

*This issue takes a look at the collaborative nature of large lake research.*

## CONTENTS

- 1 Large team collaborations in large lake research
- 3 A note from the ED
- 3 Association News
  - Run for the IAGLR board
  - IAGLR 2023 memberships
- 4 Thanks to donors & volunteers
- 5 Member News
  - Kudos
  - Welcome new members
  - Member profiles: Edina Illyes, Nick Boucher, and Kiersten McCutcheon
- 7 Modeling the importance of interdisciplinary collaboration
- 8 Odawa Ziibi: A river reborn
- 10 Does a Great Lakes cooperative effort offer hope for COP15?
- 11 Research collaborations: The best way to tackle big ecosystem issues
- 13 A promising framework to foster global collaboration
- 14 Research Briefs
  - Trust-based social networks & collaboration in a post-pandemic world
  - Regional fisheries agencies collaborate to improve prey fish assessments
- 16 Community News
  - Great Lakes Science Strategy
  - Wanted: Emerging researchers and storytellers
  - Ecosystem approach road show
  - Freshwater Research & Innovation Center gets funding
- 18 IAGLR 2023 conference update

## Large team collaborations in large lake research Are they worth the headaches?

by Lucinda B. Johnson

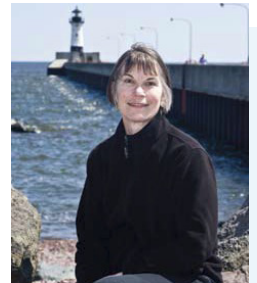
**TODAY’S GRAND CHALLENGES** associated with society at large, and large lakes in particular, are easily described as “wicked” problems—those, as [Steve Schmida states](#), that have “no recipe or set of protocols you can use to solve.” Climate change and biodiversity loss are two examples that meet the classic definition of a wicked problem.

But I would argue that only large teams are capable of tackling wicked problems in a holistic, comprehensive manner. Furthermore, to operate effectively and have the desired impact, such teams must be highly collaborative, multidisciplinary, and diverse (*Cf. [Cheruvilil et al. 2014](#)*).

The need for large teams for large lake research is generally well-recognized, so here I preach to the choir to a certain extent. Leading and managing large teams does, however, require some special considerations.

But first, what are the benefits of large teams that make them worth the management headache? In simple terms, more bodies and brains can tackle larger problems, train and mentor more individuals, and ultimately, achieve a greater impact through disseminating findings across members' research networks and their associated communities of practice. More brains provide the potential for broader perspectives and points of view leading to increased potential for spin-off discoveries and for making better predictions. Throughout my career, I have been involved in a number of large team projects as a researcher or advisor. The most relevant to the Great Lakes was the Great Lakes Environmental Indicators project (GLEI), which involved nine institutions and approximately 75 individual scientists and trainees and ultimately published more than 100 papers and reports. Elements of this project became embedded in a Great Lakes-wide monitoring program and have been used to settle some long-standing management issues. The spin-off projects and relationships continue to this day, more than two decades later.

Everyone now recognizes the benefits of diverse teams, with diversity encompassing traditional factors such as age, gender, culture, and race. But large teams have an enhanced capacity to integrate multidisciplinary and multiscale perspectives and to adopt a broader range of tools and approaches. The wicked problems of climate change and biodiversity loss in large lake ecosystems require an integrated approach that incorporates the traditional breadth of limnological investigations: physical, chemical, and biological sciences. But many of the processes underpinning these challenges are derived from the interaction with human social systems and thus require the additional perspective and contributions of social and behavioral scientists, policy specialists, and economists. Furthermore, large teams would benefit from expertise that includes a range of approaches and techniques including experimental studies at scales from benchtop to mesocosm to multi-site / regional landscape scale; modeling studies; and document analysis, interviews, and focus groups for the social scientists. Examples of multi-scale issues that are successfully addressed using these diverse approaches include harmful algal blooms—a contemporary example where drivers of bloom creation and toxicity are being addressed in laboratories, while environmental



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drivers of blooms and their impacts are being studied at a range of scales using remote sensing technologies such as satellite and drones. The challenges associated with merging and interpreting the data acquired from a variety of scales and approaches are best addressed by ensuring active engagement of the consortium of experts during the synthesis steps of the program. This challenge is significantly more complex when incorporating social science / qualitative data and information in the project; thus, the need for a large team encompassing many disciplines and brains.

But I would be remiss in not acknowledging the difficulties in creating and managing such teams, funding being the most-mentioned factor by colleagues. Large lake studies are inherently expensive at any scale, and large, diverse teams require the appropriate research infrastructure, generally crossing multiple institutions and research organizations, and leadership personnel. (However, it should be noted that there are possible economies of scale to be gained by coordinating sampling across programs.) Thus equipment and personnel can be shared, but this requires that schedules are harmonized, and a significant investment is made in project coordination to maintain consistency in methods, data collection and handling, and infrastructure / equipment maintenance.

Successful teams also invest time and effort up front to discuss and agree on factors that form the underpinnings of the social dynamics: data sharing policies, authorship, mentoring guidelines, etc. Different disciplines have different vocabularies, and it is not uncommon for the same word to have multiple meanings across disciplines, leading to vast confusion for all until someone realizes what is happening. Roles and expectations within the hierarchy of a large team, and within or across organizations and laboratories, may differ to the extent that problems and misunderstandings can easily surface and fester. I learned the hard way about such differences while serving as a co-principal investigator on a large, multidisciplinary project led by a medical professional. The team discovered mid-project that authorship and credit norms differed substantially between the ecology and medical fields, leading to difficult conversations and strained relationships. Across the large teams that I have observed, the most successful and productive are those that create a strong but empathetic and diplomatic leadership group within the overall team to help everyone navigate the thorny social dynamics that ultimately arise in any large group. Frequent, open, and honest communications are key.

The leadership and management of large teams differ significantly from that of small teams, with the level of administrative responsibilities intrinsically linked to funding source(s) and institutional requirements. Many large projects are funded through cooperative agreements, which adds another layer of complexity to communication and management issues. The benefits of such arrangements are that those projects are

“The trend away from funding single investigators is clear; it is also clear that government agencies are assembling their own large teams in addition to funding multidisciplinary projects with large teams.”

almost guaranteed to have immediate impact. A team's success largely depends upon the social dynamics formed during the proposal development phase and continued throughout the life of the project or program. Consideration of race, culture, age, and gender is as important as the logistics of implementing the project objectives. Subtle factors, such as considering safety or logistical issues unique to gender or race, can make a tremendous difference in outcomes. For example, one must consider previous life experience, level of expertise, and self-confidence when assigning field teams to ensure all members feel safe with one another and in the field environment. Performance metrics and benchmarks are useful for tracking progress across individuals and research teams; project management tools are increasingly used to assist in managing large projects and teams. In my experience with large teams, it was clear that having a well-established hierarchy of responsibility was absolutely critical, and an effective project coordinator (in addition to data manager, QC support, communication team, etc.) was essential both to the project's success and to the lead principal investigator's sanity. Finally, leading or collaborating with teams takes a special mindset and skillset; researchers with a tendency towards introversion may find such teams to be outside their comfort zone and the value of their contributions may demand that the team consider different ways of interacting and communicating to accommodate different learning and communication styles.

The trend away from funding single investigators is clear; it is also clear that government agencies are assembling their own large teams in addition to funding multidisciplinary projects with large teams. These endeavors are extremely rewarding, both professionally and socially, as long as the potential sources of conflict are addressed at the project's inception. My own career benefited immensely from the intellectual and social interactions gained during projects such as the GLEI, with lifelong colleagues and friends gained and kept. The scientific output of such teams, I hope, will also prove long-lived. Large teams require significant effort but also have the potential for much greater rewards and more rapid understanding of the “wicked” problems facing our large lakes.

Lucinda B. Johnson has retired as director of research from the Natural Resources Research Institute, University of Minnesota Duluth, and is now senior research fellow there. This column benefited from conversations with GLEI and NRRI colleagues.

## A NOTE FROM THE EXECUTIVE DIRECTOR



After a pause in recent years, the IAGLR team is now engaged in preparing for the return of our in-person Conference on Great Lakes Research. Thanks to all who proposed sessions and submitted abstracts. The IAGLR 2023 Program Committee, led by Tim Johnson, has

developed a high-quality program from your contributions, and I am also looking forward to hearing from [three fantastic keynote speakers](#) on climate policy, science, and adaptation. Although the emphasis will be on the in-person experience, we've worked hard to offer online viewing for those who cannot attend in person. The conference will be livestreamed (viewing only), and all registrants will also be able to view recordings after the conference. Despite challenges and uncertainties, the conference team is excited about IAGLR 2023 and looks forward to gathering with you in Toronto.

Earlier this month, the IAGLR Board of Directors met to discuss transitioning from a management to a governance role; a change made possible with the creation of the executive director position. We are updating some of our operating documents, and members will be asked to vote on the adoption of revised bylaws at the May 10 annual business meeting held at the conference. A copy will be emailed to all members for review before the meeting. Members will also be asked to vote in the board election at the end of March. The Call for Nominations went out earlier this month, and nominations are due March 17 (see adjacent news item). Please make sure to cast your vote! We are looking to include expertise traditionally not found on the board as fundraising takes on a growing significance for our organization.

In the coming weeks and months, we will be exploring new funding sources to ensure the sustainability and impact of the association. IAGLR has established itself as a trusted voice for large lake science, and that respected position can be used to support initiatives that benefit the lakes.

I look forward to seeing many of you in Toronto. May will be here before you know it! In the meantime, please feel free to reach out to me on any of these or other topics. I welcome your thoughts at any time!

À bientôt,  
Jérôme Marty

## Run for the IAGLR Board of Directors

Are you interested in serving on the IAGLR Board of Directors or know someone who should? We're seeking candidates for the following positions:

- 1 Regular U.S. Member  
(three-year term, 2023-2026)
- 1 Regular Canadian Member  
(three-year term, 2023-2026)
- 1 Student Canadian Member  
(two-year term, 2023-2025)

We encourage you to stand for election or nominate someone you believe would benefit the association. Note that all regular directors may be in a position to serve as vice president at some point in their tenure. This person is then intended to become president the following year and past president the next, adding to the length of service for this individual.

[View the Call for Nominations](#) to learn more about IAGLR and serving on the board. **The nomination deadline is March 17.**

**The board election will open at the end of March and run through April 7. Ballots will be emailed to members.**



## 2023 Memberships

This is a **great time** to join the association or renew your IAGLR membership!

Members receive several benefits, including a subscription to the multidisciplinary *Journal of Great Lakes Research* and a [substantial discount on registration fees for the upcoming conference in May!](#)

**[Renew or join today!](#)**

We wish to thank all the donors and volunteers who gave of their time, talent, and treasure to support IAGLR in 2022. You help keep IAGLR strong.

## GREAT LAKES BENEFACTORS

We extend a special thanks to our inaugural [Great Lakes Benefactors](#). These organizations have provided significant financial contributions to IAGLR in 2022, and we are grateful for their commitment to IAGLR and large lake science.

### Platinum \$15,000 and above

Great Lakes Fishery Commission

### Silver \$5,000–\$9,999

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### Bronze \$2,500–\$4,999

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Thomas Golden (CV)

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Julie Hinderer (C)

Calvin Hitch (B, CC)

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John Janssen (AE)

Tim Johnson (AE, CC)

Nicholas Johnson (AE)

Jory Jonas (C)

Donna Kashian (B, CC)

Andrea Kirkwood (C)

J. Val Klump (AE)

Marten Koops (C)

John Krezoski (C)

Geneva Langeland (C)

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Monica Lewis Patrick (C)

Stu Ludsin (C)

Alex Maguffee\* (B)

Matt McCandless (C)

Robert Michael McKay  
(AE, C)

Scott McNaught (CASS  
liaison)

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Kevin Obiero (C)

Felicia Oentoro (CV)

Richard Ogutu-Ohwayo  
(AE)

Jess Owen (C)

Gordon Paterson (C)

Judith Perlinger (C)

Trevor Pitcher (B, CC)

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Laura Rankin (CV)

Neil Rooney\* (B, CC)

Rebecca Rooney (C)

Lars Rudstam (AE, C)

René Sahba  
Shahmohamadloo (B, C)

Yulia Sapozhnikova (C)

Ali Shakoor (C)

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Somayeh Sima (AE)

Katie Stammler (CC)

Jason Stockwell (AE)

Wendylee Stott (AE)

Craig Stow (AE)

Bryan Stubbs (C)

Katie Thomas\* (B)

Harvey Thorleifson (AE)

Anett Trebitz (AE)

Michael Twiss (AE, CC)

Noel Urban (AE, B, CC)

Ed Verhamme\* (B, CC)

Tony Vodacek (AE)

Allison Vogelsong  
Zejnati (C)

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Les Warren (B, C)

Brian Weidel (AE)

Mathew Wells (C)

Olivia Williams (CV)

Chris Wilson (AE, C)

Christopher Winslow (C)

Ram R. Yerubandi (AE)

Lei Zhang (C)

Chiara Zuccarino-Crowe  
(C)

Thanks to all the authors who have shared their expertise and time to fill the pages of *Lakes Letter* in 2022.

IAGLR board members are indicated by a B after their names, with officers designated by an asterisk. Associate editors of the *Journal of Great Lakes Research* are designated by an AE, committee members a C, committee chairs a CC, and other conference volunteers a CV.

## MEMBER PROFILE



## Edina Illyes

Ph.D. Student, Mandrak Lab at University of Toronto Scarborough

### About my work

I am particularly interested in understanding how landscape processes,

such as the last continental glaciation and anthropogenic activities, shape species distributions and, consequently, ecosystems and biotas. My current studies focus on exploring the impacts of historical dispersal on contemporary lake fish communities of northwestern Ontario in the former glacial Lake Agassiz basin, and anthropogenic effects on fish species in, and potential dispersal from, urban ponds.

### Inspiration for this work

During my undergraduate studies, I was mesmerized by learning that, not such a long time ago, most of Canada was covered by kilometers-thick ice sheets, and I wanted to know more about its impacts on organisms. This

led to the opportunity of working on an undergraduate project with Dr. Mandrak, which eventually evolved into my graduate studies allowing me to further explore the subject.

### Something else about myself

When I am not working, I love spending my time outdoors with my dog and best bud, Rum.

### Why I joined IAGLR

As an IAGLR member, I am looking forward to learning about and keeping up to date with the work of other aquatic scientists from its diverse community. I hope to engage in knowledge sharing, make connections with like-minded people, and participate at conferences.

## KUDOS

Congratulations to the following IAGLR members for their accomplishments!

**JEAN V. ADAMS** (U.S. Geological Survey) for her retirement from the Great Lakes Science Center after 30 years of federal service. For most of that time she was a statistician for both the USGS and the Great Lake Fishery Commission, but she went back to school late in her career and became a research fish biologist specializing in sea lampreys. She continues to serve her term as IAGLR president.

**CARRIE BAKER** (Great Lakes Fishery Commission) for her promotion to science programs assistant manager. Baker has been dedicated to the commission's mission and vision and served in various roles within the science directorate since 2018. This promotion recognizes considerable training and skills development and Baker's successful completion of the Great Lakes Leadership Academy Emerging Leaders Program.

**SUZANNE DEVRIES-ZIMMERMAN** (Hope College) for her promotion to associate professor of geological and environmental sciences instruction.

**ANDREA KIRKWOOD** (Ontario Tech University) and **JÉRÔME MARTY** (IAGLR) for receiving outstanding service awards for their roles in establishing the new Society of Canadian Aquatic Sciences.

## Welcome New Members

(November 2022–January 2023)

Hazem Abdelhady	Jennifer Maki
Carrie Baker	Frank Masese
Caroline Barth	Kiersten McCutcheon
Ashley Belle	Abigail Melendez
Emily Jepyegon Chemoiwa	Paul Mumina
Chelsea Crundwell	Lauren Nawroth
Margaret Docker	Alycia Peterson
Hector Esparra-Escalera	Hannah Phillips
Sam Francis	Daniel Ruane
Shikshya Gautam	Clayton Sigmann
Brett Hayhurst	Somayeh Sima
Edina Illyes	Peter Torma
Jacob Iteba	Carol Waldmann Rosenbaum
Katarina Kieffer	Amanda Welsbacher
Sierra Legare	QianQian Xiang
Katrina Lewandowski	Yuanyan Zi
Gabriella Lükő	

*We're glad you're here!*

## MEMBER PROFILE

### Nick Boucher

Ph.D. Student, Great Lakes Acoustic Telemetry Observation System, Michigan State University

#### About my work

From November 2019 to December 2022, I worked as a fishery research program associate at the Great Lakes Fishery Commission. In this role, I coordinated review of incoming research proposals, administered ongoing projects, and coordinated the Great Lakes Acoustic Telemetry Observation System (GLATOS). As of January 2023, I am a Ph.D. student advised by GLATOS Director Chris Vandergoot. My Ph.D. research will focus on methods for analyzing acoustic telemetry data and assessing acoustic telemetry arrays.

#### Inspiration for this work

I was lucky enough to spend five days on a historic skipjack (oyster trawler) in the Chesapeake Bay as part of my fourth



grade curriculum. We spent the week catching oysters and blue crabs, and since that time I have been fascinated by aquatic ecosystems.

#### Something else about myself

While I never played organized hockey and have very little hockey skill, I really enjoyed playing in the IAGLR hockey game at the 2022 JASM Meeting in Grand Rapids. I am looking forward to playing again in Toronto this year (and hope to learn how to skate backwards before then)!

#### Why I joined IAGLR

IAGLR's State of Lake Michigan Conference in Green Bay was my first academic conference in the Great Lakes region. I really enjoyed the collegial atmosphere of the IAGLR meeting, as well as the breadth of topics covered.

## MEMBER PROFILE

### Kiersten McCutcheon

VAST Project Coordinator, Niagara Coastal

#### About my work

I am a young professional working as a project coordinator for Niagara Coastal, a small non-profit organization that works to build a healthy and resilient Great Lakes ecosystem. Over the past two years, I have been developing and managing the Visual Assessment Survey Tool (VAST). VAST is a collaborative initiative that engages community members as citizen scientists to collect data and images that provide evidence of the changing conditions on the Great Lakes. My work ranges from community outreach, project management and data analysis to implementing local coastal restoration projects.

#### Inspiration for this work

The Great Lakes basin is a region unlike anywhere on earth, and the lakes play a

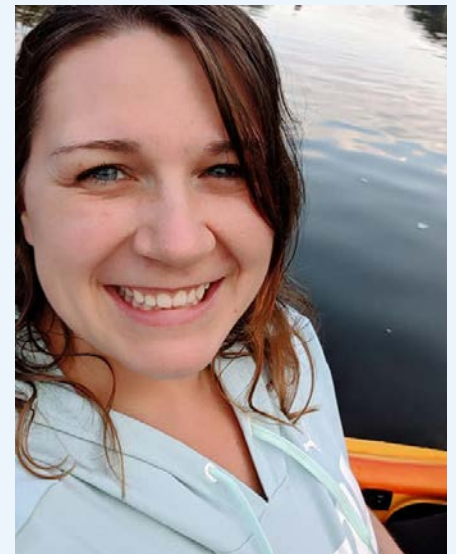
large role in the lives of everyone who lives near them. Whether for drinking water, travelling, spiritual ceremonies, swimming, or my favourite water activity, kayaking, we all rely on the Great Lakes in some way. I was inspired to enter this work to restore and preserve these ecosystems for future generations.

#### Something else about myself

I am enthusiastic about data and have a deep love for well-designed spreadsheets! One of my favourite aspects of my work is piloting an aerial drone to survey shorelines on the Great Lakes. A drone provides massive amounts of data in a fraction of the time it would otherwise take to collect. Analyses of data collected by drones can quickly assess the impact of stressors on coastal environments.

#### Why I joined IAGLR

As a shared community resource, the Great Lakes require a community of



people passionate about protecting them to ensure they can continue to be used to meet our needs. I joined IAGLR to be more involved within the larger Great Lakes community. I am looking forward to learning from and collaborating with other IAGLR members to preserve these cherished lakes!

## A SPECIAL SECTION OF THE JGLR

# Modeling the importance of interdisciplinary collaboration

by Kathleen Williams and Paul Seelbach

WE INVITE YOU to check out the [special section of the \*Journal of Great Lakes Research on Communities and Organizations\*](#). This section is important because it draws attention to one of the dimensions of ecosystem-based management (EBM) that we often take for granted: collaboration among government agencies and local community stakeholders. Although EBM requires collaboration, it is often assumed that it will just happen, and little attention is paid to the process of engaging partners, identifying community values, or understanding decision processes

The Communities and Organizations special section helps to demonstrate the spectrum of actors (agencies, organizations, and individuals) doing the remediation and restoration work, as well as how essential grassroots organizations are to these processes. The section also presents systematic investigations conducted to understand how these processes unfold in places; lessons that can be applied in other places.

In recent years, Great Lakes applied researchers have been increasingly called to integrate the social and natural sciences in support of environmental management. This is easier said than done, because often social and natural science researchers construct problems differently, use different methodologies and literatures, and may be challenged to bridge those gaps in understanding. To address this challenge in the special section, we used interdisciplinary editorial teams consisting of a biophysical and social scientist who collaboratively made the editorial decisions. This was important because we wanted to ensure that social

science research spoke to the interests and information needs of biophysical scientists, while at the same time adhering to social science or humanities or storytelling methodologies. We hope the product is a collection of articles that demonstrates the impact of interdisciplinary collaboration. Our intent was not to simply publish social science research conducted in the Great Lakes region, but rather to illustrate the many ways that emerging interdisciplinary and social science research is complimenting the biophysical sciences in support of substantial restoration and revitalization work within the region.

[Kathleen Williams](#) is with the US Environmental Protection Agency Great Lakes Toxicology and Ecology Division. [Paul Seelbach](#) is at the University of Michigan School for Environment and Sustainability.





Members of a Grand Traverse Band of Ottawa & Chippewa Indians drum circle at the former Brown Bridge Dam site during a river “reopening” ceremony (2013). Below, the Odawa / Boardman Watershed, courtesy of the Boardman River Project.

# Odawa Ziibi

## *A river reborn*

by Nate Winkler

In April 2009, a watershed decision made by a northern Michigan community resulted in the most important river restoration project to occur in Michigan to date. Over an eight-year period, three large dams were removed from an 18-mile-long segment of mainstem river, restoring connectivity for aquatic organisms, sediment, and nutrients as well as the partners collaborating on the project.

To take a step back, the river known to most as the “Boardman” was, in the late 1800s and early 1900s, a handy source of energy for Traverse City, a regional hub for timber and agricultural production. Once the timber had run out and the river was no longer assaulted by rafts of saw logs, its energy was harnessed to generate hydropower. Over the course of 60 years, five dams were constructed on the river mainstem beginning with Union Street Dam (which powered a flour mill) in 1865 and the most recent, Brown



Bridge Dam, placed online in 1922. Keystone, one of the four dams that produced hydroelectricity, failed completely in 1961 and was never rebuilt, but two dams just downstream, Boardman and Sabin, remained.

Stepping further back, the river was known as the “Odawa Ziibi” or “Ottaway River” by the Ottawa and Chippewa peoples of the region, the political successors of whom became an essential element in the success of the dam removal project. Despite the callous treatment of Indigenous peoples over the years at the hands of the U.S. government, the Ottawa and Chippewa became partners and leaders in returning a river damaged by Euro-American industry closer to the cold, free-flowing conduit of life the river served as long before log drives and dam construction.

Over time, hydroelectricity production by the Ottaway River dams diminished to a fraction of the need posed by a growing community while continuing to disrupt flow to Grand Traverse Bay. As the dams aged and deteriorated, the



City of Traverse City and Grand Traverse County were compelled to perform a cost-benefit analysis on continued operation. They discovered that the cost to implement required upgrades exceeded the projected future income, so the decision was made to decommission the three hydroelectric dams and undertake a full evaluation of their fate.



Construction of the Brown Bridge Dam circa 1920 (courtesy of Traverse Area Historical Society).

In 2005, an Implementation Team (IT) was assembled under the Boardman River Settlement Agreement, which comprised the Michigan Hydro Relicensing Coalition, Grand Traverse Band of Ottawa and Chippewa Indians, U.S. Fish and Wildlife Service, Michigan Department of Natural Resources, Michigan Department of Environmental Quality, Traverse City Light and Power, City of Traverse City, and Grand Traverse County. In tandem, the Boardman River Dams Committee (BRDC) was formed and subsequently mediated under a neutral third party. The community-based BRDC was tasked with a dam disposition assessment (2005-2008), the

key elements of which were to evaluate current conditions, perform an options and alternatives analysis, and in the end, provide a recommendation to the IT as to the dams' disposition. This exhaustive process included 180 public meetings attended by approximately 2,500 people, with 2,000 questions asked and answered, in addition to 18,000 surveys distributed throughout the region. At its conclusion, the BRDC process resulted in over 80 options for disposition with the preferred option being removal of the three hydroelectric dams and modification of the lowest-most dam at Union Street to allow for native fish passage. In January 2009, the BRDC submitted its recommendation to the IT, which then presented the findings to the owners. After reviewing the recommendation, the City of Traverse City and Grand Traverse County in April 2009 opted to pursue dam removal and modifications for fish passage.

The IT was established to conduct the disposition of the dams, and with the owner's decision, the project began in earnest. Not long after, *ex-officio* members were added to the IT and included the Conservation Resource Alliance (eventual project manager), Garfield Township, the Grand Traverse Conservation District, the Watershed Center-Grand Traverse Bay, and the Grand Traverse County Road Commission. With a vast array of resources and expertise available, the IT was well-positioned and worked collaboratively through respectful

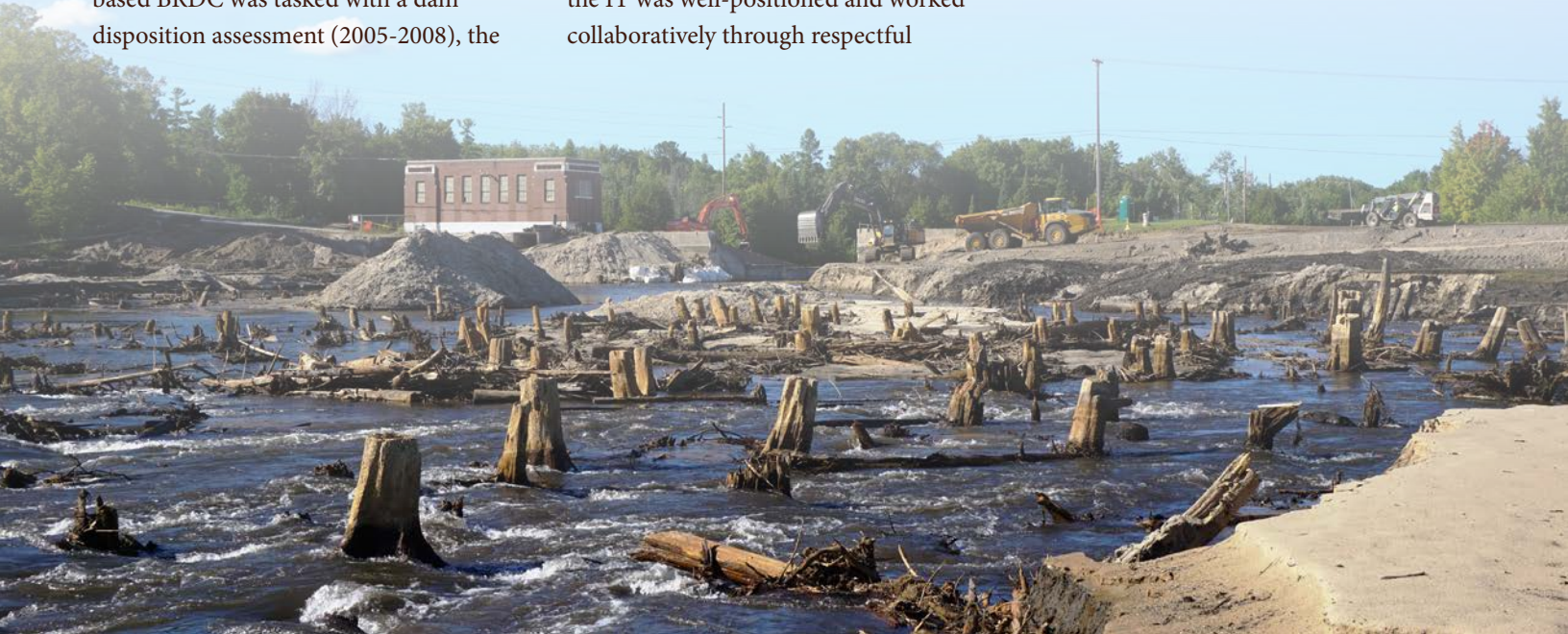


Excavator exposing the Boardman Dam penstocks during demolition (2017). Below, Sabin Pond and the dam after dewatering with the exposed stumps of trees cut during the dam's construction (2018).

consensus to carry the project through to completion in 2018. The understanding and relationships built among the team members continue to this day with new project partnerships.

The process was long and arduous, but the cultural perspectives of a community of people that has been in the region for thousands of years kept time in perspective. The Grand Traverse Band of Ottawa and Chippewa Indians provided leadership of the IT, increased awareness of the cultural significance of the river, technical support, and a significant portion of the project funding. In this way, one of the deepest lessons of irony reveals itself in time—that those who've lost the most to history have in turn given tremendously; for the river and generations to come.

[Nate Winkler is a biologist with the Conservation Resource Alliance in Traverse City, Michigan.](#)



## BENDING THE CURVE OF SPECIES INVASION

# Does a Great Lakes cooperative effort offer hope for the COP15 framework?

by Anthony Ricciardi

The recent UN Biodiversity Conference (COP15) in Montreal may spark a renewed sense of purpose among freshwater conservationists. Rather than perpetuate the old “land and sea” paradigm that has traditionally ignored lakes, rivers, and wetlands, the COP15 framework explicitly identifies inland waters among the environments to be restored and conserved. This attention is justified given that freshwater ecosystems are disproportionately diverse and threatened compared to terrestrial and marine systems.

The framework also recognizes invasive species as a major driver of biodiversity loss, and [one of its targets \(Target 6\) calls for reducing global rates of invasion by at least 50% before the year 2030](#). This ambitious goal will demand enhanced risk assessment, dedicated monitoring, and science-based management of invasion pathways. However, even a small reduction in globally burgeoning invasion rates would significantly benefit biodiversity and ecosystem stability.

Controlling the spread of invasive species is a transboundary, multidimensional challenge requiring cooperation among nations, policy makers, scientists, and industries. An encouraging example of such cooperation is the binational effort to mitigate ballast water invasions in the Great Lakes.

The Great Lakes basin is the world's most invaded freshwater system, containing nearly 190 established non-native species. These species were introduced over two centuries through various vectors including canals, aquarium dumping, bait bucket release, and aquaculture escapes. However, two-thirds of invasions recorded over the past six

decades are attributable to ballast water release, which has introduced highly disruptive species such as the zebra mussel, quagga mussel, round goby, and spiny water flea. Although ballast water has been transported to the Great Lakes for nearly a century, the opening of the modern St. Lawrence Seaway in 1959 allowed larger vessels and more frequent ship traffic to deliver greater volumes than ever before. Consequently, the invasion rate skyrocketed. [From 1959 to 2006, one new invader was discovered established in the Great Lakes basin every six to seven months on average](#)—a rate unmatched by any other freshwater system on the planet.

An attempt to control ballast water invasions through harmonized legislation by Canada and the United States in 1993 failed because of technological issues and a regulatory loophole; but its failure was only recognized in the years that followed. New harmonized regulations in 2008 mandated—with strict inspection and enforcement—that all transoceanic ships destined for the Great Lakes flush saltwater through their ballast tanks to achieve ocean salinities prior to entering the seaway. Experiments on this procedure indicated that it would significantly reduce the number of living freshwater organisms in ballast tanks.

We have now had 14 years to assess the effectiveness of binational ballast water management, and the results are impressive. [Since 2008, invasions reported in the Great Lakes basin have declined by 85% and are now at their lowest rate in two centuries](#). Additional forms of management likely contributed to this decline, but empirical evidence points to ballast



The bloody red mysid shrimp (*Hemimysis anomala*) was one of the last transoceanic ballast water invaders discovered in the Great Lakes. Photo by Steven Pothoven (Great Lakes Environmental Research Laboratory). Background shows ship discharging ballast water at sea. Photo by Sarah Bailey, Fisheries and Oceans Canada.

water regulation as the overwhelming primary cause. Nevertheless, the threat of invasive species is far from eliminated; invasion risks in the Great Lakes remain significant because of other, largely unregulated vectors such as those linked to commercial trade in live organisms. More effective management of these vectors is necessary for conserving biodiversity and protecting a fishery worth several billions of dollars.

The key takeaway message from the Great Lakes is that science-based solutions implemented through the cooperative actions of stakeholders can produce substantial results. In this case, binational cooperation apparently resulted in an unprecedented reduction in the invasion rate in the world's largest freshwater ecosystem. This success should fuel optimism and determination for achieving the COP15 global targets.

Anthony Ricciardi is a professor in the Redpath Museum and the Bieler School of Environment at McGill University in Montréal.



Preparing to deploy a real-time buoy in the Western basin of Lake Erie. Photo by Ed Verhamme.

## Research collaborations: The best way to tackle big ecosystem issues

by Elizabeth Striano, Katelynn Johnson, and Todd Leadley

**S**olving increasingly complex environmental challenges requires collaborative research networks that share expertise, data, information, and tools. Fortunately, the [Real-Time Aquatic Ecosystem Observation Network](#) (RAEON) is providing exactly what researchers need to carry out their work to understand and monitor freshwater ecosystems in the Great Lakes.

Since receiving its original funding in 2018, RAEON has been providing researchers with access to instruments that generate real-time and continuous data from aquatic ecosystems and advanced laboratory facilities, data management, and technical expertise. Lead investigator Aaron Fisk directs the network. He is a professor in the School of the Environment and Canada Research Chair in Changing Great Lakes Ecosystems at the University of Windsor.

“All our equipment is available for researchers to use, as well as the data produced,” says Katelynn Johnson, RAEON

research and operations director. Johnson says it’s important that researchers who participate in the network understand the data-sharing aspect of RAEON. “Data sharing has become such a big issue in science,” she notes. “It’s a major requirement of the grants we’ve received.”

RAEON’s data sharing requirements allow other groups access to quality data to incorporate into their own research programs, reducing expensive duplicate sampling efforts and yielding practical results. These data are improving understanding of the mechanisms and processes of large lake ecosystems and contribute to the management, rehabilitation, and enhancement of their ecosystem services.

“Ultimately the goal of these collaborations is to provide leaders in government and industry with the comprehensive science-based data and information they need to make effective, responsive policy and management decisions,” Fisk says.

*continued*

This sharing of equipment and data is the only way to tackle big ecosystem projects, particularly as monitoring instruments have become increasingly sophisticated and complicated.

“The practical benefits of a network like RAEON are its ability to provide equipment and field support to research groups that otherwise may not have access to such resources to carry out logistically difficult large, field projects,” explains Todd Leadley, RAEON Field Technician.

He goes on to note how collaboration within the network brings research groups together from all over the continent and with a wide range of expertise. “This allows a more integrated approach to common research goals,” Leadley says. “For example, for the study and early detection of harmful algal blooms in lake ecosystems, not only are nutrient experts important, but hydrologists, ecologists, genomists, and environmental engineers.”

The Great Lakes Glider Consortium, a group of both U.S. and Canadian researchers, is a large, multinational effort. In addition to RAEON, the group includes the University of Minnesota at Duluth, the U.S. Environmental Protection Agency, and the Cooperative Institute for Great Lakes Research (CIGLR), a partnership between the University of Michigan and the National Oceanic and Atmospheric Administration (NOAA). Collaborators meet regularly to share knowledge and resources for Slocum glider efforts in the Great Lakes. For example, the consortium has worked together to tackle the issue of hypoxia in Lake Erie by using gliders to inform fisheries managers on when to conduct their fall trawling surveys.

“This consortium is a great way to coordinate glider efforts in the Great Lakes, which allows us to cover more of the lakes, more frequently, giving us a better view of internal processes,” notes Russ Miller with NOAA-CIGLR.

Other projects RAEON is involved in include the Lake Erie Alliance Project, for which RAEON provides instrumentation, staff, and data management to help inform water utility managers on harmful algal blooms in the western basin of Lake Erie. RAEON also supports various fish telemetry projects through the Great Lakes Acoustic Telemetry Observation System, a binational network of researchers who collaboratively use acoustic telemetry to understand fish behavior and provide information to fish managers in their decision making. And at the University of Windsor, RAEON provides real-time buoys to support water security research in the Great Lakes.



Deploying a Slocum glider in Eastern Lake Ontario. Photo by Dmitry Gorsky. At bottom, a real-time buoy in the Western basin of Lake Erie. Photo by Katelynn Johnson.

Recently, RAEON secured more than Can\$1.77 million in additional funding, joining an even larger collaborative freshwater observational research network known as the Global Water Futures Observatories (GWFO), under the lead of the University of Saskatchewan. “With RAEON now joining GWFO, it will become part of the largest network in Canada and one of the largest freshwater research networks in the world,” Johnson says. “This collaboration will open up new collaborations with researchers outside of the Great Lakes as well.”

There are many other unexpected benefits of such collaborations. According to Leadley, RAEON has also gained interest from other groups. For example, the Marine Environmental Research Infrastructure for Data Integration and Application Network at Dalhousie University has reached out to RAEON. This group develops machine learning and data processing tools for underwater acoustic, vessel tracking, and satellite imagery. Another collaboration led to development of a novel way to retrieve data from underwater acoustic telemetry receivers. The RAEON team worked with industry partners Teledyne and INNOVASEA to develop a way for gliders to download the data from VR4-UWM receivers by flying down to those receivers and offloading the data in a fraction of the time it would take by boat.

As collaborations like these continue to evolve and expand, researchers will be better positioned to help solve some of the world’s growing environmental problems as climate changes and demand for water and resources increase. RAEON offers its equipment and services to Canadian academics and their bi-national partners. For more information, please reach out to Katelynn Johnson, [katejohn@uwindsor.ca](mailto:katejohn@uwindsor.ca) or [visit our website](#).

Elizabeth Striano is with Michigan Sea Grant. Katelynn Johnson and Todd Leadley are with RAEON at the University of Windsor.



A PROMISING FRAMEWORK TO FOSTER GLOBAL COLLABORATION

# Lake committees & advisory groups in the Laurentian and African Great Lakes

by Zeph Migeni and Evans Lomodei

**THE GLOBAL SIGNIFICANCE**

of large lakes—with their extensive biodiversity and huge provisioning ability for goods and services—calls for transboundary and transjurisdictional collaborations, partnerships, and extension in both research and education. Two pre-pandemic conferences demonstrated this thirst for such collaboration: the African Great Lakes (AGL) conference in Entebbe, Uganda (2017) and the 60th annual conference of the International Association for Great Lakes Research in Detroit, Michigan, USA (2017). At both events, a diverse group of attendees came together to explore the enormous benefits of shared and varied ideologies and resources across continents. Organizers argued that resource paucity within one lake system or region may inhibit efforts to address larger-scale challenges on freshwater fisheries, thus calling for collective transboundary collaboration to enhance the maximum beneficial use of scarce resources across regions for management and conservation of the world's large lakes.

The importance of collaboration within the African Great Lakes has been demonstrated in the Lake Victoria basin through the coordinating effort of the Lake Victoria Fisheries Organization between Kenya, Uganda, and Tanzania. Similarly, the successful coordinating and facilitative efforts of the Great Lakes Fishery Commission, the International Joint Commission,



Lake Turkana Advisory Group experts and advisors on a recent research visit. Photo by James Last.

and others in the Laurentian Great Lakes emphasize the need for large lakes collaboration. Therefore, the huge potential that can be harnessed through a joint African and Laurentian Great Lakes collaboration is highly desired. Each region has a similar framework to facilitate collaboration: advisory groups in Africa and lake committees in North America. The AGL's advisory groups are facilitated by the African Center for Aquatic Research and Education. The

organization provides lake-specific freshwater experts drawn from academia, research, and policy-making governmental and nongovernmental institutions to offer advice and conduct research for the management and conservation of the African Great Lakes. Similarly, the lake committees of the Laurentian Great Lakes are lake specific and tasked with similar roles as stated by the Great Lakes Fishery Commission. The envisaged collaboration between these two groups can enhance the interchange of ideas and resources, which will in turn contribute to and ensure sustainable management and conservation of both the African and Laurentian Great Lakes. This transboundary collaboration can benefit further from the involvement of other independent organizations playing a role in educating and sharing science about the Great Lakes.

Zeph Migeni is with the African Center for Aquatic Research and Education, and Evans Lomodei is with Turkana University College.

	Laurentian Great Lakes Lake Committees	African Great Lakes Advisory Groups
Formed	1965	2019
Purpose	To promote information sharing; became “action arms” of Joint Strategic Plan for Great Lakes Fishery Management in 1981	Primarily to promote information sharing
Composition	Senior officials from state, provincial, and U.S tribal fishery management agencies advised by at least one field-level technical committee	Members (experts in countries riparian to the lake in question) and advisors (invited large lake or freshwater experts)
Activities	Coordinate fishery management across basin through development of shared fish community objectives, establishment of appropriate stocking and harvest levels, identification of law enforcement priorities, and formulation of management plans	Currently producing a series of state-of-the-lake papers to be published in special section of the <i>Journal of Great Lakes Research</i>
Reporting	State-of-the-lake report every five years to summarize trends	<a href="#">Bimonthly advisory group reports</a>
Management Actions	Mutually agreed-upon management actions implemented by individual agencies	Management actions currently out of scope
Meetings	Formal meetings 3 times/year, informal meetings throughout year	Annually in person, monthly virtually

Source: Great Lakes Fishery Commission

Source: African Center for Aquatic Research and Education

**Trust-based social networks & collaboration in a post-pandemic world**

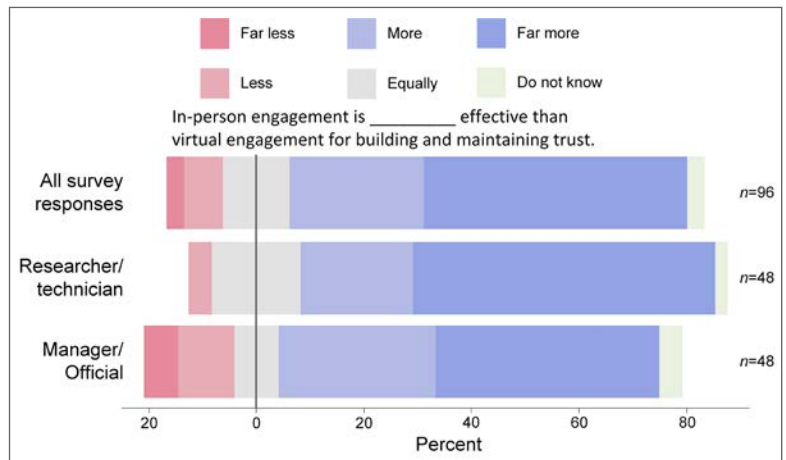
Working arrangements have been fundamentally transformed during the COVID-19 pandemic. These new arrangements have the potential to affect trust-based social networks foundational to collaborative resource management and transboundary governance. The governance structure for Great Lakes fisheries has weathered the storm associated with two years of remote working conditions; but it is unknown how long trust-based relationships can persevere without refreshed commitment to in-person engagement.

A recent survey of fishery professionals throughout the Great Lakes network provided insights into how trust-based relationships have been affected during the pandemic. Eighty three percent of fishery managers and scientists surveyed (n=117) indicated that virtual engagement was effective for maintaining well-established relationships during the pandemic; however, 76.7% of respondents indicated in-person engagement to be more effective than virtual engagement for building and maintaining trust. Only 26.5% of respondents were able to establish trust as

part of new relationships through virtual engagement, and only 7.7% of respondents strongly agreed with this sentiment.

A literature synthesis revealed threats and opportunities to resource management as a post-pandemic new normal emerges. Despite shortcomings, virtual engagement presents opportunities such as nurturing of well-established long-term relationships; short-term trust maintenance; peer-peer coordination; knowledge dissemination; and potentially enhancing diversity, equity, and inclusion.

Governments are urged to prioritize informal interactions and communications fostered by in-person meetings while also recognizing the importance of



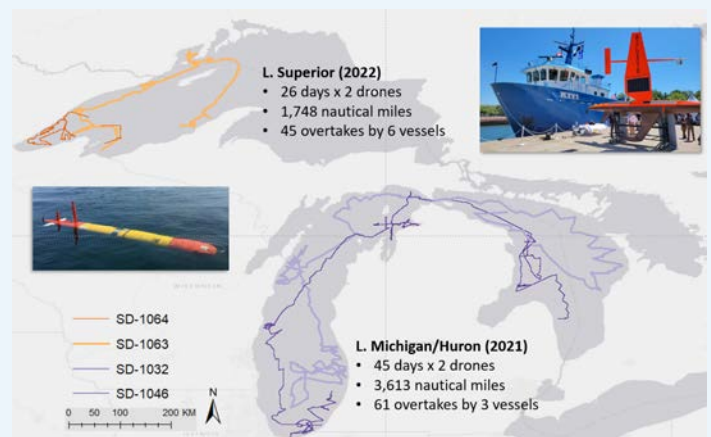
virtual meetings to conduct business in a cost-effective manner. Without renewed commitment to in-person engagement, pre-pandemic trust-based relationships foundational to cooperative, multinational resource management are under threat.

*For a further discussion of survey results, please see the [article in the Journal of Environmental Management](#). Authors include A.M. Muir, J.R. Bernhardt, N.W. Boucher, C. Cvitanovic, J.M. Dettmers, M. Gaden, J.L.M. Hinderer, B. Locke, K.F. Robinson, M.J. Siefkes, N. Young, and S.J. Cooke.*

**Regional fisheries agencies collaborate to improve prey fish assessments through adoption of advanced survey technologies**

Accurate estimates of prey fish abundances are critical to supporting the \$7 billion annual Great Lakes fishery, because prey fish feed the economically valuable predators. Inaccuracies in annual estimates of prey fish abundance can have big consequences for decisions about harvest and stocking. In 2020, the U.S. Geological Survey (USGS) launched a study with 12 other agencies to evaluate the accuracy of prey fish estimates gathered with sonar from conventional research vessels. Prior findings suggests that sonar surveys from research vessels can (1) scare fish away by engine noise from the research vessel and (2) undercount fishes near the lake surface and lakebed.

To quantify these biases, USGS brought two new technologies to the lakes—Saildrones and long-range autonomous underwater vehicles (LRAUVs). Saildrone® is a remotely helmed sailboat that collects sonar data without producing engine noise. LRAUVs fly in the middle of the water column collecting up- and down-looking sonar data. Since 2021, Saildrone has collected fisheries data across more than 5,000 nautical miles of lakes Superior, Michigan, and Huron. Vessels from nine agencies met Saildrone on the water to collect comparison data in the same water on the same nights. More missions are planned with both platforms in 2023. The comparative data will help to understand whether biases affect lakewide prey fish estimates in the Great Lakes, and if



Saildrone (upper right next to R/V Kiyi; credit: A. Miehl-USGS) is well-scaled to the Great Lakes (purple and orange lines), and able to collect fisheries data as it goes. The long-range AUV (left center, credit: P. Esselman-USGS) covered much of western Lake Superior during a single 400 km mission in 2022.

so, by how much. The study aims to provide the best possible prey fish abundance estimates to fisheries managers by correcting for biases and evaluating methods that may improve data quality.

*By Peter C. Esselman, research fisheries biologist, US Geological Survey Great Lakes Science Center.*

# Looking for a career in research?



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At the NOAA Great Lakes Environmental Research Laboratory, we are a diverse group of people that share one common trait—a love for the Great Lakes. We are a transdisciplinary team of scientists, engineers, communicators, and administrators working together to understand and protect this valuable natural resource. Our blended government-academic workforce leads Great Lakes science by bringing together innovative approaches with strong partnerships to benefit society.

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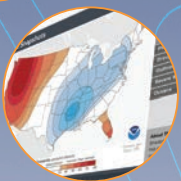
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- Offshore research vessel sampling & buoy deployments
- Hydrographic surveying



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## Great Lakes Science Strategy report published; town hall meeting planned for IAGLR 2023

A recently published report lays out a framework for placing the Great Lakes region on a sound scientific footing to ensure effective management and permanent sustainability of the system. The [Great Lakes Science Strategy for the Next Decade](#), released by the International Joint Commission Great Lakes Science Advisory Board, summarizes the science gaps and related resource needs identified by hundreds of knowledge holders. The report provides an overview of the project and integrates findings of the science strategy into a broader framework to better define science needs to understand changes in the Great Lakes for the protection of the region's economic, social, and environmental health.

Additional engagements with knowledge holders, stakeholders, rights holders, and governments are essential next steps to move beyond the science strategy toward creating, launching, and executing a comprehensive multinational Great Lakes Science Plan for the Next

### Six interrelated, fundamental priorities

- Basic process research: connecting the pieces
- Monitoring and long time series measurements: tracking change in a highly variable system
- Enhanced models and forecast systems
- Human capital: workforce development
- Research infrastructure and centers of excellence
- Inclusion of broad socioeconomic and cultural perspectives



Era. Attendees at the upcoming IAGLR conference will have an opportunity to engage in this conversation at a town hall meeting planned for May 9.

“The science plan will be the largest science initiative ever proposed for the Great Lakes,” notes Val Klump, Science Advisory Board member. “This initiative has the potential to affect all Great Lakes scientists. If you’re going to the

conference, we encourage you to engage with us to learn about the scope of the science strategy and how to get involved in developing the forthcoming science plan.”

**The town hall meeting will take place Tuesday, May 9, after the plenary. Sign up to attend the event when you register for the conference.**

### **WANTED:**

## Emerging researchers & storytellers

The combination of research and great storytelling can change the world. Two iconic organizations have come together to offer grants to people with a passion to make lasting, positive changes to the health of our planet. The Royal Canadian Geographical Society and National Geographic have created [The Trebek Initiative](#) to provide grants to support emerging storytellers, researchers, conservationists and educators. In addition to funding, Trebek Grantees receive access to networking and mentorship opportunities, the opportunity to present their work to international audiences, exclusive funding opportunities and the ability to amplify their projects via the media assets of our founding societies and media partners.

You can find us exhibiting at the IAGLR conference in Toronto this May, ready to answer your questions and inspire you to apply. In addition, Canadian Geographic will be at the conference to present *Biinaagami*, a new multimedia project about the Great Lakes-St. Lawrence watershed that includes a giant floor map. As part of the project, we are looking to amplify stories from around the watershed, so come prepared to pitch your story ideas to a Canadian Geographic editor.

*We want to hear your big, bold, audacious ideas. The future of the Great Lakes relies on the actions we take today.*





## The ecosystem approach road show

In 2022, an international conference on “[The Ecosystem Approach in the 21st Century: Guiding Science and Management](#)” was convened by many partners, including IAGLR. This event included a one-day hybrid conference and a two-day workshop made up of seven synthesis

working groups focusing on different aspects of the ecosystem approach. Each of these working groups produced recommendations and papers that will be published in a special issue of *Aquatic Ecosystem Health & Management*.

Now project organizers are taking these recommendations on the road for stakeholder feedback at 15 public forums throughout the basin. In the end, they will prepare a summary report for broad distribution throughout the basin. If you are interested in hosting one of these ecosystem approach forums, please contact John Hartig ([jhhartig@uwindsor.ca](mailto:jhhartig@uwindsor.ca)) or Catherine Febria ([Catherine.Febria@uwindsor.ca](mailto:Catherine.Febria@uwindsor.ca)).

## Freshwater Research & Innovation Center to receive \$1.6 million in federal funding

A planned freshwater center in Traverse City, Michigan, will get a big boost, thanks to the funding bill passed by Congress in December. The Freshwater Research and Innovation Center collaboration will receive \$1.6 million, which will go toward initial dockside infrastructure and planning its new facilities on the current site of the [Discovery Center & Pier](#) (shown in the foreground, right, on Lake Michigan's West Grand Traverse Bay). This includes engaging an architect in design work and site planning, as well as financial planning. It also provides a significant piece of the funding needed to help build a classroom, lab, and docks for research vessels on the pier, which will enable water-related research projects to begin at the facility as early as summer 2023.

The project is a collaborative effort of 20Fathoms, Discovery Center & Pier, Michigan Technological University, Northwestern Michigan College, and Traverse Connect.

Once complete, partners say, the center will establish the Grand Traverse region as a hub for applied freshwater innovation, offering research, education, commercialization, incubation, and



acceleration programs. The center will focus on autonomous and remote technologies, freshwater and marine technologies, Great Lakes modeling, economic policy development and the Blue Economy, and Great Lakes-related public engagement and education.

“Northwestern Michigan College appreciates this federal investment in our community partnership,” says Jason Slade, vice president for strategic initiatives

at the college. “One of NMC’s strategic plan goals is to make our Great Lakes Water Studies Institute a leading center for marine and geospatial programs, and we’re excited that the Freshwater Research and Innovation Center will allow us to further advance that work.”

For more information, contact Matt McDonough, Discovery Center CEO, at [matt@discovery.greatlakes.org](mailto:matt@discovery.greatlakes.org).



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*Lakes Letter* is edited by IAGLR Communication Director Paula McIntyre with assistance from Alex Duncan and Jessica Ives, members of the *Lakes Letter* editorial team.

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Thanks to all who submitted abstracts for [IAGLR 2023](#). It's shaping up to be a great conference! Plan to join us in May and enjoy four days full of science, with three plenaries, 100+ posters, and 500+ oral presentations across 45 sessions. Authors hail from more than 20 countries. What a great opportunity to learn about the world's large lakes!

**Registration.** [Registration will open in March](#) and includes in-person and virtual options. For best rates, renew your membership or join IAGLR now. That way, you'll be ready to register for the conference and receive not only a discounted rate for members, but early-bird savings too!

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Downtown Toronto and Lake Ontario. Photo by Maarten van den Heuvel.