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What is the LAMP?

Under the Great Lakes Water Quality Agreement, the governments of Canada and the United States are obligated to protect the physical, biological and chemical integrity of the waters of the Great Lakes.

The Lakewide Action and Management Plan (LAMP) is a collaborative, adaptive management program that assesses the ecosystems of the Lake Michigan basin. Integrated data aids in the development of targeted actions for watersheds where land-based activities are contributing to degraded water quality in the near shore and strategies are needed for habitat and biodiversity protection and restoration. The LAMP collaboration includes federal, state, tribal and local government and a public involvement partnership with the Lake Michigan Stakeholder's Forum and the Watershed Academy planning commissions network.

Overview

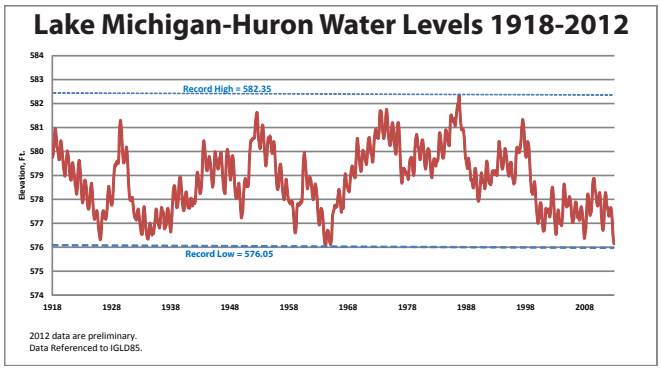
Lake Michigan is the second largest Great Lake by volume and the only one located totally within the United States. The northern portion of the basin's 45,000 square miles is covered with second growth forest and is less developed except for the highly industrial Fox River Valley. Over 300 miles to the south, the more temperate southern portion is very developed from Milwaukee through Chicago to Northwest Indiana. Lake Michigan flows into Lake Huron through the straits of Mackinac at a rate equal to a complete change of water about every 100 years.

Lake Michigan contains the world's largest collection of fresh water sand dunes along with many wetlands, prairies and savannas that provide essential habitat to a great diversity of life. The aquatic food web supports fish for food, sport and culture. The fertile southern-soils are amenable to agriculture and the coast is home to 25 harbors and hundreds of marinas. The Lake Michigan coastlines also serve as a key North American migratory bird flyway.

Lake Levels

The water level of Lake Michigan-Huron unit was at the lowest level in January 2013 compared to any month in the period of record dating back to 1918. This low level continues a 14 consecutive year streak, the longest of recorded history. Low levels in these lakes affect shoreline infrastructure, ecosystems, and all commercial navigation harbors in the Great Lakes system. Every foot of lost depth requires a 1,000-footer to reduce load by 3,200 tons.

Research is under way to determine the cause of lower lake levels. Although lake levels have always fluctuated, recent low winter ice cover (~5% in 2012) and hotter and drier than normal conditions during summer-fall may increase evaporation and affect lake water levels. http://www.lrc.usace.army.mil/



Source: US Army Corps of Engineers. Data prior to 1918 were based on a different measurement methodology and may not be comparable to current data. Historical data are not shown but can be viewed at http://www.glerl.noaa.gov/data/now/wlevels/levels.html

Canada-U.S. Great Lakes Water Quality Agreement (GLWQA) of 2012

On February 12, 2013, the Governments of Canada and the United States ratified the Great Lakes Water Quality Agreement of 2012. The Agreement facilitates binational action on threats to water quality and ecosystem health. : More information on the Agreement can be found on the following website: www.binational.net.

Accomplishments

U.S. Great Lakes Restoration Initiative

U.S. Great Lakes Restoration Initiative (GLRI) funding continues to aid the understanding and accomplishments in the Lake Michigan basin. Part of the federal budget every year since 2010 provided for capacity grants to federal, state and tribal agencies for restoration and maintenance of the Great Lakes ecosystem, as well as competitive project grants to universities and stewardship groups to achieve GLRI Action Plan goals.

Fish Stories

The Lake Michigan states are moving ahead with a 50% reduction in Chinook salmon stocking following more than a year of public engagement on the issue. The plan, coordinated by the Lake Michigan Committee of the Great Lakes Fishery Commission, is intended to help maintain a delicate predator/prey balance, which is the keystone of a multi-billion dollar sport fishery. The reductions are a response to the current large contribution of natural reproduction of Chinook, about 55% of the population, combined with the near historic low levels of the dominant prey fish, non-native alewives. The ability to better estimate natural reproduction and track movements of stocked fish have been enhanced by expansion of the Great Lakes Mass Marking Program, a GLRI-funded basin wide state and federal partnership that is now marking all stocked lake trout and Chinook salmon. Feasibility of restoring native pelagic planktivores such as lake herring is also being investigated by the Lake Michigan Committee as an alternative to the invasive alewife and following recommendations in the Fish Community Objectives (www.glfc.org/pubs/SpecialPubs/Sp12_1.pdf).

Fishery managers may be seeing evidence of natural lake trout reproduction and survival past the fry stage in Lake Michigan. The capture of unmarked lake trout in recent surveys may represent the first evidence of successful rehabilitation of this keystone predator since lamprey control and restoration stocking began in the 1960s. Lake sturgeon restoration also continues with the use of streamside rearing to stock between

Aquatic Invasive Species (AIS)

The U.S. Fish and Wildlife Service (USFWS) and its partners are initiating and expanding Great Lakes wide AIS surveillance programs to help monitor for new invasive fishes and macroinvertebrates. The surveillance includes the use of eDNA for Asian carps and other fishes and will be implemented in the spring of 2013 and go into full operation in 2014.

In 2012 no bighead or silver carp were caught upstream of the electric barrier on the Chicago Area Waterway System or in Lake Michigan. Research continues to advance and refine detection methods (e.g., eDNA and specialized nets), attractants (e.g., pheromones and food-based agents) and deterrents (e.g., water guns, electric barriers, and chemical based agents) to help prevent Asian carp from entering the Great Lakes.

Bird Stories

Winter Bird watching over Lake Michigan has provided surprising results, reporting thousands of birds on the surface of the lake. Recent surveys documented 32,714 long-tailed ducks, 20,538 red-breasted mergansers, 6,946 common goldeneyes, 1,447 buffleheads and 1,036 canvasbacks by the Lake Michigan Offshore Waterfowl and Waterbird Survey. This census work from a fixed wing aircraft has recently been funded by GLRI and the USFWS. Many of these deep-diving ducks feed on organisms found on the lake bottom. Survey data can provide important information as ducks have declined 50% in the last 30 years as the food has gone from native *Diporeia* to invasive mussels. Other uses of the survey data may include tracking climate changes and to avoid placing wind turbines in key duck foraging sites.

In 2012, growth in active bald eagle breeding sites was observed in the southern part of the State of Michigan. This growth in breeding sites is also occuring in Indiana, Milwaukee, Wisconsin, and Cook County, Illinois, after a century of absence.

Piping plover, an endangered species since 1985, has been helped by the GLRI protection actions for nests and chicks. In 2012, Great Lakes plovers experienced the third highest number of chicks fledged since the recovery program began decades ago. Sleeping Bear Dunes National Lakeshore led the way with 45 chicks fledged. A nest on South Manitou Island was the first recorded there since recovery began.

Challenges

Botulism and Aquatic Invasive Species

Botulism is caused by the consumption of a neurotoxin produced by the bacterium *Clostridium botulinum* that impacts neuromuscular function and may result in paralysis and death. Type E botulism has caused periodic mortality of fish and fish-eating birds in the Great Lakes since at least the 1960s.

Clostridium botulinum is commonly found in soil, surface waters, sediments, and the tissues of fish and other animals, but the botulism neurotoxin is only produced in anaerobic (or low oxygen) conditions within specific pH and temperature ranges. Invasive species, particularly dreissenid mussels (zebra and later quagga mussels) and round gobies are thought to play a role in the production and distribution of neurotoxin through the food web. For example, dreissenid mussels may enhance the growth of algae and associated invertebrates. Upon their death, decomposition of these organisms can create conditions required for production of the botulism neurotoxin. The invasive round goby, which consumes both native invertebrates and dreissenid mussels, is widely believed to facilitate neurotoxin transfer to fish and bird species that feed on the goby.

Type E botulism outbreaks have become relatively common in the Great Lakes region since the early 2000s, with mortality events reported annually in Lake Michigan since 2005. Large numbers of dead birds were first reported in 2006 at Sleeping Bear Dunes

National Lakeshore. In 2007, an estimated 8,000 birds were found dead or dying along the northern Lake Michigan shoreline.

During the relatively cool summers of 2008 and 2009, with Great Lakes' water levels rising slightly, the incidence of avian botulism dropped dramatically, and few dead birds were reported. Scores of dead birds began to appear again on the northern shores of Lake Michigan in 2010 and 2011 along with warmer summer temperatures and decreasing water levels. As Lake Michigan approached historic low water levels in the fall of 2012, another major type E botulism outbreak occurred at Sleeping Bear Dunes National Lakeshore, where over 1,500 dead birds were recorded. Botulism outbreaks are thought to be associated with warm or rapidly changing water temperature, fluctuating water levels, food web changes, and other factors that disrupt the ecosystem and lead to outbreak cycles.

A new website, greatlakesphragmites.net, is taking aim at invasive plant control. Launched by the Great Lakes Commission (GLC) and the U.S. Geological Survey (USGS), the Great Lakes Phragmites Collaborative is intended to serve as a central hub for information on *Phragmites*, an invasive species of plant called common reed that out-competes native wetland plants. The site will provide an interactive forum for stakeholders to discuss common challenges, identify information gaps, and strengthen ties between management and research efforts.

Invasive wetlands Phragmites tower over 5-foot-tall Michigan Tech Research Institute intern Naomi Hamermesh (now a MTRI employee).

Next Steps

An important next step is to begin to redesign collaboration in the Lake Michigan basin as Area of Concern communities begin to delist their Beneficial Use Impairments and work on restorations. The GLWQA calls for coordination in "developing and implementing coordinated planning" among governments and agencies at multiple levels. The AOC committees are centers of great experience, and a formal way to keep them involved as stewards in their communities is continued involvement in the Lake Michigan basin. The 2012 GLWQA adds emphasis for LAMP work including two key efforts that call for each LAMP to develop a Nearshore Strategy and Biodiversity Objectives.

Lake Michigan Nearshore Strategy

The 2002 the Lake Michigan LAMP proposed adding Nutrients to its Pollutant of Concern list as it met the criteria listed for causing impairments in nearshore waters. Investigations as to the state of the nearshore were undertaken by the LAMP Technical Committee, Monitoring Council and Lake Michigan Forum. In 2003, the LAMP brought together the lakeside regional planning commissions from the four Lake Michigan states to form a network of land use managers who would be involved with training and the research, regulatory agencies and stakeholders trying to work on nearshore issues.

In the 2005 Lake Michigan Coordinated Science and Monitoring Initiative (CSMI) field year, Nutrient sampling was not conducted but results from the Watershed Attributes "SPARROW" model and other models confirmed tributary inputs that were stressing the near shore and promoting *Cladophora* growth while, in contrast, the open lake waters continued to meet the GLWQA guidelines. In 2007, The Lake Michigan Monitoring Coordinating Council led Lake Michigan's role as one of three pilots to test the new National Monitoring Design. The pilot results of which improved the monitoring blueprint for the nearshore as well as the open waters. By the 2010 CSMI field year the Monitoring Coordinating Council had developed a nearshore monitoring plan and the Lake Michigan Forum had begun work to assess and provide green tools to Ports and Marinas.

In 2012 the GLRI Green Marina Sea Grant Project released its Best Management Practices Manual (www.miseagrant.umich.edu/greenmarina). The On-line Class Room is due for completion in spring 2013.

These tools along with the Lake Michigan Forum's Commercial Harbor Self-assessment Tool puts tools in the hands of owners and operators of facilities that are located in the nearshore. Sea Grant is also training and certifying Marinas as part of the program.

Biodiversity Objectives

The GLWQA calls for establishment of Lake Ecosystem Objectives in coordination with multiple agencies and levels of government and the public. The first step was an effort through a GLRI grant to The Nature Conservancy to develop the Lake Michigan Biodiversity Strategy. This effort involved 170 individuals and 79 agencies and organizations from the Lake Michigan basin. Work on the data base is complete, but the strategy to set objectives and implement priority actions is just beginning. The report lays out the important species and habitats as well as the threats like climate change that need to be addressed.

Lake Michigan Basin Water Trail Completion

The West Michigan Shoreline Regional Development Commission is playing a lead role in the development of the Michigan Water Trails effort following the principles of the National Park Service's National Water Trail criteria. Once established, the trail would complete the coverage of the whole lake connecting with trails in Indiana, Illinois and Wisconsin. Numerous studies have documented the economic benefits of providing for safe and clean outdoor opportunities.

Annual Events

State of Lake Michigan and Great Lakes Beach Assoc. Conference

October 15-17, 2013 at Blue Harbor, Sheboygan, WI
http://aqua.wisc.edu/solm

Making Lake Michigan Great On Board Education Boat Tours

Holland, Muskegon, Traverse Bay, Waukegan
For dates and more ports
vailj@gvsu.edu
ISAE@SCHOOLSHIP.org

"Invasives Month" in the Lake Michigan basin

Spring, 2013
state by state events
www.illinoisinvasives.org, www.isamcoordinator@gmail.com, www.michigan.gov/aquaticinvasives

International Beach Clean Up Day

September 21, 2013
Contact: Alliance for the Great Lakes
www.greatlakes.org

AOC Annual Meeting

March 2014
Chicago, IL
Perrecone.john@epa.gov

Great Lakes Week

September 9-12, 2013 in Milwaukee, WI
http://conference.healthylakes.org/

Making Progress in 10 Areas of Concern (AOCs)

In 2012, US EPA's Great Lakes National Program Office and its state and federal agency partners removed record numbers of cubic yards (CY) of contaminated sediments from Areas of Concern with resources from the Great Lakes Legacy Act and GLRI. The contaminants varied from AOC to AOC, but Polychlorinated Biphenyls (PCBs) and Polynuclear Aromatic Hydrocarbons (PAH) were the most common.

- Fox River (WI): Long-term work continued with 662,000 CY contaminated with PCBs dredged from the lower river reaches and reconstruction of the Cat Island Chain of islands, a very significant habitat area for many species.
- Grand Calumet River (IN): 122,000 CY of PAHs were removed and 366,000 CY were isolated under an adsorptive cap, and 22 acres of habitat were restored in the Roxana Marsh.
- Kalamazoo River (MI): the removal of toxic substance fill material and cement channel walls from Portage Creek allowed restoration with natural stream channel design and native species revegetation. (1 BUI removed since 2012)
- Manistique River (MI): a preliminary source investigation was conducted, and a strong federal/state/local partnership continued to plan for remedial action at the site.
- Menominee River (WI/MI): at this bi-state AOC, remediation of a coal tar site was completed while arsenic removal was begun in 2012.
- Milwaukee River (WI): partners completed Phase 1 by removing 120,000 CY contaminated with PCBs at Lincoln Park.
- Muskegon Lake (MI): contaminated sediment evaluations, habitat restoration, wetland remedial investigations, and geophysical surveys occurred at key sites within the AOC. (2 BUIs removed since 2012)
- Sheboygan River (WI): 300,000 CY containing approximately 1,800 pounds of PCBs and 34,000 pounds of PAHs were removed.
- Waukegan Harbor (IL): dredging is underway, a detailed habitat restoration plan has been completed, and implementation of the beach use restoration and management plan has begun.
- White Lake (MI): the local conservation district completed a 7-site shoreline habitat restoration project that will benefit fish and wildlife populations. (3 BUIs have been removed since 2012).

Education, Outreach and Engagement

The State of Lake Michigan (SOLM) and Great Lakes Beach Association Conference The 8th biennial State of Lake Michigan (SOLM) and 13th annual Great Lakes Beach Association Conference will be held jointly on Oct. 15-17, 2013 in Sheboygan, WI. Field trips will provide an opportunity to see sites that have had both sediment and habitat remediation projects. The conference will carry on the tradition established in 1999 to provide opportunities for in depth presentations and networking. PLEASE NOTE: due to the size of this facility registration must be closed at 350 participants so please register in a timely manner.

The Lake Michigan Forum stakeholders and the Watershed Academy network of regional planning commissions have updated their web site to provide for more interactive and current information. At www.lakemichigamforum.org you can find the presentations from all the State of Lake Michigan conferences since 1999.

The Lake Michigan Wiki Watershed maps and status of the 33 major tributaries are on-line at https://wiki.epa.gov/watershed/index.php/Main This format enables the addition of sub-watershed data. This is part of US EPA's Watershed Central effort to provide a site for sharing tools and new data from multiple agencies and watershed groups.

Watershed Map

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