IAGLR
LAKES Letter

In this issue, we take a look at community science, aka citizen science, and how it adds to our knowledge of the lakes.

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A call for community science standards for the Great Lakes

by Chris Winslow

COMMUNITY SCIENCE is often described as monitoring conducted by amateur scientists that can help to advance scientific research and understanding. As this issue of Lakes Letter attests, community science has become more popular with researchers and agency environmental monitoring programs over the years. This is due to several reasons. Monitoring activities can be both time- and resource-demanding, and efforts are often reduced or abandoned when program budgets fluctuate. In addition, the vast size of the Great Lakes Basin makes it difficult for agencies to effectively cover the area in a cost-effective manner.

Thanks to technological advancements that make it easier to collect, analyze, and report certain environmental data (e.g., via smart phones and new sensors), monitoring can now be efficient, accurate, and accessible. Such advancements make it possible for community science to increase the availability of temporal and spatial data needed by agencies to assess watershed and lake conditions and to anticipate future environmental changes. Further, people are curious about the land and water resources around them and want to protect and preserve the places they love. This simultaneous increase in ability and desire of the public to engage in science efforts, as well as their influence on resource management policy, provide a unique opportunity to involve communities in robust data collection.

Yet these data must meet certain standards to be widely incorporated into monitoring programs. Currently, we lack a clear understanding of what these data standards are for the agencies and academics that would benefit from their use. We need to develop a roadmap and mechanism to ensure that both providers and potential users are speaking the same language. Ultimately, there is a need to develop a user-friendly community science handbook that summarizes best practices from existing materials and provides a tool to develop and deploy a robust and reliable monitoring network. There are a few guidebooks and websites to inform community science, but not all are targeted specifically at water monitoring in the Great Lakes Basin, and they vary in the level of detail provided.

As a result, the International Joint Commission will be soliciting proposals via the State Department's RFP/work plan systems to identify a team to review existing community science materials, resources, and opportunities; identify potential roadblocks to conducting community science; develop a summary of requirements on "credible data" across the Great Lakes; and provide a framework for the future development of a user-friendly community science handbook. This work plan highlights the need to review existing materials to not only identify best practices for use in the Great Lakes Basin but also to highlight common mistakes that prevent the long-term adoption of these monitoring efforts.

Finally, it is not uncommon for a community science program to be designed for one data collection purpose or audience. The goal of this effort would be to identify collection standards that could be used to meet numerous needs and end users (e.g., students, watershed groups, university academics, state and federal agencies, etc.). Regardless of level of rigor, community science programs offer the opportunity to engage younger and more diverse populations, which can contribute to enhanced understanding of environmental science as well as to greater diversity in the environmental sciences and resource management workforce.

Chris Winslow is director of Ohio Sea Grant and Stone Laboratory. He serves on the IJC Science Advisory Board Research Coordinating Committee.

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IAGLR NEWS SHORTS

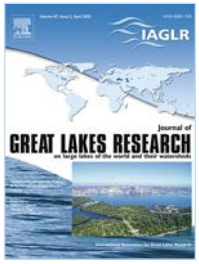
Seeking papers for special section in JGLR

What is the role of the community in environmental cleanup and revitalization? This special section of the *Journal of Great Lakes Research* will explore the social, community, and organizational dimensions of environmental remediation, habitat restoration, and community revitalization that are unfolding throughout the region. Submissions will be accepted July 1–September 30, 2021. Look for the call for papers, soon to be posted on the IAGLR website.

Help enhance member benefits

Please join us for an open meeting of the IAGLR Membership Committee on Wednesday, June 4, 2:30-3:30 EDT. We will focus on gathering suggestions and getting your feedback on several ideas to enhance the benefits of IAGLR membership. An email invitation will be coming soon with a link to the Zoom meeting. We hope to see you there. If you have any questions, please contact Jean Adams, Membership Committee Chair, at memberchair@iaglr.org.

Nominate a notable paper



The Chandler-Misener, JGLR/Elsevier Early Career Scientist, and JGLR/Elsevier Student awards all recognize papers published in the Journal of Great Lakes Research based on originality, contribution, and presentation. If you read a paper published in 2021 that excels in these categories, nominate it for an award! Nominations can be submitted at any point and will be considered for the appropriate award based on the career status of the lead author at the time of acceptance.

Board moves to create ED role for association

At its meeting on May 13, the IAGLR Board of Directors approved moving forward with plans to hire an executive director to lead the association. The board dissolved the ad hoc Executive Director Fact-Finding Committee established last year and will create a search committee to develop a job description and propose a timeline for hiring an executive director for this new role.

CASS update

IAGLR joined other members of the Consortium of Aquatic Science Societies in several initiatives over the past few months:

- Urged the Biden Administration to return to a Waters of the US (WOTUS) rule based on science, citing the loss of protections for millions of stream miles and acres of wetlands resulting from a 2020 update to the rule. This change has led to "dire consequences for fish, fisheries, wildlife, watersheds, water quality and supply, flood control, as well as the people and economies that rely on them."
- Collaborated on a proposal to NSF titled "RCN:LEAPS: A VOICE (Vision of Opportunity, Inclusivity and Community Equity) in Aquatic Science." Grant funding would support training opportunities for the IAGLR JEDI Committee.
- Explored opportunities for coordination on climate policy. The World Climate Statement of Aquatic Science Societies released by CASS members last September was distributed to all congressional environment and natural resource staffers on Earth Day, April 22.
- Continued planning the 2022 Joint Aquatic Sciences Meeting. CASS members adopted the theme "Rapid Changes, Collaborative Solutions." The meeting will include a panel discussion with nine CASS member presidents. A site visit will be scheduled for summer 2021.

State of Lake Conferences

Save the dates for two State of Lake conferences slated for next year. The State of Lake Erie Conference will be held March 16–18, 2022, in Cleveland, Ohio, and the State of Lake Michigan Conference is planned for October 24–26, 2022, in Traverse City, Michigan. We hope to see you there, in person!

CONGRATULATIONS IAGLR AWARD AND SCHOLARSHIP WINNERS

Lifetime Achievement Award
HENRY ("HANK") VANDERPLOEG, NOAA Great Lakes Environmental Research Laboratory. For important and continued contributions to the field of Great Lakes research over a period of 20 years or more.

John R. (Jack) Vallentyne Award
MARGARET LANSING, NOAA Great Lakes Environmental Research Laboratory. For important and sustained efforts to inform and educate the public and policymakers on large lake issues.

Anderson-Everett Award
PAULA MCINTYRE, International Association for Great Lakes Research (contractor)/Loracs Design LLC. For outstanding contributions to the International Association for Great Lakes Research.

Best Associate Editor 2020 Award
ERIN DUNLOP, Ontario Ministry of Natural Resources and Forestry. For outstanding support of the review process for the *Journal of Great Lakes Research.*

Best Reviewer 2020 Award
MICHAEL RENNIE, Lakehead University. For outstanding support of the review process for the *Journal of Great Lakes Research.*

Chandler-Misener Award–2020
LAUREN OLDFIELD, **SABINA RAKHIMBEKOVA**, **JAMES W. ROY**, and **CLARE E. ROBINSON**. For 2020 most notable paper in the *Journal of Great Lakes Research,* titled "Estimation of phosphorus loads from septic systems to tributaries in the Canadian Lake Erie Basin."

Chandler-Misener Award–2019
TED R. ANGRADI, **KATHLEEN C. WILLIAMS**, **JOEL C. HOFFMAN**, and **DAVID W. BOLGRIEN**. For 2019 most notable paper in the *Journal of Great Lakes Research,* titled "Goals, beneficiaries, and indicators of waterfront revitalization in Great Lakes Areas of Concern and coastal communities."

Elsevier Early Career Scientist Award
JORDAN MATLEY, Great Lakes Institute of Environmental Research, University of Windsor. For 2020 most notable paper in the *Journal of Great Lakes Research,* titled "Seasonal habitat-use differences among Lake Erie's walleye stocks."

Elsevier Student Author Award
RYAN GROW, University of Minnesota, Duluth. For 2020 most notable paper in the *Journal of Great Lakes Research,* titled "Spatial and vertical bias in down-looking ship-based acoustic estimates of fish density in Lake Superior: Lessons learned from multi-directional acoustics."

IAGLR Scholarship
MATT THORSTENSEN, University of Manitoba. For research titled "Genomics, movement, and ecology of the Lake Winnipeg walleye."

Norman S. Baldwin Fishery Science Scholarship
ZOE ALMEIDA, Ohio State University. For research titled "Do early-life conditions set lifetime trajectories in fish? Evaluating how experiential legacies influence individual and population responses to changing environments."

Norman S. Baldwin Fishery Science Scholarship
GRACEANNE TARSA, University of Wisconsin. For research titled "Round goby, Neogobius melanostomus, abundance and productivity in the rocky nearshore zone of Lake Michigan."

David M. Dolan Scholarship
STEPHANIE FIGARY, Cornell University. For research titled "Zooplankton as indicators: Understanding the Great Lakes through decades of zooplankton monitoring."

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Swim Drink Fish Citizen Science Hubs

Blending technology, advocacy, and education to protect our waters

by Mark Mattson

THE SUMMER OF 2020 saw unprecedented numbers of people turning to their local waters as the COVID-19 pandemic forced them to find new ways to connect with their surroundings and with each other. The pandemic has taught us that few things are as important as our health and the health of the world around us.

This summer of swimming has also helped us realize that safeguarding the waters we connect with can be a way of protecting our own physical and mental health. This is especially true when you consider that each year, an estimated 3.5 million people get sick after swimming in a waterbody that contains harmful bacteria or pollution.

The most beloved spots where we enter the water are not always those that are regularly monitored by governments and health units. That's why citizen scientists are sampling water in these popular but unmonitored places—so that we know when and where we can connect with our local waters, worry-free.

Citizen science has been providing data that help people make informed decisions about getting on or in the water since long before the pandemic, however. Over the decades, citizen science has demystified the scientific process and democratized the field so that amateur scientists can inform water literacy regarding development, pollution, and climate change. Citizen science encourages people to get outside and experience wilderness close to home. It provides a sense of belonging in and connection to our waters.

One prime example is the network of citizen science hubs run by Swim Drink Fish. Thanks to funding from Environment and Climate Change Canada's Great Lakes Protection Initiative over the last four years, the organization runs four citizen science monitoring hubs in Ontario on the Great Lakes: the Toronto Hub (launched in 2016 by Lake Ontario Waterkeeper), the Zhiibaahaasing First Nation Hub (launched in 2018 and hosted by Zhiibaahaasing First Nation), the Lake Erie–Niagara Hub (launched in 2019 and hosted by the Niagara Coastal Community Collaborative), and the Kingston Hub (launched in 2020 by Lake Ontario Waterkeeper).

These hubs do more than just share water monitoring results with recreational water users and connect people to water. They also create yearly reports that highlight ways to restore, protect, and promote our waters. Citizen scientists are highly trained. They are given the resources they need to collect reliable data. Citizen science is authentic science, resulting in reliable data that inform policy and give meaning and force to environmental laws and protections.

Swim Drink Fish's citizen science monitoring hubs are shifting our perception of science by blending technology, advocacy, conservation, storytelling, and education with research to enact real change for our water. The past unprecedented year has proven how imperative citizen science is. Even as our citizen science water monitoring hubs faced more challenges this year than in any previous year, their work only became more important, and the value of their efforts only became more obvious.

Due to COVID-19, the start date of the monitoring season was delayed, and sampling capacity was reduced. Social

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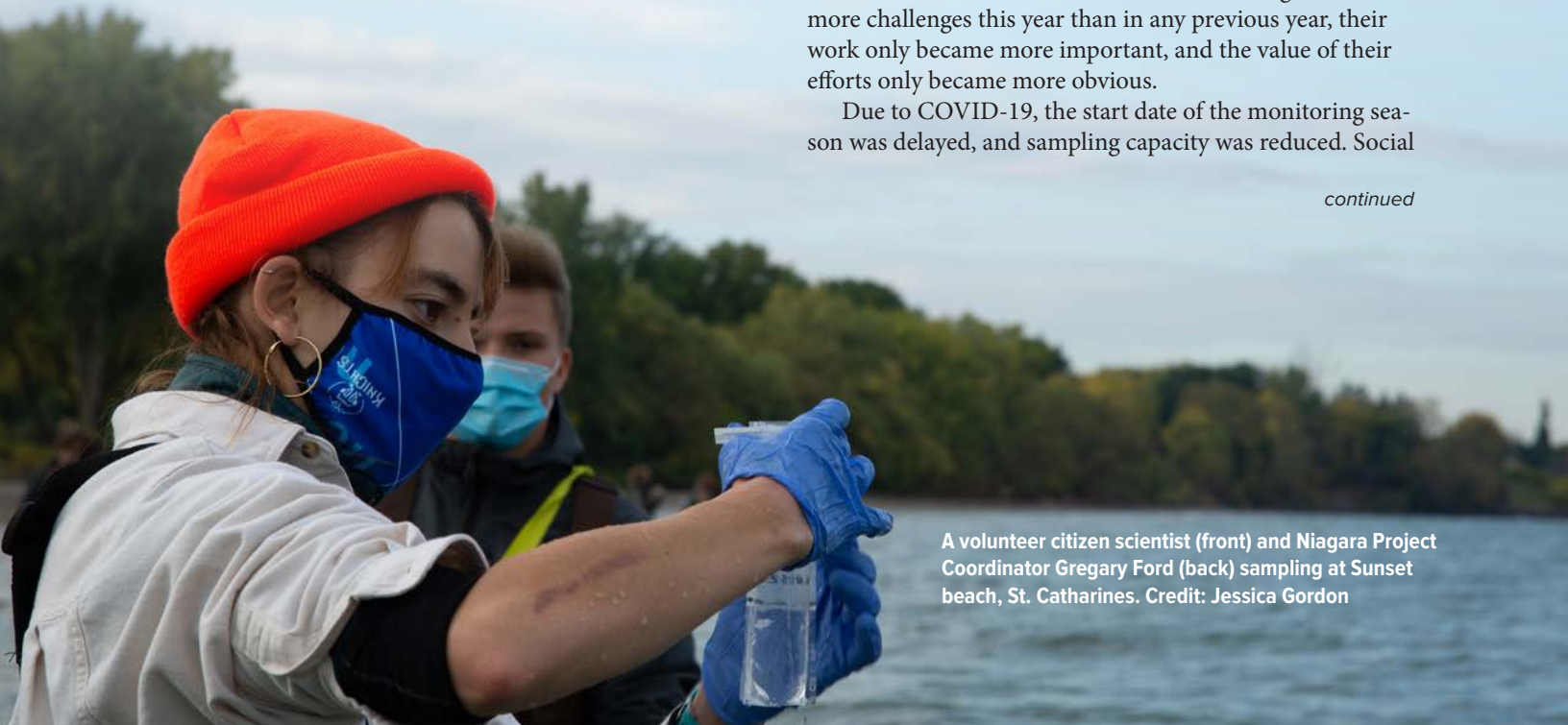

A volunteer citizen scientist (front) and Niagara Project Coordinator Gregary Ford (back) sampling at Sunset beach, St. Catharines. Credit: Jessica Gordon

distancing requirements meant that fewer volunteers could help out compared to previous years, and there were less opportunities to formally engage with the communities.

But the hubs were up to the task. As governments and health units turned their attention to the front lines of the pandemic, hub coordinators and citizen scientists stepped up to fill the gaps left in recreational water quality monitoring so people knew when and where they could enjoy their local waters and find solace during a difficult year.

"In Kingston, we have a lot of access to the waterfront, and people accessing the water, and it's only increasing," notes Hannah McDonald, Kingston monitoring coordinator. "I saw more people outside, and more people getting out on the water, especially this summer during COVID-19."

Water quality monitoring this past summer was not only important to those using the water and the hub coordinators, but also for volunteers and the community. The people who volunteered often took further steps to protect their water on their own. In Toronto, many of these volunteers were avid swimmers, scuba divers, and other recreational water users. One volunteer who frequently swam at Kew-Balmy Beach noticed that water quality was failing there. She started seeking out more information on combined sewer overflows and connected with her city councillor to learn more.

On a community level, citizen science hubs provide water literacy for communities so that they can not only safely interact with their local waters, but also safeguard them. Chelsea Antoine, the community hub coordinator for Zhiibaahaasing First Nation notes, "With COVID, I've seen people at the beaches every weekend, and a lot of people started camping out at the beach. I've helped my community become more informed, and the more they've become informed, the less litter I've found at the beaches."

Citizen scientists stepped up to fill the gaps left in recreational water quality monitoring so people knew when and where they could enjoy their local waters and find solace during a difficult year.

Though the hubs were resilient during this challenging summer, COVID-19 showed how crucial citizen scientists are to community water monitoring. With fewer (or in some cases no) volunteers at the hubs, monitoring felt more difficult, less impactful, and less engaging. However, COVID-19 didn't fully halt community engagement. As the season progressed and COVID-19 restrictions lessened in some areas, hub coordinators were able to engage with their community once again. Near the end of the season, the Lake Erie–Niagara hub safely hosted a Niagara College youth engagement event for 48 eager participants over the course of several days. This is more than double the number of the previous year.

The hubs were also able to virtually engage new citizen scientists by training them how to use Gassy, an AI tool that is learning to identify pollution, debris, wildlife, and people in the water. By uploading photos of trash, plastic bottles, ducks, fish, swimmers, paddlers, and more, users can become the eyes and ears of their water and contribute to our growing water health database.

So many of us believe that our waters must be restored and protected but are unsure of where to start. Citizen science monitoring hubs are one of the best ways a passionate individual can have a positive impact on their waters. By becoming a citizen scientist, anyone can help gather important water quality data and share invaluable information with their community.

We invite you to get involved with our citizen science hubs. Visit Swim Drink Fish for more information.

Mark Mattson is an environmental lawyer and founder and president of Swim Drink Fish. He also is the Waterkeeper for Lake Ontario.

Kingston Monitoring Coordinator Hannah McDonald sampling water at the Kingston Hub. Credit: Hannah McDonald

Community Monitoring Coordinator Chelsea Antoine in the lab at the Zhiibaahaasing First Nation Hub. Credit: Dylan Neild

THE SMART CITIZEN SCIENCE INITIATIVE

by Max Herzog, Program Manager, Cleveland Water Alliance

Seasonal surges and legacy deposits of nutrient pollution make Lake Erie the epicenter of yearly harmful algae blooms (HABs) large enough to be seen from space. This annual ecological crisis puts the health and well-being of the nearly 12 million people that rely on this great lake for their drinking water, recreation, or livelihood at risk. Lake Erie states are increasingly investing in solutions to reduce the nutrient pollution that drives these blooms, but often don't have the information needed to strategically locate these projects, evaluate their effectiveness, or optimize their performance. Further, reduction in budget allocations in Michigan, Ohio, and New York are challenging the scope and sustainability of state agency water monitoring. These challenges produce significant limitations on the scope and granularity of water quality data collected across Lake Erie and its watersheds.

Western Lake Erie HAB, Sept. 26, 2017. Landsat-8 (NASA/USGS satellite) photo.

Fighting back against HABs

Citizen science (volunteer monitoring by community members) represents an important opportunity to expand our regional data collection capacity and address pressing water quality challenges like HABs. Lake Erie residents feel a powerful sense of connection to and responsibility for their water resources and are often willing to contribute their resources and time to that end. Local organizations have been harnessing this energy to monitor water quality in communities across the region for years.

However, these groups have typically developed in response to hyper-local management needs, resulting in a fragmented regional landscape of citizen science that approaches data collection, management, and use protocols on a watershed-by-watershed basis. Many of these groups continue to rely on physical data sheets and Excel-based data management, which severely limit accessibility and discoverability to external end users. As a result, it is difficult for government, academic, and industry actors to leverage the full scope of Lake Erie's existing citizen science movement to address their most pressing research, decision making, and management needs.

Cleveland Water Alliance (CWA) is working to address these challenges through the Smart Citizen Science Initiative, a regional network of volunteer programs and community funders that support and accelerate community collection of Lake Erie Basin data. This network serves as a platform for driving regional citizen science innovation including piloting new technologies and implementing collective data standards. The initial three-year (2020–2022) effort is made possible by the support of the Great Lakes One Water (GLOW) Partnership, a collaboration of community foundations committed to solving Great Lakes water challenges.

To date, the Smart Citizen Science Initiative has engaged 12 volunteer water quality monitoring groups in a series of technology pilots, group visioning sessions, curriculum development projects, and other regional collaborations. These include Buffalo Niagara Waterkeeper, Cleveland Metroparks, Doan Brook Wa-

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Credit: Buffalo Niagara Waterkeeper

Credit: Buffalo Niagara Waterkeeper

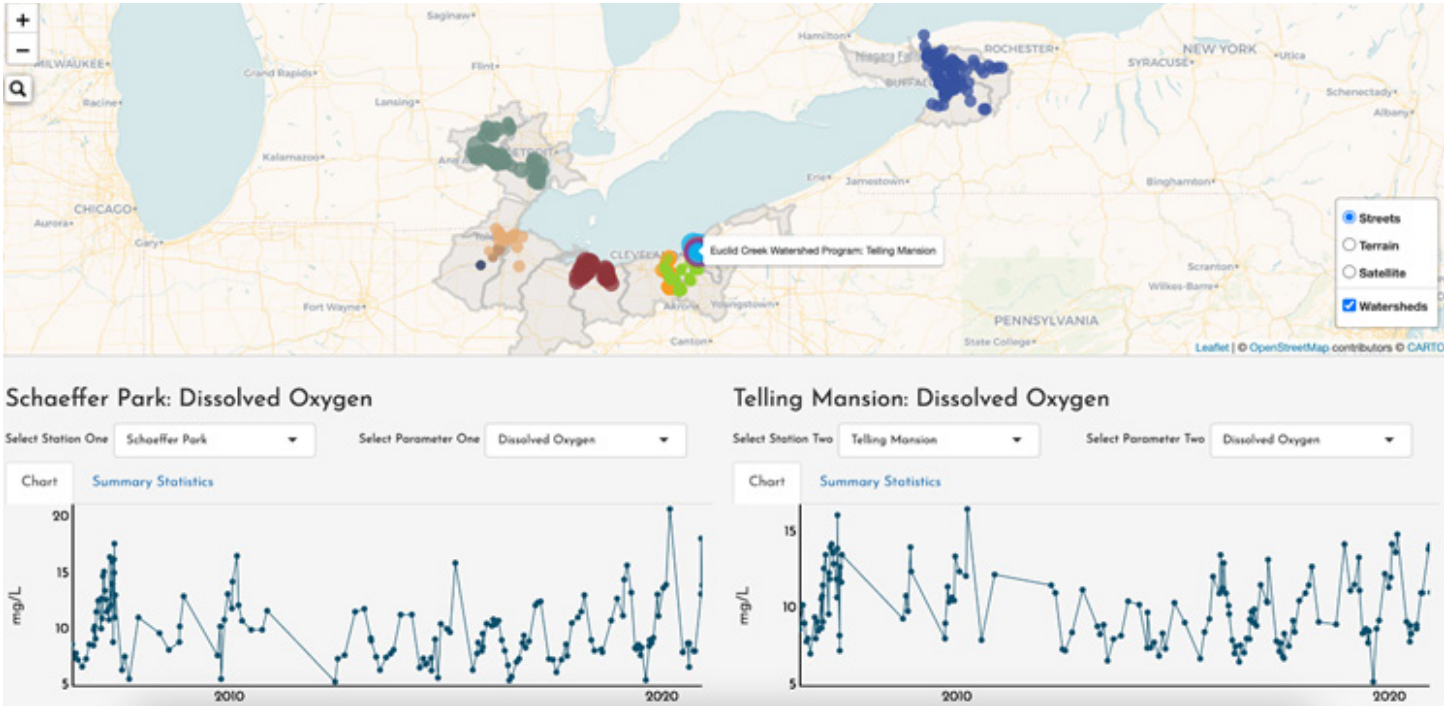
tershed Partners, Erie Soil and Water Conservation District, Friends of Euclid Creek, Huron River Watershed Council, Lorain Soil and Water Conservation District, Metroparks Toledo, Old Woman Creek National Estuarine Research Reserve, Rocky River Watershed Council, SUNY Fredonia, and Toledo Metropolitan Area Council of Governments.

"Being a part of a Lake Erie-wide network of organizations and citizen scientists with the Smart Citizen Science Initiative is exciting, inspiring, and empowering," notes Lisa Meranti, Watershed Volunteer Program Coordinator, Cleveland Metroparks. "Contributing to something that can have significant collective impact is very motivating."

Throughout the last year, CWA partnered with The Commons to provide access to their data platform, Water Reporter. With features such as volunteer vs. organizer profiles, built-in QA/QC permissions, and a mobile app for field data upload, the Water Reporter platform is set up to enable organizations to leverage the power of volunteer monitoring to produce meaningful data that are structured and interoperable. The Commons has even worked with CWA to create a unique web widget that allows users to visualize, explore, and download data from Local Champions across the Lake Erie Basin. Now, community groups, researchers, and decision makers can easily access and leverage the data.

These tools will be backed up by a set of standards for the collection, management, and use of Lake Erie citizen science data. These Smart Lake Standards will aim to formalize operating procedures and best available technology to provide an accessible framework for elevating the credibility of citizen science data. The creation of Smart Lake Standards will enable consistent, high-quality monitoring of key parameters across the region, enable wider use and comparability of currently available citizen science data, and allow rapid piloting of new data collection technologies against agreed-upon benchmarks. Further, Smart Lake Standards will provide a framework for collaborative regional research projects, comparison of locally collected data, and establishment of new community monitoring programs.

CWA is currently convening key experts and decision makers spanning academic and federal research institutions as well as state environmental agencies to support this work. These advisors will support CWA and the Smart Citizen Science network in designing and executing the first iteration of these standards by early 2022.



Credit: Cleveland Water Alliance and The Commons

STREAM

Combining DNA and people power for healthy freshwater ecosystems

by Chloe Robinson and Mehrdad Hajibabaei

Members of Junction Creek Stewardship Committee being trained in CABIN methods in Sudbury, Ontario.

Over a quarter of Canada's population lives within the Great Lakes Basin. This transboundary watershed holds one-fifth of all the surface fresh water on Earth and is under increasing pressure from growing urban populations. Threats including pollution, habitat fragmentation, and overuse of water directly degrade freshwater ecosystems and therefore impact the local economy, quality of life, and environment.

One of the major concerns with these threats is that three out of the eight Canadian sub-watersheds are data deficient for a variety of ecological health metrics, one being benthic macroinvertebrates. These data deficiencies remain severely problematic for understanding responses to threats.

Benthic (i.e., bottom-dwelling) macroinvertebrates can provide us with a great deal of information regarding water quality of freshwater systems. Groups of macroinvertebrates, including mayflies (Ephemeroptera), stoneflies (Plecoptera), caddisflies (Trichoptera), and dragonflies and damselflies (Odonata) have different levels of sensitivity to factors such as water pollution and oxygen availability, meaning they are ideal biological indicators of freshwater health.

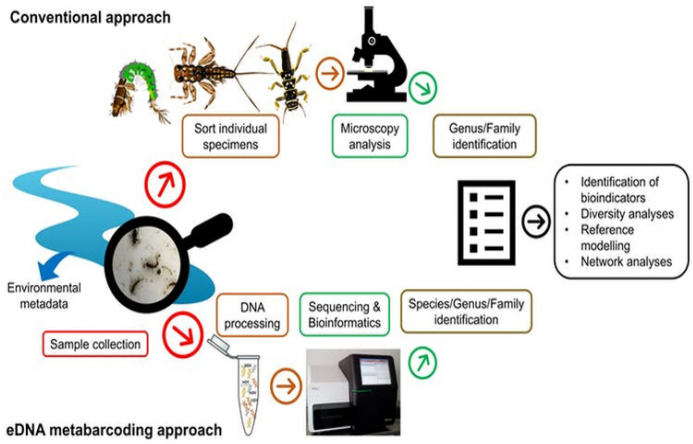
Top to bottom: Flat-headed mayfly larvae, green sedge caddisfly larvae, and golden stonefly larvae. These species are macroinvertebrates known to be sensitive to changes in environmental conditions. Credit: Chloe Robinson

continued

The STREAM solution

There is an urgent need for rapid, standardized, accurate, and accessible monitoring techniques to better understand change given the increasing threat of degradation and biodiversity loss in freshwater ecosystems. To tackle these data deficiencies, the STREAM (Sequencing the Rivers for Environmental Assessment and Monitoring) project was launched. Headquartered at the University of Guelph, the main objective of STREAM is to rapidly generate baseline benthic macroinvertebrate DNA data from across Canada through community-based biomonitoring.

STREAM was established in 2018 through a grant from the Government of Canada via Genome Canada and Ontario Genomics. This project is a national multi-stakeholder collaboration between the University of Guelph, World Wildlife Fund Canada, Living Lakes Canada, and Environment and Climate Change Canada. STREAM has partnered with community groups in Canada, including within the Great Lakes Basin, to collect these benthic samples using standardized Canadian Aquatic Biomonitoring Network (CABIN) kick-net protocols. CABIN-trained community members collect samples from their watershed and then send the samples to the University of Guelph for processing via a technique called DNA metabarcoding. This process involves generating hundred of thousands of DNA sequences from benthic samples, which are then matched against an extensive DNA library to determine which species are present.



The process of manually sorting and identifying macroinvertebrates (top) versus eDNA metabarcoding approach of species identification (bottom). Credit: Chloe Robinson

STREAM in the Great Lakes Basin

Within the Great Lakes Basin, STREAM works with two community groups: Four Rivers Environmental Services (Thunder Bay) and Junction Creek Stewardship Committee (JCSC; Sudbury). Four Rivers Environmental Services provides support and technical services to the Matawa member First Nation communities and coordinates initiatives aimed to assist community-led environmental stewardship and natural resource management in Thunder Bay. JCSC is a dynamic organization focused on the restoration of a large urban waterway in the City of Greater Sudbury.

The study aim for both community groups is to establish baseline information on macroinvertebrate communities to inform future development and restoration decisions. Between the two groups, 14 sites have been sampled since 2019, and a total of 248 macroinvertebrate species have been detected. Of these species, the most common three detected across the sites include two species of Netspinning caddisfly and a species of non-biting midge.

JCSC is conducting multi-year studies to investigate how macroinvertebrate communities change over the course of the STREAM project. For the sites sampled in both 2019 and 2020, the richness (i.e., number of macroinvertebrate species) was mostly higher in 2020, with this increase consisting of a range of bioindicator species not detected in 2019. For the Four Rivers biomonitoring, 58 species of macroinvertebrate were detected in Tidy Creek, with nearly half of these being bioindicator species.

Establishing this baseline in the Great Lakes Basin is vital for understanding both water quality and how macroinvertebrate species respond to environmental stressors. Data are especially needed within Canada's Northwestern Lake Superior, Wanipitai and French (off Lake Huron's Georgian Bay), and Lake Ontario basins. Continued biomonitoring within the Great Lakes Basin will enable longer-term trends to be investigated to infer freshwater health status in relation to global threats such as climate change.

Interested in getting involved with STREAM? Please get in touch via our website to find out more about partnering with the STREAM project.

Chloe Robinson is a postdoctoral fellow at the University of Guelph. Mehrdad Hajibabaei is an associate professor with the Centre for Biodiversity Genomics and the Department of Integrative Biology at the University of Guelph.

Erin Desjardins, stewardship intern at Four Rivers and member of Eabametoong First Nation, mobilizing winter water analysis equipment in the homelands of Constance Lake and Ginoogaming First Nations. Credit: Four Rivers Environmental Services

Don Ross from County Sustainability Group and hundreds of other testers across Canada use Water Rangers' kits for data collection and for educational purposes.

"While testing in Bancroft this past week, we met a retired environmental science professor who had also done work with the Ministry of Environment during his long career. He was saying how happy he was to know that this sort of citizen science was happening and how important it was to be doing this given all the cutbacks in government services he had witnessed over his 40 years working in this field. He seemed inspired to learn more about this and perhaps get involved with WR from his cottage on a nearby lake. Keep on testing, testers. We never know where the ripples we're making in the water will land."

Don Ross, County Sustainability Group, Prince Edward County

Uncharted Waters

A story of how community-based water monitoring can help fill data gaps

by **Emelia Duguay**, Sustainable Development Coordinator, Water Rangers

Born out of a belief that all people living in Canada have the right to participate in freshwater conservation, Water Rangers is a nonprofit organization that empowers people to do just that. It all started when, in 2014, Kat Kavanagh helped her father test the water at their family's cottage on Lake McGlashan, just north of Ottawa. After realizing that there was no easy way for the average person to organize and share water quality data like the kind she and her dad were collecting, Kat decided to use her skills as a web designer to help create one. In 2015, Kat and a team of other web designers and developers entered AquaHacking, competed with their idea for Water Rangers, and won. This marked the birth of Water Rangers, and the rest, they say, is history!

Today, Water Rangers' website and app allow anyone to store and keep track of water quality data. They also work to empower communities with their affordable, easy-to-use testkits, which test for parameters like pH, conductivity, dissolved oxygen, and more.

Spotlight: Quinte Conservation Authority

One of Water Rangers' most ardent supporters is Don Ross, a member of the County Sustainability Group (CSG), a community-based conservation group in Prince Edward County. In early 2020, Don saw an advertisement in Quinte Conservation's newsletter, saying that Quinte could potentially leverage funding to support stewardship programs in the area. Don decided to jump on the opportunity; he responded to the newsletter and asked if Quinte could assist CSG with the costs of restocking their Water Rangers testkits. Quinte's education and stewardship coordinator, Maya Navrot, responded almost immediately, saying they would indeed be able to make this happen.

Supporting CSG's water monitoring efforts would end up being incredibly valuable for Quinte that year since they had to reduce some of their own water monitoring efforts due to COVID-19. Absent any stringent public health restrictions, volunteers from groups like CSG could still test throughout the season as long as they were comfortable doing so, and that they did. Don and other volunteers in the area consistently uploaded data from more than 15 sites to Water Rangers' platform between April and November of 2020. Since the platform is all open access, Quinte can conveniently retrieve these data at any time.

Later in the season, Quinte was able to supply Moira Lake Property Owners Association and Kennebec Lake Association with Water Ranger kits, too. As the pandemic helped show, CSG and other community-based water monitoring groups can help conservation authorities like Quinte fill data gaps when they emerge. For this reason and countless others, Water Rangers is excited to see community-based water monitoring continue to grow in the coming years.

What's next?

In many ways, the pandemic exposed the hugely untapped potential of crowdsourcing water quality data. Communities want to help look after water, and with the right tools, they can. This is good news for scientists and decision makers, too, since volunteers can help collect data across a wider geographic area than professionals can do on their own. Not only that, but with the right support, these data can be accessed more efficiently than ever before. In 2021, Water Rangers is joining forces with DataStream. This collaboration will mean that data uploaded to Water Rangers' platform by community groups will feed into the new Great Lakes DataStream, where it will sit alongside those of other watershed groups, scientists, and government monitoring programs. Since the data are all shared openly, scientists can easily access these data to inform their research, while policy makers can use the data to inform their decision making.

To learn more and get involved, please visit waterrangers.ca and greatlakes-datastream.ca.

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KUDOS

Congratulations to the following IAGLR members on their accomplishments.

CATHERINE FEBRIA (Great Lakes Institute of Environmental Research, University of Windsor), **DONNA KASHIAN** (Wayne State University), and Scott Mundle (GLIER) for coordinating the inaugural binational #GLIERTRUST graduate seminar series for grad students at the University of Windsor and Wayne State's Transformative Research in Urban Sustainability program.

CASEY GODWIN on receiving the 2021 University of Michigan Research Faculty Recognition Award. This honor recognizes the impact of Godwin's research in applied biogeochemistry in the Great Lakes. In addition, Godwin and **JOHN HARTIG** (GLIER, University of Windsor) will serve as co-chairs of the 2021 State of the Strait Conference focused on contaminated sediment remediation in the Detroit and Rouge rivers, and Brianna Ellis will serve as a University of Michigan Rackham Fellow.

THOMAS HOLSEN, BERNARD CRIMMINS, Sujan Fernando, Costel Darie, and Philip Hopke, (Clarkson University), **JAMES PAGANO** (SUNY Oswego), and Michael Milligan (SUNY Fredonia) for a $6 million five-year grant awarded by U.S. EPA through the Great Lakes Restoration Initiative to continue and enhance the Great Lakes Fish Monitoring and Surveillance Program.

SARAH LAROCQUE (University of Windsor) for a successful Ph.D. defense (December 2020) and now (February 2021) working at Fisheries and Oceans Canada in the Great Lakes Laboratory for Fisheries and Aquatic Sciences as an aquatic science biologist.

R. MICHAEL MCKAY (GLIER, University of Windsor) for his appointment to the International Joint Commission's Science Advisory Board – Science Priority Committee. He also was appointed a member of the Province of Ontario's Wastewater Surveillance Implementation Table, which oversees provincial monitoring for SARS-CoV-2 in wastewater in aid of public health.

RENE SAHBA SHAHMOHAMADLOO (University of Guelph) for a successful Ph.D. defense (January 2021).

Thank you **GLIER, UNIVERSITY OF WINDSOR** for gifting IAGLR memberships to six students participating in the inaugural #GLIERTRUST graduate showcase. What a great way to support new scientists and the association!

Submit kudos to lakesletter@iaglr.org

WELCOME NEW IAGLR MEMBERS

The following members joined IAGLR between February and April 2021. Welcome to IAGLR!

Felipe Arzayus
Justin Barker
Amber Beecher
Ryan Bergstrom
Kory Bertrand
David Burden
Sara Burilo
Delaney Demro
Reagan Errera
Spencer Gardner
Calvin Hitch
Elaine Ho
Rupert Kindersley
Brendan Llew-Williams
Kamazima Lwiza
Elizabeth McKay
Luke Moslenko
Madison Myers
Gabriel Okunade
Will Otte
Tim Papakyriakou
Morgan Piczak
Taylor Sasak
Michael Schmidt
Salia Sheriff
Aubree Szczepanski
Graceanne Tarsa
Matthew Thorstensen
Teresa Tokasz
Smita Tyagi
Kavita Varma
Luwen Wan
Lauren Weller
Shasha Yang
Ben Young
Kathleen Zawrotniak

NEW MEMBER SPOTLIGHT

We've randomly selected several of our new members to introduce themselves. Below and on the next page are their stories.

Delaney Demro

M.Sc. Candidate; SUNY College of Environmental Science and Forestry

About my work

I am currently a graduate student at SUNY-ESF in Syracuse, New York. I am pursuing a master's degree in environmental science with a concentration in coupled natural and human systems, researching under Dr. Andrea Parker and Dr. Valerie Luzadis. My thesis centers around the Community Recreational Evaluation of Environmental Quality, or CREEQ Project, and is sponsored by the New York State Department of Environmental Conservation. This project applies a community science (or citizen science) approach to compare public perceptions and recreational usability of streams to biochemical measures of stream water quality. Using ESRI's ArcGIS Survey123, we developed a survey instrument where users report stream conditions, recreational uses, and upload photos. After receiving a survey, we performed the same assessment on location and collected water samples for analysis. We hope to validate the use of community-sourced data to inform and optimize stream monitoring efforts across the state.

Why IAGLR?

As a graduate student, I always try to explore ways to expand my professional network. Because I was presenting at this year's conference, I saw joining IAGLR as a great opportunity to connect with other freshwater researchers, enthusiasts, and advocates! I will be graduating this August and will continue on to a multidisciplinary career. I decided to study environmental science because I want to create increasingly convenient and affordable pathways for the general public to live more sustainably, whether that be through connecting with nature or reducing individual impacts. After finding a love for science and policy, my career path could take many forms, through research, consulting, or planning. Regardless, I am excited to broaden my knowledge of Great Lakes research and connect with other researchers at future conferences.

Patricia Ann Owl

Sagamok Anishnawbek First Nation

About my Work

Ahnee and greetings kinaahwiiyah (everyone). I am pleased to be welcomed to this circle of research and environmental protections for the Great Lakes, IAGLR. I was introduced by a dear friend, who has helped me in so many ways. My name is Waskwo-nengi-gun-emengwonot-kwe (Woman who brings the light), and I am an Anishinaabekwe endow (Indigenous woman) Ojibwa. I've had the privilege of working closely with the Great Lakes Water Quality Agreement under the Chiefs of Ontario as a senior environmental communication analyst. It was an honor to assist in restoring and protecting the waters of the Great Lakes through this contract. The agreement provided a framework for identifying binational priorities and implementing actions that improve water quality. Indigenous peoples / First Nations struggle to bring knowledge to the table in fear of disappointment of government. There I began to understand the need to connect the spirit of the water to the framework of research by sharing in Traditional Knowledge. I've been working in my home community as a tourism manager, writing curriculum for the environmental keepers and developing land-based training that incorporates Traditional Knowledge. I also am a part of the gdaakiimon (lands management) team that asserts jurisdiction over Crown land access and employs environmental protection under their natural laws in the Sagamok Anishnawbek territory in the Robinson Huron Treaty. I am very honored to work with Elders in sharing the natural law and stewardship practices of my people. Further to embracing my culture and identity, I am interested in obtaining a master's degree in environmental sustainability at the University of Waterloo. I am interested in water resources management and governance. Thank you for this opportunity to connect and bridge Indigenous views and natural law.

Why IAGLR?

I joined IAGLR not only to help advance my knowledge of current research going on in the Great Lakes, but also to interact with the IAGLR community. I hope to attend conferences and present my work to other Great Lakes scientists. IAGLR also provides many opportunities for the Anishinaebe to advance education and for me to connect spirit and science through my ambition to share my knowledge ceremonies.

IAGLR

When you join IAGLR, you join a community of people devoted to understanding the world's large lake ecosystems

iaglr.org/membership

NEW MEMBER SPOTLIGHT

Michael Schmidt

M.Sc. Candidate; Teaching Assistant, Trent University

I am currently in the first year of my master's degree in the Environmental and Life Sciences Graduate Program at Trent University. I am also a member of the Quinte Farm Research and Stewardship Collaborative. My research is currently focused on nitrate contamination in groundwater. I am curious about how interactions between shallow groundwater and surface water impact nitrate levels. I also want to better understand nitrate lag time in groundwater. My thesis examines nitrates in groundwater in Lake Ontario watersheds. The first chapter explores existing datasets and the relationships between nitrates and other parameters (e.g., land use/land cover data, overburden, groundwater geochemistry). I presented these findings in a poster during the IAGLR 2021 conference. My second chapter will seek to better characterize groundwater nitrate contamination in areas draining into the Bay of Quinte. I hope to publish the results of my work in the Journal of Great Lakes Research. Moreover, I want to continue a career of research focused on groundwater and biogeochemistry within the Laurentian Great Lakes region. Next step: Ph.D.

Luwen Wan

Graduate Research Assistant, College of Natural Science, Michigan State University

About my Work

I am a Ph.D. candidate in the Department of Earth and Environmental Sciences at Michigan State University. In our collaborative Hydrogeology Lab, I am working closely with Dr. David Hyndman and Dr. Anthony Kendall to quantify the nitrogen and phosphorus delivered to the U.S. Great Lakes coastline with a Spatially Explicit Nutrient Source Estimates and Flux, aka SENSEflux, model. This model will also be used to estimate the contributions of different nutrient sources and pathways. This work is funded through an interdisciplinary NASA project that aims to better understand historical and present-day drivers of change in Great Lakes coastal wetlands. I am excited to be involved in this project and am enjoying working with researchers from multiple universities – the Great Lakes Wetland Ecohydrology Science Team. In addition to this project, my dissertation will use remotely sensed data and machine learning approaches to detect tile drainage, which is a commonly neglected but important nutrient pathway to the Great Lakes. With this data product, I will be able to simulate the effects of tile drainage on the fate of nutrients and transport across the U.S. Midwest region.

Why IAGLR?

I joined IAGLR mainly because my research is focusing on the Great Lakes Basin. Early this year, I had the opportunity to give an oral presentation at the State of Lake Ontario Conference (virtually) hosted by IAGLR. After the pandemic, I would like to engage in more IAGLR events, interact with other scholars, and connect with scientists, managers, and stakeholders who share an interest in Great Lakes research and communication. I also hope my research can enrich the IAGLR science community and benefit Great Lakes watershed management.

IAGLR APPRECIATION AWARDS

During the Annual Business Meeting on May 26, IAGLR recognized the following indiviuals for their service to the association:

The **IAGLR Board of Directors Appreciation Award** went to **JENNIFER BOEHME**, International Joint Commission, **MARY GINNEBAUGH**, retired from Wisconsin Department of Natural Resources, **JESSICA IVES**, University of Windsor, **SARAH LAROCQUE**, University of Windsor, **RICHARD OGUTU-OHWAYO**, African Lakes Network, **SCOTT MCNAUGHT**, Central Michigan University, and **PAUL SIBLEY**, University of Guelph. They have faithfully served on the IAGLR board and completed their terms of service.

The **IAGLR Committee Chair Appreciation Award** went to **SARAH LAROCQUE**, University of Windsor, and **FRANCINE MCCARTHY**, Brock University, outgoing Awards Committee co-chairs; **RICHARD OGUTU-OHWAYO**, outgoing International Committee chair, and **PAUL SIBLEY**, outgoing chair of the Conference and Nominations committees.

The **IAGLR Conference Appreciation Award** went to IAGLR 2021 Conference Site Chair **NOEL URBAN** and IAGLR 2021 Program Co-Chairs **JUDITH PERLINGER** and **GORDON PATERSON**, all of Michgan Technological University.

The **JGLR Outgoing Associate Editor Appreciation Award** went to **DAVID (BO) BUNNELL**, US Geological Survey, **LEE GRAPENTINE**, Environment and Climate Change Canada, and J**OE MAKAREWICZ**, SUNY Brockport.

IN MEMORIAM

David B. Baker
1936–2021

Credit: The (Toledo) Blade

IAGLR has lost a great friend in David Baker, who died of pneumonia on April 16 at age 84. The founder of Heidelberg University's renowned National Center for Water Quality Research, Baker was aptly described by University of Toledo Lake Erie Center Director Tom Bridgeman as the "father of tributary monitoring."

That lab contains the longest continuing dataset on water quality samples in the Great Lakes region, dating back to 1974. Such sampling results are used in a variety of ways, including the emerging science of predicting algal blooms based on agricultural inputs, precipitation, and other factors.

Baker remained a fixture at Great Lakes conferences, especially those focused on western Lake Erie, throughout the two decades after his retirement in 1999. He was known as much for his affable, kind demeanor, and his willingness to help young or other lesser-experienced people as he was his highly cited, peer-reviewed science.

Heidelberg University President Rob Huntington hailed Baker as "an environmental pioneer" in a statement following the scientist's death. He is mentioned prominently in a 250-page online book about the lab.

"I don't think he ever saw anything at the lab as work," Laura Johnson, Heidelberg's current NCWQR director, said. "I think he saw it as who he was."

In a letter, Jeff Reutter, retired Ohio Sea Grant and Ohio State University Stone Laboratory director, told IAGLR the half-century of field data generated by the Heidelberg lab Baker created is "the most, or one of the most, valuable datasets on nutrient loading in the world" and that it allows the Great Lakes scientific community "to be a leader in understanding the drivers for nutrient loading and harmful algal blooms - issues that have become global problems."

Founded in 1969 as River Laboratory, the NCWQR was renamed the Water Quality Laboratory in 1974. It got its current name following passage of a U.S. House of Representatives resolution in 2004.

Steve Davis, who has spent more than 40 years in northwest Ohio as a watershed specialist for the U.S. Department of Agriculture's Natural Resources Conservation Service, said Baker's findings initially drew skepticism from the ag community. "But Dave persevered because he was at core a scientist and let the scientific process and the data do his talking," Davis said. "And that process and data eventually won folks over and led us to the greater understanding and knowledge of the natural world we have today. The Heidelberg lab is his legacy to the people of Ohio."

A former Heidelberg lab director, Ken Krieger, a colleague and friend of Baker's for 43 years, described him as "truly a remarkable man, both as a scientist-educator and community member." Krieger notes, "He left a positive impact on everyone who interacted with him, both professionally and personally. His contributions to water quality science and to individual lives will be long lasting."

Ellen Ewing, who recently retired after more than 40 years as one of the lab's employees, said he "never stopped trying to learn and understand."

by Tom Henry, The (Toledo) Blade and IAGLR's 2014 Jack Vallentyne Award recipient. Read more about Dave in this tribute, written by Ken Baker.

Deborah Swackhamer
1954–2021

On April 23, the Great Lakes scientific community lost a luminary. Dr. Deborah Swackhamer passed away after a short battle with cancer. Her work in the Great Lakes began early in her academic career, publishing work on PCBs in Lake Michigan sediments in 1983. She continued exploring organic contaminant dynamics in the Great Lakes with pioneering work aboard submersibles through the National Undersea Research Program, and work aboard the USEPA's R/V Lake Guardian with the Lake Michigan Mass Balance and the Great Lakes Fish Monitoring Program. Her work did not end in the field or laboratory. She was a staunch advocate for policy to protect the Great Lakes, serving on the Science Advisory Board to the International Joint Commission (2000-2013), the US Environmental Protection Agency's Science Advisory Board (2003-2012) serving as chair from 08-12 and chairing the EPA's Board of Scientific Counselors from 2015 until 2017. Deb's involvement in IAGLR will be long remembered by its members. She served on the Board of Directors for 1989-92 and had numerous students receive IAGLR awards during her career mentoring the next generation of advocates for our Great Lakes. A scholarship has been created in her memory. Contributions may be made at z.umn.edu/Deb-Swackhamer.

by Matt Simcik, University of Minnesota

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