

Strengthening Great Lakes Monitoring and Assessment

An aerial photograph showing a wide, winding river or delta system flowing through a lush green landscape. The water is a light blue-grey color, contrasting with the vibrant green of the surrounding land. The river branches out in several places, creating a complex network of channels. In the background, a city skyline is visible across the water.

Great Lakes Monitoring Inventory Identifies Gaps and Recommends Improvements to Great Lakes Monitoring Programs

Environmental monitoring helps us keep track of the health of the ecosystems we live in by identifying trends and effects in the environment. Monitoring data is used to establish baseline conditions, trends over time, regulatory requirements and scientific investigations. Comprehensive monitoring strategies are important in order to detect subtle changes to the environment that may have long-term negative consequences if they are not understood and controlled.

The Great Lakes have benefited greatly from environmental monitoring. With effective monitoring programs the Great Lakes community is able to set fish consumption guidelines; better understand the health of Great Lakes fisheries; curb the loss of important wetlands; maintain safe air and drinking water; post public beach closings to avoid illness; control the introduction of invasive species through early detection; and maintain high water quality standards. These are just a few of the many benefits of maintaining a robust environmental monitoring regime in the Great Lakes basin.

In September 2004 the Government Accountability Office issued a report, *Great Lakes Organizational Leadership and Restoration Goals Need to be Better Defined for Monitoring Restoration Progress* (GAO-04-1024), that identified coordination of restoration goals and monitoring activities as a key challenge facing Great Lakes leaders. The report singled out the lack of a centralized repository of information on monitoring activities as a key gap in the overall Great Lakes management structure. Responding to this critical unmet need, the Great Lakes Commission developed a centralized repository of Great Lakes monitoring information, the *Great Lakes Monitoring Inventory and Gap Analysis*. Funded through a grant from the Joyce Foundation, it is the first comprehensive binational inventory of monitoring programs in the Great Lakes basin.

The *Great Lakes Monitoring Inventory and Gap Analysis* is the first comprehensive binational inventory of monitoring programs in the Great Lakes basin.

www.glc.org/monitoring/greatlakes



The Lake Guardian, U.S. EPA; Below: volunteer monitoring, Huron River Watershed Council



Using the inventory and input from U.S. and Canadian monitoring experts, Commission staff assessed the capacity of current programs to respond to established monitoring needs. During this process, the monitoring inventory was evaluated based on a suite of indicators of Great Lakes health previously defined by the U.S. and Canadian governments under the State of the Lakes Ecosystem Conference (SOLEC) process. In addition to highlighting recommendations for improving the overall Great Lakes monitoring regime, the inventory identified gaps, overlaps and opportunities for improved regional cooperation. The final report provides 41 specific recommendations in 20 topical areas, including:

- fish consumption
- drinking water
- beach safety
- air
- water quality
- sediment quality
- soil
- groundwater
- climate/weather
- fish population health
- aquatic invasive species
- coastal wetlands
- wildlife ecology
- benthic and invertebrate ecology
- plant ecology
- habitat and biological communities
- atmospheric deposition
- nutrient management
- land use
- erosion

Results of the monitoring inventory and accompanying report are available online at www.glc.org/monitoring/greatlakes. As a future addition, the web-based inventory will include an interactive map of sampling station locations.

Highlights from the Gap Analysis Findings

Fish Consumption

► Fish tissue sampling methodology and parameter selection across U.S. and Canadian sides of the Great Lakes basin need to be coordinated to allow for trend analysis across the basin.

Drinking Water

- More resources need to be directed at monitoring water quality conditions near drinking water intakes to minimize risks to the public.
- A targeted program to monitor high-risk, private, single-family well-water systems is needed.

Beach Safety

► While standards are defined at the federal level, states have been given limited autonomy to design their own beach monitoring programs to meet their specific needs. This has led to a decentralization of beach monitoring activities resulting in inconsistent, disjointed monitoring efforts and beach advisory postings.

Air Monitoring

► Current funding levels inhibit maintenance of an adequate network of ambient air monitoring stations. Without additional funding it will not be possible to implement new national standards that require more stringent monitoring efforts.

Water Quality

- While the cost of monitoring increases each year, the level of governmental funding dedicated to water quality monitoring remains the same or decreases.
- There is limited data on toxic chemical concentrations in offshore waters of the Great Lakes. More investigation is needed to determine if the benefits of monitoring the toxic chemical concentrations in water is worth the added expense when similar data are being collected in sediments and fish.

Sediment Quality

► While there is a considerable amount of issue-driven sediment sampling, more baseline sediment monitoring is needed. Currently there is little guidance on baseline sampling for open waters and nearshore areas of the basin.

Stream training, Huron River Watershed Council



The Great Lakes Observing System (GLOS) is a regional forerunner in providing real-time access to Great Lakes observing and monitoring data for the Great Lakes.

GLOS, currently under development, will provide access to information on climate, meteorology, chemistry, geology, biology and human activities that affect the Great Lakes, their interconnecting waterways and the St. Lawrence River. Data about the Great Lakes system will be drawn from numerous sources, consolidated, and then made available via the internet to meet the needs of resource managers, researchers, educators, commercial shippers, recreational boaters, beach users and homeland security personnel.

A regional node of the U.S. Integrated Ocean Observing System (IOOS), GLOS is a cooperative activity of many U.S. federal and state agencies as well as academic institutions, non-governmental organizations and commercial interests across the region. The development of GLOS will also engage Canadian federal agencies and provincial ministries. The Great Lakes Commission is coordinating initial development of GLOS, with funding provided by the Coastal Services Center of the National Oceanic and Atmospheric Administration.

The *Great Lakes Monitoring Inventory and Gap Analysis* is being integrated as a foundational element of the GLOS data system. Integrating with GLOS will move this initial, static inventory effort into a dynamic decision support system that can enhance environmental management in the Great Lakes basin for years to come. www.glos.us



Monitoring and Observing Coordination Initiatives

State of the Lakes Ecosystem Conferences (SOLEC) are hosted by the U.S. Environmental Protection Agency and Environment Canada on behalf of the two countries every two years. The conferences are intended to provide a forum for exchange of information on the ecological condition of the Great Lakes. Indicator reports are generated in the off years in response to the binational Great Lakes Water Quality Agreement. The SOLEC indicators provide a baseline for assessing the health of the Great Lakes basin.

www.on.ec.gc.ca/solec

The **Great Lakes Regional Collaboration (GLRC)**, initiated through an Executive Order issued by President Bush in May 2004 and released in December 2005, is a wide-ranging, cooperative effort to design and implement a strategy for the restoration, protection and sustainable use of the Great Lakes. As part of the Strategy, an Indicators and Information chapter identifies elements needed to improve coordination, integration and enhancement of Great Lakes observing and monitoring activities.

www.glrc.us

Results from the *Great Lakes Monitoring Inventory and Gap Analysis* provide critical information needed to evaluate the effectiveness of current monitoring efforts in relation to SOLEC and the Great Lakes Regional Collaboration strategy. Results from the inventory and gap analysis support these initiatives by providing a centralized listing of active monitoring programs in the collective Great Lakes monitoring regime and by identifying potential needs and shortfalls.

Soil

- ▶ To develop baseline data on soil characteristics and the potential environmental impacts of alterations, SOLEC participants should consider adding an indicator to address soil composition and contamination.
- ▶ The U.S. Department of Agriculture's Natural Resources Conservation Service manages the Soil Climate Analysis Network (SCAN) which collects real-time soil moisture and temperature data at locations across the Great Lakes basin. A need for additional sampling locations has been identified.

Groundwater

- ▶ More resources need to be directed toward monitoring groundwater resources across the region.
- ▶ The U.S. Geological Survey gauging station program monitors surface water, groundwater, and water quality across the U.S. portion of the basin. Federal, state and nongovernmental budget cuts over the last two decades have reduced the extent of this network.

Climate/Weather

- ▶ A considerable amount of weather-related data is collected at land-based stations. While 47 marine buoys are also used, they are not well dispersed to assess complex climatic patterns over the lake surfaces. These differences in spatial coverage lead to accuracy differences between land and marine temperature models.

Fish Population Health

- ▶ The *Joint Strategic Plan for Management of Great Lakes Fisheries*, supported by 15 federal, tribal, state and provincial organizations, was developed to address fisheries-related issues. This partnership framework is a strong example of effective coordination and collaboration and should be used as a model for other areas of Great Lakes monitoring.
- ▶ The Canadian Department of Fisheries and Oceans' Great Lakes Fish Contaminants Surveillance Program has been collecting important fish contaminant data since 1977. Recent funding cuts to this program have created a gap in regional fish contaminant monitoring and interrupts one of the few long-term monitoring programs capable of documenting trends and changes.
- ▶ More fish habitat monitoring is needed in the Great Lakes basin at both the federal and state/provincial levels to allow for reporting on several key SOLEC indicators.

Red-winged Blackbird, Canadian Wildlife Service



Aquatic Invasive Species

- ▶ The region would benefit from the development of a scientifically based Aquatic Invasive Species (AIS) early detection monitoring program. This type of monitoring program is particularly important in light of the limited funds available for AIS control.
- ▶ The region would benefit from a coordinating body to organize and record AIS monitoring and management activities.

Coastal Wetlands

- ▶ Wetland ecosystem health is a high priority in the region, but additional resources are needed to meet the goals set forth in the *Great Lakes Regional Collaboration Strategy*, released in December 2005. In addition, implementation of state wetland monitoring plans called for by U.S. EPA's Office of Wetlands, Oceans, and Watersheds may require additional resources.
- ▶ A comprehensive inventory of coastal wetlands has been completed and landscape level changes can be computed at a coarse scale, but currently there are no programs to regularly update individual wetland boundaries nor assess the composition or health.
- ▶ There are numerous efforts to restore coastal wetlands, but no programs appear to be tracking the success of the basinwide restoration effort.

Wildlife Ecology

- ▶ Natural Heritage Inventory Programs and related biological community surveys collect data that is used to assess the nearshore species diversity indicator. Two potential limitations are that datasets are primarily land-based; and the scope of these activities are not focused enough.
- ▶ Wildlife managers in the region and SOLEC decisionmakers should re-evaluate wildlife monitoring approaches to better fill monitoring gaps and coordinate individual species monitoring programs.

Benthic and Invertebrate Ecology

- ▶ Monitoring for benthic macroinvertebrate abundance and diversity may be sufficient (except in the Lake Superior basin), but native species are often overlooked.
- ▶ Zooplankton and phytoplankton are regularly collected at only 11 sites throughout the basin. Monitoring for *Diporeia* and *Hexagenia* is limited to only a few programs in single-lake basins. These programs need to be expanded to develop a better understanding of the population dynamics of these species.
- ▶ There are a number of programs monitoring mussel populations, but further investigation is needed to determine if these programs are effective in assessing the health and trends of these sensitive native species.

Plant Ecology

- ▶ Forest age-class and forest successional stage data collection are limited.
- ▶ Little monitoring data are available regarding insect or disease monitoring in terrestrial plant communities.
- ▶ Some SOLEC indicators need to be refined to address the quality and extent of available data.

Habitat and Biological Communities

- ▶ A standardized habitat classification map for the basin is needed to support basinwide assessments.
- ▶ The Illinois Department of Natural Resources Critical Trends Assessment Program provides a good example of using species and habitat occurrence data as a foundation for assessing habitat conditions and ecological health. Expansion of this type of program across the basin would improve assessments of habitat conditions.



Water quality sampling, U.S. EPA

Dip netting, Huron River Watershed Council





Atmospheric Deposition

► The Integrated Atmospheric Deposition Network (IADN) appears to be the only program collecting information on the parameters needed to evaluate SOLEC's Atmospheric Deposition of Toxic Chemicals indicator. A potential limitation of IADN lies in the distribution of sampling stations and in the corresponding activities at each station.

Nutrient Management

► Additional efforts should be made to compare results from nutrient and pesticide management programs (i.e., rates of growth in implementation) with direct monitoring of nutrients and pesticides in surface waters.

Land Use

► Potential limitations to the USGS National Land Cover Database and NOAA's Coastal Change Analysis Program (C-CAP) include time periods between dataset development; the spatial resolution of the imagery used in these projects; and the level of detail of the classification systems.

► A more detailed analysis, focused on evaluating specific GIS data needs and availability, should be conducted to identify specific gaps or overlaps in land use and land cover data.

Erosion

► Comprehensive coastal erosion monitoring programs, such as Pennsylvania's Bluff Recession Monitoring Project and Ohio's Lake Erie Coastal Erosion Study, are good examples of effective coastal zone management programs. It would be useful from a basinwide perspective for other states and provinces to implement such programs.

Recommendations for the Great Lakes Monitoring Community

These recommendations, based on the results of the monitoring inventory and gap analysis, are directed at improving the overall regional monitoring network.

Form coordinating bodies to organize monitoring efforts in key issue areas. The formation of such coordinating bodies is a necessary element for managing monitoring programs. An excellent example is the *Joint Strategic Plan for Management of Great Lakes Fisheries*, developed by the Great Lakes Fishery Commission to manage binational fishery resources in the Great Lakes. This partnership framework could be a model for other areas of Great Lakes monitoring.

Encourage regular discussions among individuals managing similar monitoring programs. Currently, there is limited interaction between program managers directing similar monitoring programs in different parts of the Great Lakes basin. Open discussions will increase coordination and collaboration across monitoring programs, leading to more comparable datasets to evaluate basinwide trends.

The monitoring inventory should be used by SOLEC indicator working groups as a resource for information on monitoring efforts in the region. Currently, there is no systematic process in place for identifying monitoring efforts that address each SOLEC indicator. During the next review of SOLEC indicators, reviewers should examine the monitoring inventory to refine indicator implementation plans.



Big Sand Bay, Canadian Wildlife Service. Opposite page: Fyke net, Presquile, Marsh Monitoring Program sampling, and Frog - Canadian Wildlife Service

Evaluate monitoring needs, costs and current regulations prior to establishing funding levels. Funding levels should be based on resources needed to meet previously set monitoring objectives and regulatory requirements. Funding levels also need to account for constantly changing monitoring costs.

Monitoring programs need to be assessed for compatibility. Before summarizing data from disparate datasets, it is critical that a compatibility analysis be conducted to determine if monitoring methods, data analysis and reporting elements are comparable among programs. If they are not, steps should be taken to better coordinate programs to allow for direct comparison and aggregation of data.

Federal and state monitoring mandates should respond more directly to regional basinwide monitoring needs. Many of the programs included in the inventory are national in scope and are designed to meet national objectives. Often, these objectives are not compatible with the informational needs of the Great Lakes or other regions. Regional offices of federal agencies need to encourage program administrators to allow greater discretion and flexibility in addressing regional needs. Similarly, state, provincial and critical local or nongovernmental programs need to have the flexibility to be altered to address regional information needs.

Encourage regional and local level participation at planned monitoring coordination meetings. Regional and local agencies perform a great deal of monitoring in the basin, as the results from the monitoring inventory demonstrate. Their experience and data can be extremely valuable to basinwide monitoring coordination efforts and, if included, could lead to greater monitoring efficiency and effectiveness.

Short-term, small-scale monitoring programs should be balanced with basinwide monitoring initiatives. Monitoring is needed at a variety of levels to address numerous objectives. Both small-scale and basinwide monitoring programs are taking place across the basin. Each level can provide a great deal of value and, when analyzed in conjunction with one another, provide a deeper understanding of the health of the Great Lakes ecosystem.

Regional Monitoring Coordination and Collaboration Successes

The Great Lakes basin is home to a number of excellent examples of groups working to coordinate and collaborate monitoring activities in specific issue areas. These successful groups can serve as models for other areas of Great Lakes monitoring.

A Joint Strategic Plan for Management of Great Lakes Fisheries, supported by 15 federal, tribal, state, and provincial organizations, was developed in 1994 to address fishery-related issues. The Joint Strategic Plan has laid a framework for organizations to coordinate fisheries-related monitoring activities across the Great Lakes basin. Through the Joint Strategic Plan, Lake Committees have been established for each of the five Great Lakes and Technical Committees have been established to advise Lake Committees that prepare formal “State of the Lake Reports” every five years. The binational Great Lakes Fishery Commission facilitates the Joint Strategic Plan by convening the meetings, publishing reports and minutes, and undertaking other activities to ensure the plan is implemented. www.gllc.org/pubs/sglcon

The Great Lakes Panel on Aquatic Nuisance Species, established in 1991, with staff support provided by the Great Lakes Commission, is a key binational body in the Great Lakes basin working toward the prevention and control of aquatic nuisance species. Comprised of representatives from government, business and industry, academia, citizen environmental groups and the larger community, the Panel works to prevent and control the occurrence of aquatic nuisance species in the Great Lakes by providing guidance on ANS research initiatives, policy development and information/education efforts. www.gllc.org/ans/panel

The Great Lakes Coastal Wetlands Consortium consists of scientific and policy experts drawn from key U.S. and Canadian federal, state and provincial agencies, nongovernmental organizations, academia, and other interest groups with responsibility for coastal wetlands monitoring. Approximately two dozen agencies, organizations and institutions have been brought into the Consortium as Project Management Team members. The Consortium’s purpose is to design an implementable, long-term program to monitor Great Lakes coastal wetlands. www.gllc.org/wetlands

State and regional monitoring programs should better utilize citizen-based, volunteer monitoring resources.

The monitoring inventory includes a number of examples of citizen or volunteer-based monitoring programs. The vast availability of volunteer resources should not be overlooked, as they can provide a cost-effective way to collect broad-scale status and trends data. State/provincial, regional and federal programs should assess the viability of using volunteer data to enhance the effective monitoring breadth of their programs.

Conclusion

The *Great Lakes Monitoring Inventory and Gap Analysis* and associated recommendations provide building blocks for strengthening regional observing and monitoring systems. Efforts are under way to integrate the inventory and gap analysis into larger Great Lakes monitoring coordination initiatives, including GLOS and SOLEC indicator implementation. Complete findings from the *Great Lakes Monitoring Inventory and Gap Analysis* have been disseminated to the monitoring community, resource managers, and federal and state legislators in the Great Lakes region. More detailed information on the recommendations and additional information can be found in the full report, available online at www.glc.org/monitoring/greatlakes or by contacting Matt Doss at mdoss@glc.org.

Acknowledgments

This project was funded through a grant from The Joyce Foundation. Special thanks are extended to the Great Lakes monitoring community for dedicating their time and expertise to populating the Great Lakes Monitoring Inventory and reviewing the gap analysis document. In addition, thanks are extended to the Binational Executive Committee (BEC) monitoring inventory team for sharing data, and the project's technical advisory committee for their guidance.

TheJoyceFoundation



Great Lakes
Commission
des Grands Lacs

Great Lakes Commission
2805 S. Industrial Hwy., Suite 100
Ann Arbor, MI 48104-6791
Phone: 734-971-9135

The Great Lakes Commission, chaired by Thomas Huntley (Minn.), is a nonpartisan, binational compact agency established under state and U.S. federal law and dedicated to promoting a strong economy, healthy environment and high quality of life for the Great Lakes-St. Lawrence region and its residents. The Commission consists of state legislators, agency officials, and governors' appointees from its eight member states. Ontario and Québec have associate memberships.

