



Annual Impact Report

A bi-national nonprofit, GLOS provides end-to-end data services that support science, policy, management, and industry in the U.S. and Canada.

glos.org

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A letter from our CEO

As I reflect on the end of 2021, I'm reminded of the saying "Never let a good crisis go to waste." The Great Lakes [continue to experience](#) the effects of climate change through ongoing coastal erosion, spreading harmful algal blooms, and a flurry of extreme weather events. As a region, we grapple with the policy and management decisions needed to better prepare and adapt, all while our society faces these and the many other challenges that are amplified by the ongoing pandemic.

Despite the obstacles, we are rising to the occasion. I am continually amazed and grateful that our staff and partners are able to stay resilient, motivated, and forward-thinking. The GLOS network has proved to be scrappy, resourceful, and collaborative, and our growth and impact, even in these challenging times, has increased as a result.

This special edition of our annual impact report reflects on the cumulative gains we've made over the last five years as we pivot into a new five-year funding cycle. GLOS has managed to leverage resources and scale our capacity, reaching more areas of the region and improving how we monitor and predict environmental changes, to improve lives and build the blue economy.

And there's a lot more for the Great Lakes to look forward to, from regional investments from the Infrastructure Bill to growing interest in Smart Great Lakes. I am optimistic that we will continue to thrive and make the most of the opportunities we discover as we make our way through this difficult period.

As always, thanks to our dedicated board, staff, and many partners who make it all possible.



Kelli Paige, Chief Executive Officer
kelli@glos.org

2016-2020 Financials

Over the past five years GLOS has invested over \$12 million into advancing the region's capacity for data collection and information sharing through the programs described in this report.

Program Revenue:

\$12,453,304



Expense Breakdown:

● Observing Activities.....	32%
● Data Management.....	26%
● Manage and Build GLOS.....	22%
● Models, Apps, and Tools.....	10%
● Outreach and Communications.....	9%

Filling Gaps in the Observing System

High-Frequency Radar

The currents that flow through the Straits of Mackinac can be fast and unpredictable. Home to infrastructure like the Mackinac Bridge and Line 5 oil pipeline, the Straits are also a critical, busy shipping and boating passage between Lakes Huron and Michigan.

Understanding water surface currents is important for improving the safety of maritime operations, guiding search and rescue missions, speeding the cleanup of hazardous spills, and validating hydrodynamic models. Current data is important to coastal managers, forecasters, anglers, scientists, emergency responders, mariners, and recreational boaters.

This Year

With support from GLOS and the State of Michigan, Michigan Technological University completed the installation of the first-ever Great Lakes pair of high-frequency radar antennas capable of gathering data to create two-dimensional maps of surface currents every hour.

This data will soon be available on the [IOOS website](#) and on GLOS' new [Seagull platform](#).

What's Still Needed

With this initial pair now operating on the west side of the bridge, the push has begun for additional funding for another pair to cover the east side as well as additional current-sensing technology to cover other relevant areas in the Great Lakes.



Now operational, the high-frequency radar antennas at either end of the Mackinac Bridge provide a near-real time picture of complex surface currents. Photo by Lorelle Meadows, Michigan Tech.

Uncrewed Systems

Autonomous observing platforms, or uncrewed systems (UxS), help monitor water conditions by collecting data continuously over large areas and during long periods of time.

These systems help monitor ecosystem dynamics, track fish movement, assess climate variability, and more.

This Year

With support from GLOS, 16 deployments of seven gliders were conducted during the 2021 field season, with deployments taking place in all five of the Great Lakes. Some of these missions were completed collaboratively by federal and academic partners, which enabled researchers to share expertise and resources.

Most of the data gathered with these UxS is already publicly available via the [IOOS Glider Data Assembly Center](#) and will soon be available on Seagull.

What's Still Needed

The region needs resources to hire additional glider technicians that can operate and maintain uncrewed systems. Further funding will enable researchers to extend glider deployments into the early spring and late fall seasons and also support under-ice observations.



(Left to right) Hayden Henderson and Russ Miller from the Cooperative Institute for Great Lakes Research launch GLOS' Josephine glider into Lake Erie during a 2021 summer mission. This data helped locate low oxygen "hypoxic" areas that can impact drinking water quality.

Tracking Harmful Algal Blooms

Lake Erie has been impacted by Harmful Algal Blooms (HABs) for many decades. The intensity of algal blooms has increased in recent years, and climate change might exacerbate bloom intensity as well as toxicity in years to come. Though Erie's blooms are the most severe, HABs are becoming a recurrent issue in all five Great Lakes.

GLOS, in collaboration with partners, has worked with Lake Erie water treatment plants to purchase and deploy water quality sensors that provide real-time data via GLOS' web apps. In addition, GLOS funded an autonomous Environmental Sample Processor (ESP) that measures HAB toxicity in near real-time.



A harmful algal bloom stretches over a massive area of western Lake Erie in 2017. These blooms can move and change quickly, making real-time water quality data essential to life in nearby communities. Photo by Aerial Associates Photography, Inc., Zachary Haslick.

This Year

GLOS helped purchase an autonomous surface vessel that will be outfitted with an ESP and continued to support the operations of sensors collecting real-time HAB data in Lakes Erie, Huron, Michigan, and Superior. In response to feedback from the water treatment community, GLOS developed a customizable early warning capability into Seagull. Now, anyone can set alerts based on real-time water quality measurements and be automatically texted or emailed as conditions change.

What's Still Needed

The ability to track algal blooms and assess their toxicity levels in real-time over large spaces is crucial for an effective HAB early warning system. To create monitoring systems in other areas of the Great Lakes impacted by HABs, additional resources are needed for more instrumentation and improved technical capacity.

Filling Gaps in the Lakebed Map

Today, less than 15 percent of the lakebed of the Great Lakes has been mapped at high-density. Modern mapping technologies, however, make completing the map not only a possibility, but a necessity for securing infrastructure, understanding shoreline change, and revealing underwater habitats and cultural heritage sites.

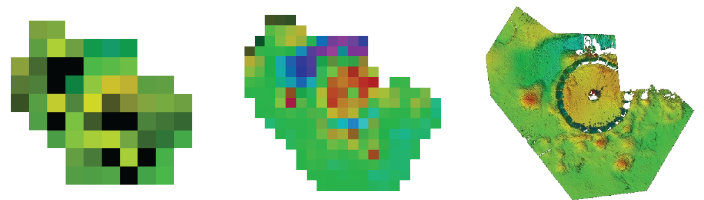
This Year

GLOS served as an integral part of the emerging network of government, private, and academic institutions working toward a high-density map as part of the [Lakebed 2030](#) effort. In 2021, we:

- Supported the third annual [Lakebed 2030 conference](#) that brought the international mapping community together to learn and plan.
- Completed the "[Costs and Approaches for Mapping the Great Lakes](#)" report.
- Finalized a study that helps prioritize areas for mapping, based on stakeholder needs.
- Funded the development of a kit that equips electronics on recreational boats to automatically send depth information directly to GLOS, creating one of the first pipelines for crowdsourced lakefloor data in the region.
- Became a "trusted node," able to send crowdsourced bathymetry data directly to the International Hydrographic Organization to update existing lakebed maps.

What's Still Needed

Analysis commissioned by GLOS found that completing a map of the lakebed that is free to use and open to everyone is well within the constraints of today's technology. It will require a total investment of \$130-200 million toward scanning missions and data processing.



A high-density map of the Great Lakes would allow us to get a clear picture of important underwater infrastructure. This water intake near Detroit, MI is difficult to see at 20 and 10 meter density (left and center), but comes into focus at 0.5 meter density.

Smart Great Lakes Initiative

In 2019, it was clear to GLOS and many of our partners that we needed a way to organize around a vision of how we could collaboratively apply technology to improve our understanding, use, conservation, and management of the Great Lakes. GLOS helped to launch the [Smart Great Lakes Initiative](#) (SGLi), which has now grown to 59 different organizations across sectors and borders, including nonprofits, government agencies, and private businesses.

This Year

GLOS and SGLi partners published the “[Common Strategy for Smart Great Lakes](#)” which lays out 10 far-reaching goals ranging from improving the observing network to strengthening Great Lakes policies. SGLi shared this common strategy throughout the region in op-eds, webinars, and a television program.

In addition, GLOS began investing in the Smart Great Lakes vision by funding 24 projects via Smart Great Lakes Mini-Grants. This wide range of projects included research into a potential Indigenous-led SGLi, adding under-ice monitoring capacity, and a community science project at a high school.

What's Still Needed

The vision expressed in the Common Strategy requires significant investment in shared water monitoring infrastructure, research that delivers actionable insights to decision makers, and the cyberinfrastructure that can manage the region's water data and deliver information to a wide range of people.



Connecting people to the lakes with Segull

This Year

To make lake data and information accessible to all types of observers across the region, we developed [Segull](#).

Segull, a cloud-based IT platform, takes data from dozens of sensors all over the lakes, along with forecast models and more, and, like a weather app, puts it into a simple web interface that's free, visually engaging, and ready for anyone, from a researcher to a recreational boater, to use.

Segull lets users easily:

- Check a local buoy for live conditions.
- See lakewide forecasts for wind, waves, temperature, and more.
- Find areas of high algae concentration to keep drinking water safe.
- Discover data from other researchers and share data to make research dollars go further.

Equipping people with a map, alerts, and simple visualizations makes it possible for anyone to have a deep, updated understanding of the water that they rely on for swimming, fishing, and drinking, and for researchers, policymakers, and resource managers to take action.

What's Still Needed

Segull will transition from a pre-release beta version to full release in spring of 2022. Fully building out the platform's functionality and supporting the expanding observing network requires additional cyberinfrastructure investment.



Segull makes live lake information easy to visualize and understand, in real-time. Try it at seagull-beta.glos.org.

24

Mini-Grant
projects funded

1

New IT platform
launched

33

New observing
platforms joined

2

High-frequency radar
antennas added

59

Organizations joined the
Smart Great Lakes initiative

1

Smart Great Lakes
Common Strategy

230,000

Users served

300

Seagull Beta testing volunteers

1,400

People using Seagull Beta



"The live data provided by GLOS-funded buoys on the south shore of Lake Superior is critical for commercial and recreational boaters as well as the National Weather Service, Environment Canada, and NOAA."

Carl Lindquist | Executive Director of Superior Watershed Partnership and Land Conservancy



"Meteorologists, charter fishing businesses, surfers, swimmers, and recreational boaters rely on buoy data to stay safe on the water...Having real-time and historic data available online via GLOS' data portal helps these stakeholders and more."

Carolyn Foley | Research Coordinator at Indiana-Illinois Sea Grant



"What makes the Great Lakes strong is the ability to work and share together for the greater good. GLOS makes this possible."

Guy Meadows | Researcher at Michigan Technological University



"Through the end of September we use the buoy information daily, sometimes 20 or 30 times a day. We use wave height and interval to determine if we are going to run our charter."

Gary | Charter Boat Captain



"I work on a rescue boat out of Mackinac Island. We depend on Buoy 45175 for real-time data on wave conditions and check it before every trip. The information given by these buoys is critical in our go/no go decision process."

Mike | Rescue Boat Operator



great lakes
observing system

GLOS is one of the 11 regions that make up the Integrated
Ocean Observing System (IOOS). ioos.noaa.gov

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