models that predict conditions days or weeks in advance, nowcast models focus on providing immediate or near-term information based on the most recent data. The lower Green Bay buoys will be equipped with a variety of advanced optical sensors to detect algal



pigments and nutrients, providing data to improve toxin modeling efforts.

“The outcomes of this work will significantly enhance our understanding of the timing and occurrence of toxic cHABs in lower Green Bay compared to other regions of the Great Lakes, such as Lake Erie,” said Miller. “This comparative analysis will not only shed light on the specific conditions that lead to cHABs in different areas, but also help us identify patterns and trends across various environments. By examining buoy data from locations that experience toxic cHAB events, we can develop more accurate and timely models for predicting these blooms. This information is crucial for making informed decisions and ensuring public safety, as it enables proactive measures to mitigate the impacts of cHABs on both the environment and human health.”

This buoy is deployed near Bay Beach in Green Bay, Wisconsin. In addition to advanced optical sensors, this buoy also contains a high-resolution video camera. Photo: Todd Miller

“Advanced buoy sensors are transforming our ability to predict algal toxins and cHABs in the Great Lakes, providing critical insights and early warnings that are essential for safeguarding water quality and public health.”

—Todd Miller, PhD

## EXPANDED CIGLR RESEARCH ENGAGEMENT TEAM FACILITATES

# Connections Between Scientists and Society

## IN THE GREAT LAKES REGION

**CIGLR RESEARCH ENGAGEMENT** supports CIGLR's mission to lead research, develop applications and products, and engage end users to achieve environmental, economic, and social sustainability in the Great Lakes. The **Research Engagement program** is led by a team of researcher-practitioners who seek to inform the design of CIGLR and NOAA GLERL research and products through the experiences, needs, and knowledge of stakeholders, rights-holders (**individuals or social groups that have particular entitlements**), and end users, ultimately ensuring successful service delivery in line with CIGLR's mission.

Research engagement is a two-way interaction between researchers and end users for the mutually beneficial development and transfer of knowledge, policy decisions, technologies, products, methods, management actions, or other outcomes. Our program has four objectives:

1. to identify stakeholders, rights-holders, and end users; build meaningful relationships; and support existing relationships for CIGLR and NOAA GLERL research projects and products,

2. to ensure that research products are useful and usable by involving stakeholders and rights-holders in every stage of a project,
3. to bridge the gap between scientists and end users to ensure knowledge and research outcomes translate effectively to decision support and operations, and
4. to conduct social science research on topics relating to our work.

The CIGLR Research Engagement team is growing and currently consists of three specialists. **Riley Ravary**, the Research Engagement Program Lead, joined CIGLR

in October 2022, shortly after completing her Ph.D. in Cultural Anthropology at the University of Florida. **Megan DiCocco**, Research Engagement Specialist, re-ignited the Research Engagement program as the first hire to our team in June 2022. Megan joined CIGLR following the completion of her M.S. in Ecosystem Science and Management at U-M's School for Environment and Sustainability. **John McClure** joined CIGLR as a Research Engagement Specialist in the fall of 2023 and completed his M.S. in Environmental Justice and Environmental Policy and Planning at U-M's School for Environment and Sustainability. A fourth Research Engagement Specialist will join the team in fall 2024.

"Our team collaborates on multiple projects across CIGLR's entire research portfolio," said Ravary. "Last year our research portfolio consisted of eight projects, and this year we're involved with 10 projects. Our work spans across CIGLR



The CIGLR Research Engagement team is growing and currently consists of three specialists: Riley Ravary, PhD (left), Megan DiCocco (middle), and John McClure (right).

themes and programs, and contributes to projects on topics including water and ice forecasting/modeling, capacity building and decision support, and ecological forecasting and monitoring. In our work, we engage end users, stakeholders, and rights-holders in the research and product design process through collaborative design—or co-design—to ensure the products we create at CIGLR and NOAA GLERL are useful, usable, accessible, and efficient. We facilitate the interaction of stakeholders, rights-holders, and end users

with researchers, fostering opportunities for them to actively participate in product design and co-produce knowledge.”

CIGLR’s Research Engagement team utilizes the combined scientific, technical, practical, traditional, local, and experiential ways of knowing held by co-designers and researchers to improve a product’s usability and usefulness. Co-design might involve informal discussions, interviews, focus groups, surveys, usability tests, workshops, or other facilitated modes of participation.

“Our work is highly collaborative and funded through research projects—we are always interested in working on new projects and developing relationships to advance Great Lakes science and enhance societal impacts,” said Ravary.

If you’d like to learn more about CIGLR’s Research Engagement

program, please take a look at this [informational slide deck](#) or email Dr.

Ravary at [ravary@umich.edu](mailto:ravary@umich.edu).



**Learn more about the Research Engagement Team**

“Our goal is to increase understanding of Great Lakes culture and behavior, and how it relates to science and technology. These insights support physical and natural science research at CIGLR and NOAA GLERL that accounts for and responds to these sociocultural considerations. We hope to contribute to research products that fit real world contexts, have greater impact, and provide more equitable public services.”

— Riley Ravary, PhD

## CHALLENGES AND OPPORTUNITIES FOR

# Next Generation Water Resources Modeling

## OVER THE LAURENTIAN GREAT LAKES BASIN

**WATER RESOURCES MANAGEMENT** throughout the Laurentian Great Lakes basin requires accurate hydrologic predictions. These predictions are also essential for mitigating natural disasters, supporting economic activities, protecting the environment, and ensuring the overall well-being and safety of communities; they are the foundation for informed decision-making in a wide range of sectors. Given the Great Lakes' ecological, economic, and cultural significance, the region offers abundant recreation and a beautiful home to approximately 30 million people across the United States and Canada. To provide short- and medium-term hydrological forecasts to this region, NOAA has expanded its operational National Water Model (NWM) domain to also cover the Canadian portion of the Great Lakes basin with NWM version 2.1 (NWM V2.1), which is essential for Great Lakes water level and coastal inundation predictions. The NWM provides historical simulations, near real time analysis, and operational deterministic forecasts for short range (18 hours), medium range (up to 10 days), and long range (30 day) configurations.

Since the Great Lakes basin and its water bodies cross international boundaries, there are many challenges when trying to acquire consistent estimates of hydrometeorological data for

accurate model simulations and predictions. CIGLR Assistant Research Scientist Yi Hong, PhD, and colleagues Lauren Fry, PhD (NOAA GLERL) and Sophie Orendorf (formerly CIGLR) aim to comprehensively evaluate

the accuracy of the operational NWM V2.1. Their work includes retrospective, near real-time analysis, long-range forecast model simulations across borders, and assessment of opportunities to advance the NWM to a next generation (NextGen) water resources modeling framework over the Great Lakes basin.

"Performance of the NWM V2.1 was evaluated by comparing model simulations with stream gauge observations from different U.S. and Canadian sub-catchments throughout the Great Lakes basin as a whole," said Hong. "Our results indicate that the retrospective model and near-real time simulations matched well with the majority of the downstream gauging stations and also with the Great Lakes Coordination Committee monthly hydrometeorological



datasets [derived from Great Lakes meteorological and hydrological data, 1860-recent], suggesting this dataset is adequate for water balance modeling and for providing whole lake discharge data. However, the accuracy for the long-range forecast model simulations, particularly for several Canadian sub-catchments of Lake Superior, need to be improved. These identified sub-catchments could be test cases for learning how to use and contribute to the NextGen NWM advancements for the Great Lakes basin.”

“The planned evolution to a NextGen NWM will build on the current operational NWM, offering interagency cooperation and a model

framework that delivers maximum flexibility, interoperability, and eases the implementation and evaluation of different modeling approaches,” said Hong. “Ultimately, the NextGen NWM framework will be designed to facilitate integration of alternative modeling approaches and contributions from partners across different agencies and academic research communities (such as CIGLR). We will use results from this collaborative research to identify major river basins where enhanced model function could significantly improve water balance modeling, including the prediction of whole lake streamflows and total runoff, particularly for the long-range forecasting period.”

“Our team at CIGLR is working to advance NextGen National Water Model capabilities for the Great Lakes and facilitate future advancements in adaptive water management for approximately 30 million residents living in the United States and Canadian Great Lakes coastal zones.”

—Yi Hong, PhD

## ALUMNI SPOTLIGHT

# Holly Kelchner

## 2020–2022 CIGLR AQUATIC ECOLOGY RESEARCH ANALYST

**HOLLY KELCHNER** was an Aquatic Ecology Research Analyst for CIGLR from 2020 – 2022. Kelchner was an integral part of the harmful algal bloom (HAB) research team, coordinating the western Lake Erie monitoring cruises and leading toxin quantification through bioassay techniques.

While completing her master's degree at Louisiana State University (LSU), Kelchner's graduate advisor, Reagan Errera, PhD, joined the HAB monitoring team at NOAA GLERL, providing Kelchner the opportunity to relocate to Michigan.

After graduating from LSU, Kelchner continued her collaboration with Dr. Errera and joined CIGLR as an Aquatic Ecology Research Analyst as the primary fieldwork coordinator for the HAB team. Throughout the fieldwork season, Kelchner prepared equipment for water collection on Lakes Erie and Huron and coordinated the team's complex field schedules. Due to the dynamic nature of her position, no two days were alike. "One day, I might find myself conducting fieldwork on the water, while another I might be in the laboratory conducting toxin analysis or DNA extraction," said Kelchner. "I would also take part in discussions about how HABs impact local communities, which brought my work face-to-face with the public."

In the fall of 2022, Kelchner seized an opportunity to join Viking Expedition Cruises to Antarctica, becoming the Viking Polar's inaugural Field Scientist. "I collaborated with the Chief Scientist to oversee the ship's science program," said Kelchner. "I used my expertise in phytoplankton ecology to spearhead the

Sampling water during the 2022 Lake Erie field season.  
Photo: Andrew Camilleri

polar citizen science initiative known as Fjord Phyto, a partnership with Scripps Institution of Oceanography (La Jolla, CA) and the Universidad Nacional de La Plata (Buenos Aires, Argentina), to collect phytoplankton samples from the Antarctic coast to monitor how melting glaciers influence phytoplankton populations. I was also in charge of several other operations that included launching weather balloons, deploying Remotely Operated Vehicles (ROVs), gathering data through Baited Remote Underwater Video Surveillance (BRUVS), and conducting water quality analysis.”

“Despite the allure of working on a luxury cruise ship, the reality was demanding,” said Kelchner. “The workdays were long, often stretching beyond 12 hours, depending on where the ship was located and prevailing weather conditions.”

Nonetheless, Kelchner fondly recalls the highlight of her experience: the diverse team with whom she collaborated. “I had the pleasure of working with a team from various corners of the globe and representing diverse backgrounds,” said Kelchner. “I embraced the ethos that ‘everyone has something to teach you,’ a mindset that resonated throughout my six-month tenure in the Southern Ocean.”



Sampling for the Fjord Phyto initiative in Antarctica, November 2022. Photo: Josh Pons

Following several months of travel, **Kelchner recently joined the Implementation Team at the Science Education Resource Center (SERC)** at Carleton College in Northfield, MN. “At SERC, I utilize my wide array of science experience to connect educators from all over the country with resources and activities to enhance curriculum and implement systemic change, increasing diversity and equity within STEM education.”



**News Article**



**Journal Article**

## Q & A with Holly Kelchner



Holly Kelchner holding up a full sample of filtered phytoplankton. Photo: Josh Pons

### **Q: Which is your favorite Great Lake and why?**

Lake Superior will always be superior to the other Great Lakes in my world. I grew up in Minnesota and spent countless nights camping along the north shores of Lake Superior, kayaking around the Apostle Islands in Wisconsin, and exploring the northern shores of Michigan's Upper Peninsula. One of my most proud childhood moments was earning \$50 on a dare to take the polar-like plunge in Lake Superior with all my clothes on. I was not prepared to swim in a 45°F lake!

### **Q: Where did you do your college/graduate work and what did you study?**

I completed my undergraduate degree at the University of Alaska Southeast (UAS) in marine biology. UAS is located in Juneau, Alaska and gave me the opportunity to study the natural world in the natural environment. I don't know of any other place in the country where I would get to learn about primary succession at a glacier or get an email from a professor asking if I wanted to help with an orca necropsy (after it had washed up on a nearby beach). The environment I had at UAS was the best place to get a hands-on education.

I completed my Master of Science degree at Louisiana State University in Baton Rouge, LA where I primarily studied oceanography and coastal science.

My master's project centered on novel research exploring the harmful algal bloom and plankton ecology of coastal Mozambique, a southern African nation. Our study area was located near the remote beach town of Tofo, an area that is known for year-round sightings of whale sharks and manta rays (megafauna that eat plankton). This project was full of

challenges due to its remote location and pioneering research questions. I definitely learned how to adapt quickly and how to be resourceful!

### **Q: What is your current position and what led you to pursue this career path?**

I currently work for the Science Education Resource Center (SERC) at Carleton College in Northfield, MN. It was by chance that I found my current position. I was looking for a career change but didn't necessarily know where to look. I wanted to remain working in the natural sciences but didn't necessarily think that my experience in oceanography was too useful to bring back to Minnesota. But then I found the team at SERC and it has been incredibly rewarding, a positive reminder that it's possible to find a great fit when you least expect it.

### **Q: Why were you interested in working at CIGLR?**

When I was finished with my master's degree in harmful algal bloom ecology, I saw the perfect opportunity to utilize my skills and return home to the Great Lakes region. By joining the CIGLR team, I was surrounded by incredible scientists from many different backgrounds and was



Yost, the little Great Lakes Corgi, happily exploring the trails near Lake Superior and Split Rock Lighthouse. Photo: Aubrey Lashaway

able to bring my own specialized skills to our research group. It was fulfilling to be a part of such a critical research team that helps protect and inform the local community and ecosystem health.

**Q: What advice would you give to someone interested in an environmental science career?**

I would say, “don’t be afraid to try something new.” You never know what you might learn about yourself or your interests along your life’s journey. Take advantage of opportunities, get out of your comfort zone, and learn something new. You never know what could be waiting for you.

**Q: What was your favorite part about working at CIGLR?**

My favorite part about working for CIGLR was the people. I loved the diversity of research and personal interests of the [research teams](#), I was always learning

and discovering something new. I also looked forward to [CIGLR’s annual photo contest](#) and trying to submit photos better than Yost, the little Great Lakes Corgi!

Holly Kelchner uses a Secchi disk to measure water clarity in Fournier Bay in the Palmer Archipelago, Antarctica, with other members of the science team, Emily Cunningham and Dr. Daniel Moore. Photo: Viking Cruise Guest



## Monitoring Lake Ontario Using Distributed Fiber-Optic Sensing:

### A NOVEL TECHNIQUE TO MONITOR WAVES IN THE GREAT LAKES



Distributed Acoustic Sensing (DAS) is a cutting-edge technology utilizing the backscattering of lasers in fiber-optic telecommunication cables to measure and monitor acoustic signals over long distances. This technology is

valuable for drilling activity, ships, infrastructure monitoring, transportation, seismic activity, landslides, movements of glacial ice, earthquakes, distant storms, and more. DAS can detect and distinguish changes in acoustic or vibrational signals with high spatial precision (down to a depth of a few meters) and with frequent temporal updates (up to hundreds of times per second). Such high-resolution observations have the potential to monitor massive waves generated by storm surges, seiches, meteotsunamis, and other natural phenom-

**Kim Chu-Fang Yang**, PhD (U-M), along with mentors Zack Spica, PhD (U-M), and Ayumi Fujisaki-Manome, PhD (U-M, CIGLR) are utilizing DAS technology in western Lake Ontario to gain insights into the dynamic interactions between the hydrosphere (water), atmosphere (air), and lithosphere (Earth), including phenomena like wind-induced gravity

waves, wind-driven ocean currents, and wave-wave interactions. “Our objective is to understand the intricate fluid dynamics that influence how wave motions transfer energy from water to the solid Earth, and to develop scaling factors that quantify physical parameters, such as wave height, current, and wind speed, from DAS data,” said Yang.

“Our team used an existing fiber-optic cable at the bottom of the lake, with DAS signals at 5,000 distinct segments or channels over a 50 kilometer stretch of the cable, making it the largest DAS array ever measured in the Great Lakes,” said Yang. “We are identifying the sources and dynamic processes that produce environmental signals in DAS measurements across seasons and various weather conditions.”

Compared to conventional buoys, which are often removed during winter months to prevent damage, DAS provides year-round real-time monitoring of the lake’s dynamic state. “The high-resolution spatiotemporal measurements that DAS provides can capture intricate details of motion, such as wave propagation, dispersion, and wave-wave interactions, offering insights into the dynamic processes of wind-driven waves,” said Yang.

Preliminary results indicate DAS not only detects ground motions caused by gravity waves transferring energy from the hydrosphere to the lithosphere, but it is also sensitive to disturbances from air-wave and wave-wave interactions carried by surface currents. “This demonstrates the potential of DAS technology in monitoring wave activities and other metrics in lakes and oceans,” said Yang. “DAS offers high-resolution, real-time, extensive data collection capabilities and valuable insights from this research will help inform better management, science, and safety throughout the Great Lakes region.”

Read about the Seed award that laid the foundation for Yang’s research on page 31.

# Centering Communities in Great Lakes Restoration and Ecosystem-Based Management Programs



The traditional focus of environmental programs

and restoration in the Great Lakes has been on the biological, chemical, and physical dimensions of the ecosystem. However, a notable transformation is occurring across the U.S., Canada, and the globe that reframes “ecosystem restoration” as not only technical actions that improve the environment, but also as collective actions that include the human and social systems that coexist with the ecological. It is critical to harness this moment in time, in which both new funding opportunities and a heightened emphasis on prioritizing social systems and community in restoration efforts provide momentum to expand the traditional restoration narrative.

**Katie Mika**, PhD (formerly U-M, currently Michigan Department of Environment, Great Lakes, and Energy’s Office of the Great Lakes) along with Sara Hughes, PhD (formerly U-M, currently RAND Corporation), Mike Shriberg, PhD (U-M, CIGLR), Casey Godwin, PhD (U-M, CIGLR),



Workshop co-organizer Mike Shriberg, PhD (U-M, CIGLR) welcomes the attendees and outlines the objectives for the meeting. Photo: Aubrey Lashaway

Laura Rubin (Healing Our Waters-Great Lakes Coalition), Katie Williams, PhD (U.S. EPA), and Paul Seelbach, PhD (formerly U-M) worked together to outline the next steps for more effectively incorporating human dimensions into Great Lakes restoration and ecosystem management

efforts. “Integrating human dimensions such as community revitalization into environmental restoration helps ensure that both ecosystems and their communities are healthier and more resilient in the face of stressors,” said Mika. “Our research team identified a group of experts to participate in a **CIGLR-hosted summit**, where we collaboratively outlined five key social outcomes. These outcomes included ensuring that restoration actions enhance equitable human well-being, preparing and supporting communities for continuous adaptation to change, and actively fostering a multigenerational and

multicultural stewardship ethic. We identified aspirational values crucial to any activity or strategy, including Tribal sovereignty, justice and equity, adaptive management, and strong infrastructure to acknowledge multiple ways of knowing.”

“Once the broader goals and principles were identified, we developed recommendations and focused on the best ways to implement them into Great Lakes restoration and ecosystem management programs,” said Mika. “Taken together, the steps defined through this work have the potential to broaden the narrative of restoration to improve and contribute to not only ecosystem resilience, but also to community resilience.”



**Summit information**

## Assessing Drivers of Spatial and Temporal Greenhouse Gas Dynamics

### IN LAURENTIAN GREAT LAKES COASTAL WETLANDS



Coastal wetlands are crucial ecosystems for maintaining clean water. They effectively remove pollutants due to their high organic matter and low oxygen soils, which promote microbial processes that eliminate pollutants such

as nitrogen. However, these same processes also produce greenhouse gasses like methane and nitrous oxide. Currently, the Laurentian Great Lakes lack comprehensive measurements of greenhouse gas emissions from its associated wetlands.

**Amanda Suchy**, PhD (Central Michigan University) along with mentors Don Uzarski, PhD (Central Michigan University) and Casey Godwin, PhD (U-M, CIGLR) addressed this information gap by leveraging ongoing monitoring programs to gather greenhouse gas emissions data from more than 100 coastal wetlands throughout the Great Lakes basin. “To gather samples from a large number of wetlands, we leveraged the Coastal Wetlands Monitoring Program’s 2023 and 2024

summer sampling efforts,” said Suchy. “This program is a multi-institutional and international collaboration funded by the U.S. EPA, which assesses the condition of Great Lakes emergent marsh coastal wetlands larger than four hectares by sampling biota, water quality, and habitat.”

Water samples containing dissolved gasses were extracted and analyzed for methane and nitrous oxide concentrations. “So far, we have data from 67 wetlands

sampled in 2023 and will have data from a similar number of wetlands sampled during summer of 2024,” said Suchy. “Additionally, we have been collecting dissolved gas samples every other month, including through the winter at six wetlands in Saginaw Bay, with data expected soon.”

Each sample was collected from an open water environment 10 meters from the wetland and from dominant vegetation zones within the wetland. “This allows us to compare greenhouse gas emissions between the wetland and open water, as well as between different types of vegetation within a wetland,” said Suchy. “Our preliminary analyses show methane concentrations that range from 192 to over 36,000 times the concentration expected if methane was only in equilibrium with the

atmosphere. This indicates that the water is always supersaturated with methane. We also saw nitrous oxide concentrations that ranged from near equilibrium values to 10 times the expected concentrations.”

This study has revealed that vegetated wetlands have higher methane concentrations compared to open water areas, whereas open water areas exhibit higher nitrous oxide concentrations. “We also discovered that wetlands experiencing higher levels of human impact exhibited increased greenhouse gas concentrations,” said Suchy. “These initial findings indicate that Great Lakes coastal wetlands can emit significant amounts of greenhouse gasses, highlighting the need for further research into the factors driving these emissions.”

## Do Hydrogen Peroxide Concentrations in Lake Erie Influence the Toxicity of *Microcystis* Blooms?

Lake Erie provides drinking water for approximately 11 million people. During the summer months, Lake Erie has been plagued with cyanobacterial harmful algal blooms (cHABs) that produce harmful toxins, threatening human health and aquatic life. The cHABs in Lake Erie are often composed of cyanobacteria of the genus *Microcystis*, which produces the toxin microcystin. *Microcystis* is believed to make this toxin to mitigate damage from hydrogen peroxide, an oxidative stressor present in high concentrations in Lake Erie.

**Emma Johnson**, a 2023-24 CIGLR Graduate Research Fellow and PhD student at U-M, is working with her advisor, Rose Cory, PhD (U-M) and Casey Godwin, PhD (U-M, CIGLR) to gain a comprehensive understanding of Lake Erie *Microcystis* in relation to hydrogen peroxide concentrations. "Hydrogen peroxide is produced naturally at concentrations many orders of magnitude lower than in home medicine cabinets where it is used for its antimicrobial properties," said Johnson. "Concentrations of hydrogen peroxide are higher in Lake Erie compared to other freshwaters due to abundant light and high amounts of dissolved organic matter, which fuel

its production. On average, summertime concentrations of the toxin microcystin are positively correlated with summertime concentrations of hydrogen peroxide, suggesting that the toxin microcystin may protect *Microcystis* from oxidative stress caused by hydrogen peroxide, thereby contributing to the overgrowth of *Microcystis* in Lake Erie."

Understanding why some summers have more or less toxic blooms may depend on the processes that produce and destroy hydrogen peroxide in Lake Erie. "My work with CIGLR provides the opportunity to utilize ship resources for sampling and collecting data," said Johnson.



Emma Johnson aboard the R/V Laurentian deploying a radiometer system to measure light in the water column. Photo: Emma Johnson

During 2023 Johnson sampled the waters of western Lake Erie during a cHAB for signs of hydrogen peroxide sources and sinks. She found higher hydrogen peroxide concentrations in the bottom waters than in the surface waters.

"This result is surprising because the well-known sources of hydrogen peroxide depend on sunlight and microbial biomass, which are more abundant in the surface than in the bottom water of Lake Erie," said Johnson.

"The higher concentrations

of hydrogen peroxide in the bottom waters might suggest there is an unknown source of hydrogen peroxide in the sediments of Lake Erie."

Johnson will use supporting water quality data to examine biogeochemical processes in the sediments. "Our team is focused on where potential net sources and sinks of hydrogen peroxide are located in Lake Erie's western basin," said Johnson. "Understanding these dynamics is crucial for maintaining the lake's ecosystem and ensuring the health of our water resources."

# Constraining Evaporative Fluxes from Lake Erie Using an Isotope Mass Balance Model



The Great Lakes hold over 20% of the world's freshwater and are vital to the lives of more than 30 million people. A key component of managing this critical resource is characterizing the Great Lakes water balance: inflow, outflow, and storage. Forecasts of monthly water balance are used to inform water management strategies at local, state, and federal levels. Accurately quantifying water evaporation remains challenging due to uncertainties and biases in current water balance models. Climate change is exacerbating this problem as rising temperatures significantly boost evaporation and disrupt the water balance, especially in Lake Erie, the shallowest and most sensitive of the Great Lakes to water level fluctuation. Measuring the stable isotopes  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$  makes it possible to monitor hydroclimatic changes and quantify evaporation rates, which could be used to refine model predictions of Great Lakes evaporation.

**Jada Langston**, a 2023-24 CIGLR Graduate Research Fellow and PhD student at U-M, is working with Naomi Levin, PhD (U-M), Drew Gronewold, PhD (U-M), and Lauren Fry, PhD (NOAA GLERL) to refine Lake Erie evaporation estimates using stable isotope geochemistry. "Given that millions of people depend on water from Lake Erie, accurately forecasting changes in lake levels is crucial," said Langston. "To do this effectively, we need to precisely measure the amount of water evaporating." In addition to her work on contemporary

climate conditions, Langston is investigating Lake Erie's paleoclimate over the past 10,000 years. "By utilizing advanced stable isotope techniques, such as clumped and triple oxygen isotopes, we are reconstructing historical temperature and evaporation patterns, providing valuable insights into how climate change could affect Lake Erie in the future."

An aerial photograph of Lake Erie with a semi-transparent red and white striped overlay. The text "Lake Erie" is written in white over the overlay.

Lake  
Erie

## Unveiling the Traits of Great Lakes Bloom-Forming Cyanobacteria

Harmful algal blooms (HABs) are a major environmental problem that threatens water quality, ecosystem and human health, and coastal communities. The frequency and severity of HABs have increased worldwide, including in the Laurentian Great Lakes, where cyanobacterial harmful algal blooms (cHABs) have been observed in all five lakes. Despite diverse environments, the same bloom-forming taxa are present in all the Great Lakes. While the dominant cyanobacterial species in each bloom vary across lakes and basins from year to year and can change throughout a season, the same five genera are generally present, suggesting that Great Lakes cyanobacteria have adapted to a broad range of conditions.

### Carol Waldmann

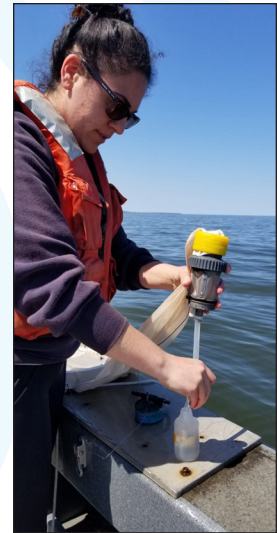
**Rosenbaum**, a 2023-24 CIGLR Graduate Research Fellow and PhD student at Michigan State University, is working with her advisor Elena Litchman, PhD (Michigan State University) and collaborators Anders Kiledal, PhD (U-M), Casey Godwin, PhD (U-M, CIGLR), and Todd Miller, PhD (University of Wisconsin-Milwaukee) to investigate how temperature and nutrient traits vary across and within cyanobacteria populations in the Great Lakes, whether these factors relate to population genetic diversity, and how they contribute to bloom dominance. "During the 2022 and 2023 summers, water samples were collected and received from

several locations in Lakes Superior, Michigan, Huron, and Erie and approximately 300 cyanobacteria strains were isolated," said Waldmann Rosenbaum. "I have been characterizing temperature and nutrient traits for a subset of these strains, including their temperature optima and nutrient quotas and affinities. In addition, Drs. Kiledal and Miller have been analyzing the ribosomal RNA gene sequencing and toxicity of the cyanobacteria strains, respectively."

"So far, our results indicate that Lake Superior's cyanobacterial population is locally adapted and has lower phosphorus

affinity and temperature optima than the cyanobacteria strains from the other Great Lakes," said Waldmann Rosenbaum. "These results were expected considering the oligotrophic (low phosphorus concentrations) and colder nature of this lake. Additionally, Lake Superior's cyanobacteria populations seem to be genetically distinct from Lakes Michigan and Erie."

Multi-trait and genomic comparisons between and within the Great Lakes' cyanobacterial populations will help better define cyanobacterial ecological niches and improve understanding of cHAB drivers. "Results regarding inter- and intraspecific trait variation can help us answer questions such as whether cHABs might become more frequent in locations with sporadic or no blooms; which species or strains will dominate future blooms; and what evolutionary potential under future climatic conditions these strains may have," said Waldmann



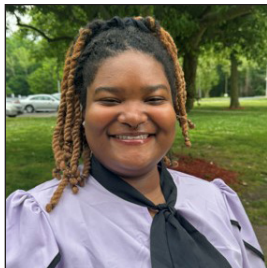
Carol Rosenbaum collecting a phytoplankton tow in Lake Superior's Mawikwe Bay in 2022. Photo: Carol Waldmann Rosenbaum

Rosenbaum. "Moreover, the comparison of cyanobacteria strains across lakes facilitates further ecological knowledge integration in the Great Lakes watershed where cHAB study is typically compartmentalized and system-oriented (lake, basin, bay). cHABs are becoming more widespread, and it is imperative that we understand more about their environment and mechanisms for growth and toxicity."

## GREAT LAKES SUMMER FELLOWS

In partnership with NOAA GLERL, the **Great Lakes Summer Fellows Program** is the cornerstone of CIGLR's efforts to train the next generation of scientists. Each year, CIGLR has the pleasure of hosting a group of bright, upcoming scientists to participate in a 12-week fellowship through which they conduct an in-depth research project, attend career development seminars and science discussions, receive skills training, and bond as a cohort. The fellows, mentors, and CIGLR ECO (Engagement, Career Training, and Outreach) team truly demonstrated just how much can be accomplished in a short 12-week period. We applaud everyone involved for their dedication, creativity, and positivity that shaped a meaningful, career-building experience.

**We offer an enthusiastic thank you and congratulations to the 2024 Great Lakes Summer Fellows:**



**Amari Dupree**  
*University of Maryland Eastern Shore*

Amari worked with CIGLR's Ayumi Fujisaki-Manome and Yang Song and University of Maryland Eastern Shore's Meng Xia to understand how storm events impact lake surface currents, ice cover, vertical mixing, lake bottom stress, and ultimately what implications these interactions have on sediment plume and turbidity extents in the southern basin of Lake Michigan.



**Brandon Ferro**  
*SUNY College of Environmental Science and Forestry*

Brandon worked with CIGLR's Alain Isabwe, Casey Godwin, and Jasmine Mancuso and NOAA GLERL's Craig Stow to describe the impacts of environmental conditions and available nutrients on algae growth in western Lake Erie.



**Sydnie Hansen**  
*University of Louisville*

Sydnie worked with CIGLR scientists Abby Hutson, Jamie Ward, Dani Jones, and Ayumi Fujisaki-Manome on finding correlations between teleconnections and Great Lakes extratropical cyclones and investigating whether those relationships have shifted with our changing climate.



**Cristian Hernandez**  
*University of Minnesota*

Cristian worked with CIGLR's Rao Chaganti and NOAA GLERL's Ed Rutherford to track the dispersal of larval fish in Lake Michigan using environmental DNA.



**Jamie Huerta**  
*North Carolina State University*

Jamie worked with CIGLR's Yi Hong, Anna Boegehold, and Alain Isabwe and NOAA GLERL's Mark Rowe to explore how spatial and temporal variations in nutrient loading from multiple rivers impact ecological responses in the Great Lakes.



**Ruben Jimenez**  
*University of Michigan-  
Dearborn*

Ruben worked with CIGLR's Shay Keretz and Anna Boegehold to investigate quagga mussel growth and filtration rates using lab experiments.



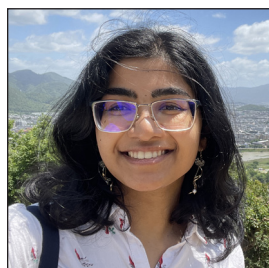
**Abigail Merolle**  
*University of Michigan*

Abigail worked with CIGLR's Mike Shriberg and Michigan Sea Grant's Kat Cameron to provide resources that support long-lasting and equitable mitigation efforts to Michigan coastal resilience managers and communities.



**Erin Redding**  
*University of California,  
Berkeley*

Erin worked with CIGLR's Dani Jones, David Cannon, and Russ Miller and Great Lakes Observing System's Shelby Brunner to help with the strategic placement of the next generation of Great Lakes observing stations and sampling sites using machine learning techniques.



**Roshni Sahu**  
*University of California,  
Berkeley*

Roshni worked with CIGLR scientists Justin Riley and Abby Hutson to model how orographic features, such as hills, dunes, and mountainous terrain, affect lake effect snowstorms on Lake Erie and Lake Ontario.



**Elleanna Viere**  
*Northland College*

Elleanna worked with CIGLR's David Cannon and NOAA GLERL's Jia Wang to reconstruct historical ice cover records in the Laurentian Great Lakes from 1897 – present.



**Ruthanne Ward**  
*Clark University*

Ruthanne worked with CIGLR's Yi Hong and Justin Riley and NOAA GLERL's Dan Titze to combine high-resolution dynamic flood mapping with hydrodynamic modeling for the Great Lakes coasts.



2024 CIGLR Great Lakes Summer Fellows. Photo: Margaret Throckmorton



**Hear about the program from the fellows themselves!**

## SUMMITS, SEED, & ECO FUNDING



The Ohio State University Stone Lab hosted the September 2023 CIGLR Summit focused on cyanobacterial blooms. Harmful algal bloom experts from the U.S. and Canada discussed the latest ideas of why so many lakes are now experiencing blooms. Photo: Ohio State University Stone Lab

### CIGLR Summit:

#### Disturbance Ecology: Effects on Great Lakes Harmful Algal Blooms and Phycology



**Disturbance  
Ecology  
Summit  
information**

From September 26-28, 2023, a team of experts led by scientists from Ohio State University, Environment Climate Change Canada, United States Geological Survey, Essex Region Conservation Authority, Great Lakes Commission, and NOAA GLERL convened to (re)integrate key concepts of limnology, community ecology, phycology, and molecular ecology into a more holistic paradigm for harmful algal bloom (HAB) management in the Great Lakes.. The objectives of the summit were to determine the sources of uncertainty in predictions of HAB occurrence, severity, and toxicity; characterize the data and knowledge needed to address key gaps in understanding of HAB dynamics and identify existing datasets that can be used to reduce uncertainty; establish a set of science priorities to help fill associated data/knowledge gaps; and identify potential participants for a collaborative working group to lead targeted research programs.

During the summit, participants engaged in a roundtable discussion led by Federal agency representatives on science needs for HAB

management, identified possible factors that are changing the Great Lakes system to affect HAB proliferation and toxicity,

and developed questions for future research. The group is preparing a journal article based on the summit outcomes, which will include a critical review of factors influencing HABs drivers in lake systems; gaps in data, knowledge, and research; and recommended research priorities to address knowledge gaps and improve HAB management on short and long time scales. For more on the summit and associated products, please [visit the summit webpage](#).



Lake Superior State University's Center for Freshwater Research and Education (CFRE) hosted scientists and resource managers from the U.S. and Canada for the Great Lakes Connecting Waters Summit, July 17-19, 2023.

### **CIGLR Summit:**

## **Developing a Conceptual Framework and Vision for Coordinating Great Lakes Connecting Waters Research and Monitoring**

Great Lakes connecting waters are globally unique and economically valued ecosystems. They are the arteries of the Great Lakes and include the St. Marys River connecting Lakes Superior and Huron, Straits of Mackinac connecting Lakes Michigan and Huron, St. Clair-Detroit River System connecting Lakes Huron and Erie, Niagara River and Welland Canal connecting Lakes Erie and Ontario, and the St. Lawrence River extending from Lake Ontario to the Gulf of St. Lawrence in the Atlantic Ocean. They are major sources of fisheries production, provide municipal and industrial water supplies, are transportation and industrial epicenters, possess Tribal and First Nations Indigenous heritage, and are highly susceptible to catastrophic events and climate change influences, making them extremely vulnerable ecosystems. Recent reports have emphasized the need for building and coordinating partnerships and collaborations, facilitating connecting waters research and monitoring plans, and facilitating the development of a coordinated collective impact framework across and within connecting waters.

A team of experts from the U.S. Geological Survey Great Lakes Science Center, Lake Superior State University, and

NOAA GLERL led a summit to encourage a collaborative network and leadership that will provide consistent

representation by emphasizing connecting waters research, surveillance, and monitoring needs to promote water quality and ecological resilience. This connecting waters network will advocate for connecting waters stewardship by developing and carrying out education and outreach programs detailing the critical ecosystem services that connecting waters provide and how uniquely vulnerable these systems are to anthropogenic hazards including climate change. The summit group worked to develop a conceptual framework and priorities for connecting waters science and monitoring that will provide a communication network to share information, lessons

learned from management actions, and identify and fill information gaps. One of the emerging themes from the summit was the need to address socio-cultural aspects and capacity building across the connecting channels for coordinated environmental monitoring and assessments.

Next steps for the summit organizers include a journal publication detailing the summit process, conclusions, and recommendations, along with a 2024 special section in the Journal of Great Lakes Research titled "Great Lakes Connecting Waters."

For more on the summit and associated products, please [visit the summit webpage](#).



**Great Lakes  
Connecting  
Waters  
Summit  
information**

## SUMMITS, SEED, & ECO FUNDING



Katie Williams (U.S. EPA) addresses the summit on the societal components of Great Lakes restoration. Photo: Aubrey Lashaway

### **CIGLR Summit:**

## **Discerning the “Bricks and Mortar” Required to Implement the Societal Components of Comprehensive Great Lakes Restoration**



**Read the report**

Through the Great Lakes Restoration Initiative (GLRI), the U.S. has invested nearly \$4 billion to improve environmental conditions including Areas of Concern (AOC) cleanup, nonpoint source pollution mitigation, invasive species prevention and control, habitat restoration, and youth education. Because of these efforts, there is now a body of experience and evidence demonstrating that, to meet community needs, environmental restoration must integrate social and organizational dimensions to fully implement comprehensive Great Lakes restoration.

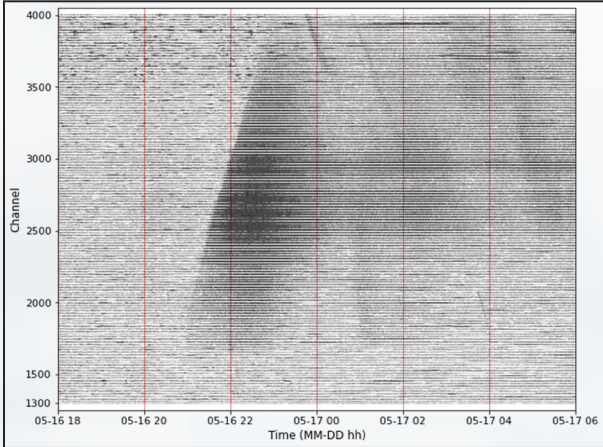
From May 17-19, 2023, a team of experts led by scientists from the University of Michigan School for Environment and Sustainability, Healing Our Waters-Great Lakes Coalition, and the U.S. Environmental Protection Agency (U.S. EPA) Great Lakes Toxicology and Ecology Division convened to identify and characterize the social dimensions associated with ecosystem-based

management and restoration. Through this workshop, the group identified key desired social outcomes that can be the result of environmental restoration. Participants also identified top activities and strategies to achieve the desired social outcomes and form the foundation of future work in this region.

By compiling these findings into a publicly available **report**

and fostering connections among diverse scientists, scholars, and leaders focused on community-centered clean-up and restoration in the Great Lakes, this summit group developed a framework outlining effective strategies for ecosystem-based restoration. This approach integrates societal goals with ongoing restoration efforts and specifies actions that governmental agencies, NGOs, grassroots organizations, foundations, and local governments can take to achieve this shared vision.

For more on the summit and associated products, please **visit the summit webpage.**



The DAS monitored the moving surface currents associated with wave-wave interactions, which generated high-amplitude strains while a moderately low-pressure system crossed Lake Ontario.

**Seed Funding:**

**Distributed Acoustic Sensing Data Acquisition at the Bottom of Lake Ontario**

Due to severe winter conditions, most aquatic instruments installed in the Great Lakes region must be removed and redeployed yearly. This dramatically increases the operational cost of monitoring these vast areas, but more importantly, it prevents the scientific community from collecting year-round data about the dynamic state of the lakes. With the help of CIGLR Seed funding, a geophysics group from the University of Michigan (including additional work by CIGLR funded postdoc Kim Chu-Fang Yang, see page 20) explored a new monitoring method that repurposed telecommunication fiber-optic infrastructure existing at the bottom of Lake Ontario. The group used a novel technique called Distributed Acoustic Sensing (DAS) that turned the fiber-optic cables into thousands of real-time sensors, recording continuous strain data for almost a year and totaling 5,000 measurement points over 50 kilometers. The group is working on converting and interpreting the distributed strain signals into relevant metrics for CIGLR, such as wave height, currents, sediment transportation, and more.

This first-of-its-kind dataset is being utilized to study the dynamics of Lake Ontario from its depths and is anticipated to contribute new findings to our understanding of the lake’s ecosystem and behavior. A livestream of this data collection was available on YouTube from April 2023 - March 2024 and was used for educational purposes, sharing unique, innovative details about the new DAS monitoring method. Valuable insights from these data will help inform future research and management efforts for the Great Lakes.

Lake Ontario’s Woodbine Beach, where the fiber optic cable leads to the bottom of the lake. Photo: Kim Chu-Fang Yang

## SUMMITS, SEED, & ECO FUNDING



Earth Camp students and ECO Award Recipient Robert Davis (standing), engaging in a collaborative learning experience as they tackle GIS modules. Photo: Alyssa Sklar



**Read the report**

### **ECO Funding:**

### **Empowering Students with GIS: Mapping Environmental Justice and Flood Risk**

The University of Michigan Earth and Environmental Sciences Department educates approximately 60 students per year through a high school outreach program called Earth Camp. This high-impact program aims to bring diversity to the field of environmental sciences and support students along their education journey. Over 90% of Earth Camp students are Black, Indigenous, and People of Color (BIPOC), with 100% going on to attend college and 95% majoring in a STEM field. Earth Camp encourages students to get involved in outdoor, hands-on activities and helps them gain exposure to career opportunities and skills offered in the earth and environmental sciences. Students are provided various educational opportunities throughout Earth Camp, but there is a noticeable skills gap in Geographic Information Sciences (GIS). GIS is often a required skill in the environmental sciences due to its widespread use and application.

With CIGLR ECO funding, a team of University of Michigan students created user-friendly GIS modules for Earth Camp to aid the next generation of BIPOC environmental scientists. The modules were created to teach the basics of GIS through

mapping exercises that explore Great Lakes environmental issues being studied by CIGLR, such as flood risk, with a focus on environmental justice issues. Earth Camp students learned how to create GIS maps, communicate and

visualize data, generate information from the maps, and investigate map features with trial-and-error exploration. The goal of this program was for students to gain exposure to GIS, helping them be more competitive in today's job market, feel comfortable taking a college GIS course, and gain enough experience to make an introductory GIS map. For many of the students, this was their first time hearing of GIS, and some expressed interest in pursuing a GIS career at the conclusion of the module. The modules from this program are located on ArcGIS Online in the StoryMap Collection "**Examining Great Lakes Environmental Justice Issues with GIS.**"

# SUMMITS, SEED, & ECO FUNDING



From left to right: Hira Ahmad, Kausthubh Sumanth, and Francesca Levethan presenting their Master's project work at the 2024 University of Michigan School for Environment and Sustainability capstone conference. Photo: David Brenner

## ECO Funding:

### Media with Impact: Building a Community-Driven Model for Drinking Water News Coverage

Community-driven environmental reporting is a critical way to generate accurate local news in the Great Lakes region. Unfortunately, due to financial strains and a more centralized, corporate media, there has been less substantive and authentic reporting of frontline environmental justice stories in recent years, particularly in under-served communities. Many journalists lack the knowledge, training, and resources to accurately report on environmental justice issues. To help remedy this situation, there is a growing need and interest to help rebuild media organizations and more equitably uplift the narratives of frontline environmental justice communities.

A Master's project team from the University of Michigan School for Environment and Sustainability along with a Great Lakes regional media client, Great Lakes Now (GLN), developed an equitable and community-based

environmental media model, connecting journalists with affected stakeholders. The team did a thorough review of existing resources and an assessment of need through 42 interviews with diverse stakeholders and rights holders

to create a comprehensive set of recommendations intended for both media organizations and philanthropic institutions. The group's key findings are shared in a **report and corresponding toolkit**. These resources provide recommended goals, strategies, and actions for media organizations and journalists to advance equitable and community-based environmental journalism and amplify the stories of frontline environmental justice communities, with the goal to promote community change and help reinvigorate journalism. This work helped earn team

member Hira Ahmad the River Network's 2024 **"Emerging Leader" award**. The response from the stakeholders, rights holders, and journalists in this study has been very positive and the toolkit is already being put to use.



More about Media with Impact

Still water creating a mirror image of the sunset and scattered clouds in the Pinckney Recreation area. Photo: Paris Schofield

## 2024 PROGRAM WINNERS

### CIGLR AWARDS \$470,000 IN 2024 PARTNER PROGRAMS

Each year, CIGLR offers competitive programmatic funding for Consortium partners to build collaborations with NOAA. Through these partnerships, recipients provide early career training to graduate students and postdocs, delve into big Great Lakes issues in multidisciplinary summits, translate research to the public, research emerging issues, and respond to emergencies and other time-sensitive needs in the Great Lakes. The recipients of the 2024 partner awards will advance important areas of Great Lakes research and form connections between our partners and NOAA. Thank you to all who applied and congratulations to the winners!

#### POSTDOCTORAL FELLOWSHIP AWARDS

- **Karen Alofs, PhD, University of Michigan:** Incorporating Bioenergetics to Investigate Effects of Dreissenid Mussel Invasions in the Great Lakes on Growth and Diet of Native Larval Fishes
- **Yadu Pokhrel, PhD, Michigan State University:** Assessment and Forecasting of Floods in the Laurentian Great Lakes Region Using Hydrological-Hydrodynamic Modeling
- **Xinyi Shen, PhD, University of Wisconsin-Milwaukee:** Enhancing Inundation Forecasting in Great Lakes Regions Fusing Remote-Sensed Flood Mapping and Depth Estimation

#### GRADUATE RESEARCH FELLOWSHIP AWARDS

- **Jenan Kharbush, PhD, University of Michigan:** Quantifying Winter Nitrification Rates in Lake Erie
- **Silvia Newell, PhD, University of Michigan:** Using Stakeholder Opinions and Fuzzy Cognitive Mapping to Inform Ecosystem-Based Fisheries Management of Lake Erie's Valued Fisheries
- **Lei Zuo, PhD, University of Michigan:** Enable Year-Round Great Lake Observation with Floating Offshore Platform to Power Autonomous Underwater Vehicles

#### SUMMIT AND WORKING GROUP (SWG) AWARDS

- **Aaron Fisk, PhD, University of Windsor:** Understanding Recreational Fishing for Food in the Great Lakes
- **Jing Liu, PhD, University of Michigan:** AI Horizons: How Machine Learning and Artificial Intelligence Will Shape Great Lakes Observations, Modeling, and Forecasting in the Coming Decade
- **Ryan Newton, PhD, University of Wisconsin-Milwaukee:** The Use of Archival Environmental DNA in the Laurentian Great Lakes

#### ECO AWARDS

- **Paul Barrow, PhD, University of Michigan:** Great Lakes on The Air: A Public Outreach Initiative Through Social Media

#### SEED AWARDS

- **Kaisen Lin, PhD, Michigan State University:** Degradation of Microcystin in Harmful Algal Bloom Aerosols during Atmospheric Transport



1. Rao Chaganti, PhD (formerly U-M, CIGLR) works on zooplankton grazing experiments. Photo: Aubrey Lashaway

2. Andrew Camilleri (U-M, CIGLR) celebrates as the rosette sampler comes up from a successful deployment in Lake Erie! Photo: Aubrey Lashaway

3. Teige O'Brien (U-M, CIGLR) works on nutrient analyses. Photo: Aubrey Lashaway



4. CIGLR's Mary Ogdahl and Russ Miller steer an ROV through the Muskegon Channel. Photo: Patrick Hullman

5. CIGLR's Jasmine Mancuso (left) and Paris Schofield (right) measure chlorophyll *a*. Photo: Aubrey Lashaway

6. 2024 CIGLR Great Lakes Summer Fellows learning about invasive mussels. Photo: Patrick Hullman



7. CIGLR's Maddie Tomczak and Paris Schofield decorate pumpkins during the 2024 CIGLR fall social. Photo: Aubrey Lashaway

8. NOAA Lapenta intern Bella Filagrossi trying on a Gumbo survival suit during safety training aboard the R/V Laurentian. Photo: Aubrey Lashaway

9. CIGLR volunteers after a successful rain garden workday at an Ann Arbor city park. Photo: CIGLR Social Committee



10. Russ Miller (U-M, CIGLR) performs maintenance on a Great Lakes buoy. Photo: Abigail Goodman

11. The CIGLR social committee sponsored a trash pick-up event at Argo Park in Ann Arbor, Michigan. Photo: CIGLR Social Committee

12. A MOCNESS sample full of *mysis* from a Lake Huron CSMI spatial cruise. Photo: Maddie Tomczak

# Staff & Governance

## ADMINISTRATION

### Gregory Dick

Director

\*Sara Hughes

Associate Director

### Mike Shriberg

Associate Director &  
Director for Engagement

### Mary Ogdahl

Managing Director

### Margaret Throckmorton

Administrative Project  
Coordinator

### Aubrey Lashaway

Communications Specialist

### Ayumi Fujisaki-Manome

Modeling & Forecasting  
Theme Lead

### Casey Godwin

Ecosystem Dynamics Theme  
Lead

### Russ Miller

Observing Systems Theme  
Lead

## RESEARCH INSTITUTE

### Research Scientists

### \*Dmitry Beletsky

Research Scientist

### David Cannon

Assistant Research Scientist

\*S. Rao Chaganti

Assistant Research Scientist

### Ayumi Fujisaki-Manome

Associate Research Scientist

### Casey Godwin

Associate Research Scientist

### Yi Hong

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### Abby Hutson

Assistant Research Scientist

### Dani Jones

Associate Research Scientist

### Research Staff

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Research Assistant

Tait Algayer

Research Associate

\*Peter Alsip

Ecological Modeling Data  
Analyst

\*Aubrey Arnt

Research Engagement  
Specialist

\*Khush Bafna

Research Assistant

\*Raisa Beletsky

Research Associate

### Anna Boegehold

Algal Toxin & Ecology  
Research Specialist

\*Ashley Burtner

Aquatic Ecology Laboratory  
Manager

### Andrew Camilleri

Biogeochemistry Laboratory  
Analyst

### Glenn Carter

Aquatic Research Analyst

### Paul Den Uyl

Bioinformatics Specialist

### Megan DiCocco

Research Engagement  
Specialist

### Olivia Doty

Ice-Hydrodynamic Modeler

### Brianna Ellis

Decision Support Tools  
Project Coordinator

### Lindsay Fitzpatrick

Environmental Data Scientist

\*Katy Frank

Application Programmer

### Madeleine Gorman

Project Manager

\*Connor Gluck

Biogeochemistry Laboratory  
Analyst

\*Abigail Goodman

Communications Assistant

### Haoguo Hu

Ice Modeler

### Alex Kain

Modeling Data Analyst

### Patrick Kelly

Project Manager

\*Linfeng Li

Research Assistant

### Songzhi Liu

Programmer/Analyst

Marlayna MacKay

HABs Seasonal Support

### Jasmine Mancuso

Aquatic Ecology Research  
Analyst

### Melissa Mattwig

Earth System Modeler

Matt McAnear

Research Assistant

### John McClure

Research Engagement  
Specialist

### Russ Miller

Mechanical Technician  
Intermediate

\*Ronald Muzzi

Research Associate

\*Srikanth Nelakuditi

Research Assistant

### Nhung Nguyen

Aquatic Ecology Laboratory  
Analyst

### Teige O'Brien

Biogeochemistry Laboratory  
Analyst

### Brooke Odstrchel

Earth System Modeler

\*Sophie Orendorf

Data Analyst

AiLi Pigot

Data Visualization Fellow

### Erica Pillar

Aquatic Ecology Laboratory  
Technician

Jiyahna Price

Research Assistant

### Tongyao Pu

Ecological Modeling Data  
Analyst

### Heidi Purcell

Research Area Specialist  
Intermediate

### Riley Ravary

Research Engagement  
Program Lead

### Paris Schofield

Aquatic Ecology Laboratory  
Technician

### Yang Song

Hydrodynamic Modeler

\*Kausthubh Sumanth

Research Assistant

### Madeline Tomczak

Food Web Laboratory  
Analyst

### Lucas Vanderbilt

Environmental Genomics  
Specialist

### Paige Williams

Aquatic Field Research  
Technician

### Postdoctoral Research Fellows

### Hazem Abdelhady

### Alain Isabwwe

### Shay Keretz

\*Kristie Mitchell

### Meena Raju

### Justin Riley

\*Kyla Semmendinger-Raney

\*Jamie Ward

## EXECUTIVE BOARD

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Michigan (Ex-Officio)

Carl Gouldman

Director, U.S. Integrated  
Ocean Observing System  
(IOOS) Office, NOAA  
National Ocean Service

Deborah Lee

Director, NOAA GLERL  
(Ex-Officio)

Scott Lundgren

Director, NOAA Office of  
Response and Restoration

Bradford Orr

Associate VP for Natural  
Sciences & Engineering,  
University of Michigan

Jonathan Overpeck

Samuel A. Graham Dean,  
School for Environment &  
Sustainability, University of  
Michigan

\*Indicates personnel transitions

Bold names indicate profile links

\*Steven Thur  
*Director, National Centers  
for Coastal Ocean Science,  
NOAA National Ocean  
Service (currently Assistant  
Administrator for NOAA  
Oceanic & Atmospheric  
Research)*

### COUNCIL OF FELLOWS

**Gregory Dick**  
*Director, CIGLR, University of  
Michigan*

Karen Alofs  
*Assistant Professor,  
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Michigan*

John Bratton  
*Senior Scientist, LimnoTech*

Bret Collier  
*Ecosystems Dynamics  
Branch Chief, NOAA GLERL*

Patrick Doran  
*Associate State Director  
for Michigan, The Nature  
Conservancy*

Aaron Fisk  
*Professor, Great Lakes  
Institute for Environmental  
Research, University of  
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Steve Fondriest  
*President, Fondriest  
Environmental*

**Ayumi Fujisaki-Manome**  
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Sciences & Director, Great  
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University of Wisconsin  
Milwaukee*

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Michigan State University*

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National Wildlife Federation  
Great Lakes Regional Center*

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the Center for Freshwater  
Research & Education, Lake  
Superior State University*

\*Steve Ruberg  
*Group Leader, Marine  
Instrumentation Lab, NOAA  
GLERL*

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Field Station, Cornell  
University*

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Water Resources Institute,  
Grand Valley State University*

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*Director, Large Lakes  
Observatory, University of  
Minnesota Duluth*

Donald Uzarski  
*Director, Institute for Great  
Lakes Research, Central  
Michigan University*

Andrea Vander Woude  
*IPEMF Branch Chief, NOAA  
GLERL*

Chris Winslow  
*Director, Stone Laboratory,  
Ohio Sea Grant, Ohio State  
University*

## CIGLR ASSOCIATE DIRECTOR SARA HUGHES TAKES ON NEW CHALLENGE



Thank you for your service to CIGLR and the Great Lakes community, Sara! Photo: U-M Water and Climate Policy Lab

Sara Hughes has transitioned from her role as CIGLR Associate Director into a new position as a full-time senior policy researcher at the RAND Corporation. Sara will maintain an

adjunct role at U-M for the time being, continuing to mentor her students and collaborate on ongoing projects. "I'd like to take this opportunity to thank Sara for her leadership of CIGLR's social science efforts," said Gregory Dick, CIGLR Director. "Sara's time as our Associate Director was short, and I'm sorry to see her go, but I wish her all the best in this new and exciting chapter of her career." CIGLR's Mike Shriberg has stepped into the CIGLR Associate Director role, in addition to his role as CIGLR Director for Engagement, and will continue Sara's work to build CIGLR's social science research program.



**CIGLR  
Organization**



**CIGLR research  
staff**

# CIGLR welcomes new team members!



**Hazem Abdelhady**, PhD, is a CIGLR postdoctoral research fellow working with Drs. David Cannon and Ayumi Fujisaki-Manome (CIGLR) to advance understanding of interannual variability and extreme events in the ice cover and thermal structure of the Great Lakes, both historically and under future climate scenarios, using physics-based and data-driven methods.



**Paul Den Uyl** is CIGLR's first Bioinformatics Specialist. Paul's research revolves around the implementation of microbiological and bioinformatic methods, such as metagenomics, amplicon sequencing, and qPCR, to investigate microbial life present in the Great Lakes.



**Olivia Doty** is an Ice-Hydrodynamic Modeler working with Dr. Ayumi Fujisaki-Manome (CIGLR) on collaborative modeling projects for the Great Lakes and Alaska coastal regions.



**Brianna Ellis** is a Decision Support Tools Project Coordinator working with Drs. Casey Godwin (CIGLR) and Reagan Errera (NOAA GLERL) to assist principal investigators with tracking progress towards project milestones and deliverables.



**Madeleine Gorman** is one of CIGLR's two new Project Managers, working with Dr. Ayumi Fujisaki-Manome (CIGLR) and the NOAA GLERL Modeling and Forecasting research group. Her work covers experiments, modeling, and monitoring related to ecosystem processes and change in the Great Lakes, Arctic Ocean, Alaska coastal region, and Sea of Okhotsk.



**Patrick Kelly** is another one of CIGLR's new Project Managers, working with Dr. Casey Godwin (CIGLR) and the NOAA GLERL Ecosystem Dynamics research group. He has over 12 years of experience working across disciplines including public health, health policy, social research, and environmental health and justice.



**Nhung Nguyen** is an Aquatic Ecology Laboratory Analyst working with Dr. Casey Godwin (CIGLR) to study the freshwater ecology and carbon cycling of harmful algal blooms in the Great Lakes.



**Erica Pillar** is an Aquatic Ecology Laboratory Technician working with Dr. Casey Godwin (CIGLR) and the harmful algal blooms (HABs) team to help further our understanding of algal bloom ecology in western Lake Erie and Saginaw Bay.



**Meena Raju**, PhD, is a CIGLR postdoctoral research fellow working with Dr. David Cannon (CIGLR) and NOAA GLERL's Climate, Ecosystems, and Fisheries Initiative (CEFI) team to simulate the circulation and thermal structure of the Laurentian Great Lakes using a next-generation regional ocean model.



**Staff profiles**

## **\$1.75M AWARDED FOR GREAT LAKES MARINE BIODIVERSITY OBSERVATION NETWORK**

The University of Michigan, with CIGLR's Casey Godwin as principal investigator, was awarded **\$1.75M from the National Oceanic and Atmospheric Administration's Integrated Ocean Observing System** for the Great Lakes Marine Biodiversity Observation Network (GL-MBON). The GL-MBON will assess biodiversity, habitat, and key ecosystem functions in the region to meet stakeholders' information needs. The Great Lakes are experiencing dramatic shifts and losses in biodiversity that threaten ecosystem services in these inland seas of North America, which are under pressure from invasive species, climate change, nutrient pollution, hypoxia, and harmful algal blooms. The University of Michigan is partnering with NOAA's Great Lakes Environmental Research Laboratory, Oregon State University, Great Lakes Fisheries Commission, and the Great Lakes Observing System (GLOS) to assess habitat and biodiversity across a range of spatial and temporal scales. A key innovation of the GL-MBON will be integration across multiple technological approaches, including high-throughput sequencing and bioinformatics, telemetry for fish populations, and mapping large-scale biogeographic patterns measured by satellites. Working closely with GLOS, data from those approaches will be integrated to maximize interoperability of information, links with existing data repositories, and access to the information.



**Read more**

## IN THE MEDIA



Read our stories

### NEW AWARDS

**Biden-Harris Administration invests \$16.7 million for marine technology innovation through the Inflation Reduction Act,** NOAA Research News

**U-M will lead new partnership on Great Lakes biodiversity,** Michigan News

**U-M lands \$6.5M center to study links between Great Lakes algal blooms, human health,** Michigan News

**Three new U-M 'catalyst grants' address PFAS pollution, wave energy, road durability,** Michigan News

### HARMFUL ALGAL BLOOMS

**Are Lake Erie's algae blooms home to the next pharmaceutical drug? Some scientists think so,** Milwaukee Journal Sentinel

**Can robots provide data on toxic cyanobacteria in lakes?,** NOAA Research News

**'Green as pea soup': Warming water hinders fight against Lake Erie algae blooms,** The Detroit News

**Is this the source of a Wonder Drug? | The Catch,** Great Lakes Now

**Toxic blooms on Lake Erie still a problem 10 years after Toledo issued a 'do not drink' order,** Michigan Public

### ICE, WATER LEVELS & INVASIVE SPECIES

**UMich researchers identify warming winter weather trends in the Great Lakes region,** Michigan Daily

**U-M research forecasts warmer, rainier winter storms ahead for Great Lakes region,** Michigan News

**Predicting and monitoring ice weather events: The Great Lakes approach to ice research,** Environmental Monitor

**Historically low Great Lakes ice coverage: U-M experts available,** Michigan News

**Dwindling Great Lakes ice cover highlights troubling trend,** Detroit Metro Times

**Mild winter keeps Michigan ice fishers at bay,** The Detroit News

**Climatologist talk lack of ice on Great Lakes and its meaning moving forward,** Local 4 Click on Detroit

**Great Lakes ice cover hits record low through mid-March of this year,** Chicago Tribune

**Webinar: Quagga mussel food choice at the HAB buffet,** Invasive Mussel Collaborative

### OTHER STORIES

**OVPR awards 15 staff members for research service, leadership,** The University Record

**Scientists just discovered cold, dark sinkholes in Lake Michigan. What's living in them?,** Milwaukee Journal Sentinel

**New forecast tool provides advance warnings of low oxygen levels in Lake Erie,** NOAA Research

**The Great Lakes as great unifiers can turn disruption into opportunity,** NEMWI Weekly Update

Stay up to date on CIGLR news! Subscribe to our quarterly eNewsletter: [cigl.seas.umich.edu/resources/latest-news](https://cigl.seas.umich.edu/resources/latest-news)

## GLENN CARTER AND SONGZHI LIU RECEIVE UNIVERSITY OF MICHIGAN RESEARCH STAFF RECOGNITION AWARDS

The Office of the Vice President for Research recognized 15 staff members from across the University of Michigan for their outstanding service and leadership in advancing research, scholarship, and creative practice. “The remarkable efforts and dedication of our research staff are essential to the vitality and progress of the University of Michigan’s diverse research landscape,” said Arthur Lupia, interim Vice President for Research and Innovation.

CIGLR’s Aquatic Research Analyst Glenn Carter received the Research Associate/Assistant/Technician Recognition Award, which recognizes distinguished service to the University of Michigan research community and celebrates exemplary performance in their role as a research associate/assistant or technician. “Glenn first started with CILER (now CIGLR) in 1996 and has spent most of his career working with the University’s research partnerships related to the Great Lakes and aquatic science,” said Casey Godwin, CIGLR Associate Research Scientist. “In addition to his contributions to Dreissena mussels and lower food web research, Glenn has improved our workplace

through mentoring new employees and fellows and by promoting a culture of safety and respect in the lab and aboard vessels.”

CIGLR’s Programmer Analyst Songzhi Liu received the Research Data Management and Analysis Staff Recognition Award, which recognizes a staff member’s distinguished service to the University of Michigan research community and celebrates exemplary performance in their data manager or analysis roles. “Songzhi has served as the Operations Manager for NOAA’s CoastWatch Great Lakes Node since 1997,” said Ayumi Fujisaki-Manome, CIGLR Associate Research Scientist. “Songzhi works to obtain and deliver near real-time and retrospective



Gregory Dick (CIGLR Director), Casey Godwin (Associate Research Scientist), Glenn Carter (Aquatic Research Analyst), Songzhi Liu (Programmer Analyst), and Ayumi Fujisaki-Manome (Associate Research Scientist) gather to honor Glenn and Songzhi as they receive 2024 Research Staff Recognition Awards from the University of Michigan Office of the Vice President.

satellite observations for the Great Lakes data users in collaboration with NOAA scientists. He has made many achievements to establish pathways from science to public service. Most notably, Songzhi played essential roles in organizing the annual CoastWatch Satellite Data Training Courses, which provided valuable opportunities to learn satellite products, data access, and data analysis for students, scientists, and professionals across the Great Lakes region.”



**More awards**

## PEER-REVIEWED PUBLICATIONS

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- Yancey, C. 2023. The Biosynthetic Repertoire of *Microcystis* spp. in Western Lake Erie Harmful Algal Blooms: Insights into Biosynthesis of Known and Novel Secondary Metabolites in Natural Populations using a 'Multi-Omic' Approach. Deep Blue Documents. (DOI: [10.7302/8493](https://doi.org/10.7302/8493)).

## \$6.5M AWARDED FOR GREAT LAKES CENTER FOR FRESH WATERS AND HUMAN HEALTH

Great Lakes researchers at the University of Michigan and CIGLR have been awarded a \$6.5 million, five-year federal grant to host a center to study the links between climate change, harmful algal blooms, and human health. CIGLR Director Gregory Dick will serve as director of the Great Lakes Center for Fresh Waters and Human Health, while CIGLR Associate Research Scientist Casey Godwin will join a team of scientists to assess the occurrence, transport, and effects on human health of aerosolized cyanobacterial toxins. Results of the center's studies will inform management strategies and public policies to protect drinking water and safeguard human health in the Great Lakes region and other freshwater systems afflicted by cyanobacterial harmful algal blooms worldwide.



Get the details



Mary Ogdahl receives the SEAS Most Valuable Player (MVP) Award. Photo: U-M SEAS.

## MARY OGDahl RECEIVES MOST VALUABLE PLAYER (MVP) AWARD FROM THE UNIVERSITY OF MICHIGAN SCHOOL FOR ENVIRONMENT AND SUSTAINABILITY (U-M SEAS)

CIGLR's Managing Director Mary Ogdahl was selected for the U-M SEAS Most Valuable Player (MVP) Award. This award celebrates the employee who consistently delivers exceptional results, makes significant contributions to the team, and goes above and beyond in their role to support the U-M SEAS community. "Mary's dedication, hard work, and excellence to the U-M SEAS community have set her apart, and we are thrilled that she was selected and honored for her accomplishments," said Gregory Dick, CIGLR Director. "This award is certainly well deserved, and CIGLR is so lucky to benefit from Mary's exceptional work every day."

## CONGRATULATIONS TO CIGLR'S 2024 AWARD RECIPIENTS AND FINALISTS

The CIGLR Staff Awards program recognizes the outstanding work done by our staff and postdoctoral research fellows. This year, awards were given to CIGLR personnel who exemplify excellence in research, support science and public service, and make exceptional contributions to the CIGLR community. Please join us in congratulating Anna Boegehold, Jasmine Mancuso, Madeline Tomczak, and Riley Ravary!



The **Community Award** was given to **Anna Boegehold** (Algal Toxin & Ecology Research Specialist) and



**Madeline Tomczak** (Food Web Laboratory Analyst) in recognition of their exceptional contributions to building the CIGLR community, encouraging teamwork, and excellence in mentoring. "Anna's vibrant

personality, professionalism, and dedication to help others has set an outstanding example for all at CIGLR, and she consistently and enthusiastically uses her own voice to elevate those around her and encourages everyone to bring their whole selves to work, routinely finding a way to help her colleagues learn and grow." "Maddie's patience, enthusiasm, dedication, and positive attitude towards her work have been essential to creating an inclusive and welcoming environment in the office and broader CIGLR community. She has proven herself time and time again as someone who incorporates the spirit of community at CIGLR."



The **Research Excellence Award** was given to **Jasmine Mancuso** (Aquatic Ecology Research Analyst) for her outstanding performance in laboratory research, fieldwork, computer modeling, data analysis, scientific achievements, and innovative work. "Jasmine's passion for her work and initiative to grow beyond what was expected of her in such an early stage in her career is an indicator of the continued success she will have as a CIGLR researcher." **Haoguo Hu** (Ice Modeler) was runner-up.

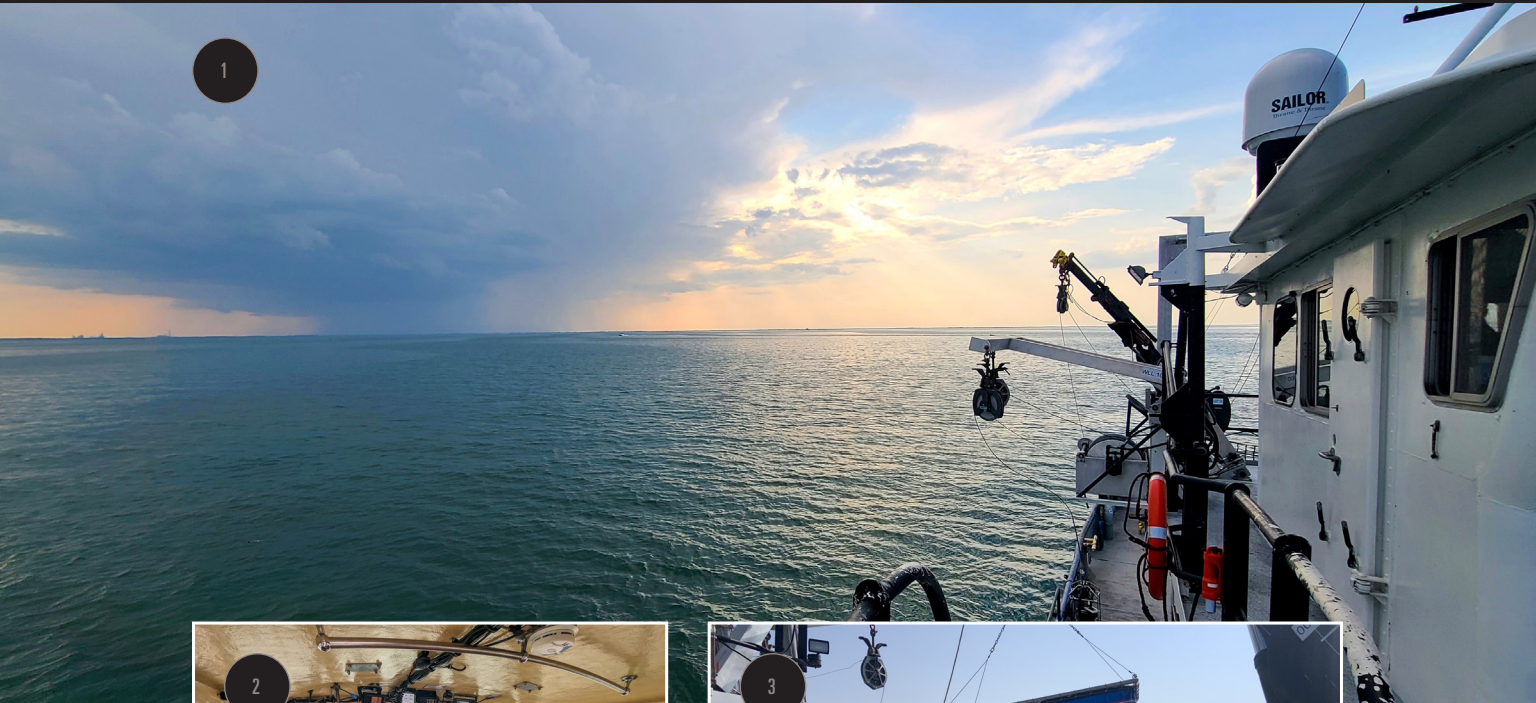


The **Science for Society Award** was given to **Riley Ravary** (Research Engagement Program Lead) and recognizes exceptional activities or accomplishments that support the link between science and public service. "Riley's leadership has helped the research engagement team authentically engage with stakeholders, rightsholders, and potential end users of CIGLR research while prioritizing traditionally underserved groups. Her enthusiasm, passion, and understanding of what it means to create science for the purpose of bettering society has and will continue to shape CIGLR's greater impact across the nation and world."

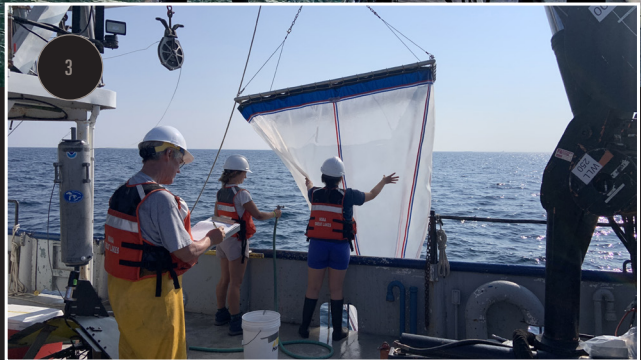


**Find out more**

# 2023 Photo Contest Winners



1



**CIGLR IN ACTION** With a shared passion for water, the Great Lakes, and science, photographers from the Cooperative Institute for Great Lakes Research seek to tell their stories through the lens. For the seventh year in a row, the CIGLR Photo Contest entries feature images that inform, inspire, and amaze.

1st place: *Laurentian Distant Rain*, Paris Schofield

2nd place: *Heading Out*, Aubrey Lashaway

3rd place: *Larval Fish Slip and Slide*, Heather Truong



Explore more photos

1



**CIGLR SCENERY** Viewing scenery through CIGLR lenses is always an inspiration. The creative stories that emerge offer shared experiences and adventure through our Great Lakes research.

1st place: *Isle Royale Sunset*, Mike Shriberg

2nd place: *Magnificent Mill Pond*, Paris Schofield

3rd place: *Mirror Mirror*, Paris Schofield



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## Great Lakes Science for Society



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The Great Lakes are the most critically important freshwater resource on the planet. They support the fourth-largest economy in the world and offer clean drinking water to more than 35 million people. CIGLR leads exciting new research, trains the next generation of scientists, and turns research into action for safe and healthy Great Lakes communities. To "Take Action" and support our Great Lakes, consider a donation today.