Great Lakes Concerns

BACKGROUND

The Great Lakes—Erie, Huron, Michigan, Ontario, and Superior—and their connecting channels form the largest fresh surface-water system on Earth. Covering more than 94,000 square miles, the Great Lakes and connecting waterways comprise about 90 percent of the nation's supply of fresh water and 18 percent of the world's. If the volume of Great Lakes water were spread over a surface area the size of the lower 48 states, it would create a lake nearly 10 feet deep. With 3,288 miles of Great Lakes shoreline, Michigan has a longer coastline than any state except Alaska. More than 200 Michigan rivers flow into the Great Lakes.

This system greatly affects the quality of life in Michigan and throughout the Great Lakes basin, the region drained by the lakes. It is a major source of domestic and industrial water; it provides an economical way to transport raw materials, agricultural products, and manufactured goods; it is the cornerstone of the tourist industry of the region; and it provides a wealth of recreation opportunities. The Great Lakes affect the region's weather and provide unique water and coastal habitats that support a wide range of plants and animals.

Problems

In the 1960s, reports of serious Great Lakes problems began to alarm the region's residents. Domestic water supplies were threatened, swimming beach closures were common, and toxic chemicals, including mercury, DDT, and polychlorinated biphenyls (PCBs), were found to be accumulating at alarming levels in fish and wildlife. Moreover, alewife—which had been limited to the Atlantic Ocean and Lake Ontario until the 1932 Welland Canal expansion around Niagara Falls—had become the dominant species in lakes Huron and Michigan, and the annual die-off was fouling beaches and clogging water-intake systems.

In the last three decades significant progress has been made in controlling pollution and improving the quality of Great Lakes water. There is heightened public awareness about how land use and waste-disposal practices affect the lakes. Federal law requires the governors of the eight Great Lakes states to agree to any significant diversion of Great Lakes water outside of the basin. However, the following issues are still of major concern:

- Toxic contamination
- Nonpoint-source pollution and excessive nutrients
- Exotic species
- Water diversions
- Lake levels
- Habitat loss

Lakes Management

While the legal ownership of Great Lakes bottomland rests with the eight states and two Canadian provinces that border the lakes, the interests of the two countries in commercial navigation and pollution control in this shared water resource prompts strong

GLOSSARY

Bioaccumulation
The increase in concentration of a substance by a biological organism above the level found in its food supply or environment; often the concentration increases through successive levels of the food chain (biomagnification).

Consumptive use
Human consumption of basin waters through agricultural and industrial processes (e.g., evaporation from irrigation and steam emitted from power plants) plus that incorporated into products (e.g., milk).

Ecosystem
The interdependent relationship among members of a biological community and their natural environment.

Great Lakes basin
The hydrological unit (region) drained by the Great Lakes; also referred to as the Great Lakes watershed.

Great Lakes states
The eight U.S. jurisdictions bordering the Great Lakes: Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin. Two Canadian provinces also border the lakes: Ontario and Quebec.

Non-native species (exotics)
Species not native to a locale.

Nonpoint-source discharge
A diffuse discharge (one that does not have a single point of origin)—e.g., rain or runoff from adjacent lands that enters a water body; may carry pollutants.

Point-source discharge
A single, identifiable source of a discharge, (e.g., pipe or smokestack); may carry pollutants.

federal interest. Under the Boundary Waters Treaty of 1909, Canada and the United States established the International Joint Commission (IJC) to prevent and resolve disputes over water use and provide independent advice on such other transboundary environmental issues as air pollution.

Under the auspices of the IJC, in 1972 the two governments entered into the Great Lakes Water Quality Agreement (GLWQA) to "restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes basin ecosystem." The focus of the IJC and the cooperating federal, state, and provincial agencies for nearly 30 years has been to develop and implement pollution-abatement measures that will restore and maintain beneficial uses of the lakes.

DISCUSSION

Toxic Chemical Contamination

The Great Lakes basin is vulnerable to the accumulation of pollutants released as by-products of agriculture, manufacturing, power generation, and waste incineration. The IJC has identified at least 360 pollutants in the water, sediments, and wildlife of the Great Lakes, including many persistent toxic chemicals that are of significant concern: dioxin, PCBs, mercury and lead, poly-aromatic hydrocarbons, and several pesticides. These pollutants are toxic at low concentrations, accumulate in fish and wildlife (bioaccumulation), and increase in concentration at successive levels of the food chain (biomagnification).

Toxic chemicals enter the Great Lakes by direct discharge from such "point sources" as manufacturing sites and wastewater treatment facilities, from atmospheric deposition (precipitation containing toxic particles), and through runoff from the land. Studies show that atmospheric deposition accounts for as much as 90 percent of the PCBs, lead, and mercury that annually reach the lakes, coming from as far away as Mexico and South America. State and regional initiatives to protect the lakes from toxic deposition include the Regional Great Lakes Air Toxics Emissions Inventory, a collaborative monitoring effort among the Great Lakes states.

In cooperation with state food-inspection agencies, the federal Food and Drug Administration regulates the chemical levels allowed in commercial food products, including commercially caught fish. The Great Lakes states and provinces, however, are responsible for protecting their residents from the health risks of consuming contaminated, non-commercially caught fish and wildlife. This is accomplished by issuing consumption advisories for the general population (and sensitive subpopulations, such as pregnant women, nursing mothers, and children) when a lake's fish/wildlife are found to contain concentrations above a certain level of such chemicals as mercury and dioxins. In Michigan, the advisories are issued annually by the Michigan Department of Community Health and recommend limiting or avoiding consumption of certain fish/wildlife from specific water bodies.

Nonpoint-Source Pollution and Excessive Nutrients

Nutrients—including phosphorus, various forms of nitrogen, and other elements—provide the basic building blocks for biological productivity of aquatic organisms, and they support the production of small plant organisms (i.e., phytoplankton) that are the primary link in the Great Lakes food chain. Too many nutrients, however, can cause significant problems. Excessive phosphorus in Lake Erie led to widespread algae blooms, odors, poor aesthetics, and lowered dissolved oxygen to the point that in the 1960s Lake Erie was declared "dead."

One major source of phosphorus is household laundry detergent. Since 1972 the United States and Canada have spent approximately $10 billion on building and upgrading sewage treatment facilities, and this has reduced all nutrients, but primarily phosphorus, that eventually find their way to the lakes. In addition, in the 1970s, Michigan imposed a phosphorus content restriction on laundry detergents sold in the state.

Another source of lake nutrients is runoff, or non-point source pollution: When rainfall or melting snow flows across the landscape, it washes soil particles, bacteria, pesticides, fertilizer**,** animal waste, oil, and numerous other toxics into the lakes and the tributaries that feed them. This is one of the leading causes of water-quality problems in Michigan and the Great Lakes. Through both voluntary and regulatory programs, the Michigan Department of Environmental Quality's (MDEQ) Nonpoint Source program targets activities to reduce the effect of polluted runoff in Michigan.

Non-Native Aquatic Nuisance Species (Exotics)

So-called exotic species of plants and animals are those that have been transported from their natural range into new territory. Many are highly beneficial: Most U.S. crops and domestic animals, many sport fish and aquaculture species, numerous plants, and most biological-control organisms originated elsewhere. Many exotic species, however, cause significant environmental, socio-economic, and public health damage because they have no natural predators in their new locale. They can negatively affect commercial and recreational fishing, power generation, manufacturing, navigation, tourism and beach use, natu-

ral area/native species appreciation, public water supplies, and whole populations of native plants and animals. A Cornell University study (1999) tags the annual cost of harmful exotics in the United States at $138 billion.

Since the 1800s, more than 160 exotic aquatic organisms, including plants, fish, algae, and mollusks have become established in the Great Lakes. About 10 percent have created severe problems. These species out-compete more desirable species for food and habitat and carry diseases that are transmitted to other fish and wildlife. One, the zebra mussel, was discovered in Lake St. Clair in 1988 and now has been found in all five Great Lakes and 165 inland Michigan lakes and is spreading across the country. The zebra mussel is particularly troublesome to industries and municipalities that rely on large-scale water withdrawals from the Great Lakes because they attach themselves in barnacle-like colonies to water-intake screens and restrict water flow, costing millions annually to keep intakes free of them.

More than one-third of the current exotics have been introduced in the past 30 years, a surge that coincides with the St. Lawrence Seaway expansion. Once successfully established, a non-native organism is virtually impossible to eradicate. The most effective defense is to prevent unintentional introductions in the first place. Shipping practices, most notably the discharge of ballast water from ocean-going vessels, primarily are responsible for introduction of exotics, but they also can enter the Great Lakes through aquaculture, bait harvesting operations, aquarium trade, and other ways.

In 1993 the U.S. Coast Guard issued regulations requiring that ships destined for the Great Lakes from abroad and not fully loaded with cargo must discharge and exchange their ballast water in the ocean; the intent is to flush out potential invaders. Although this is an important step in reducing future exotic invasions, it is not completely effective. Critics point out that the regulations exempt approximately 80 percent of the 500 or so vessels transiting here each year from conducting any type of ballast-water management or treatment. These are the infamous "NOBOB" (no ballast on board) vessels. "No ballast" is a misnomer, because they actually may be carrying up to 100 metric tons of unpumpable water and residual sludge, which mixes with the Great Lakes ballast water that they take on and discharge as they off load cargo at one port (e.g., steel at Gary) and take on cargo at another (e.g., grain at Duluth).

Michigan Public Act 114 of 2001 addresses the ongoing invasion of exotic species. The law requires the MDEQ to

- determine whether vessels operating on the Great Lakes and the St. Lawrence Seaway are complying with ballast-management techniques adopted by the Shipping Federation of Canada (for oceangoing vessels) and by the Lakes Carriers' Association and the Canadian Ship Owners' Association (for non-oceangoing vessels);
- determine whether ballast-water management practices have been made a condition of passage on the St. Lawrence Seaway;
- determine whether oceangoing vessels operating on the Great Lakes are using a ballast-treatment method to prevent introduction of exotics; and
- compile and maintain lists of vessels that comply with the management practices or treatment methods, maintain the lists on the MDEQ Web site, and provide them to the governor, certain legislative committees, and shippers.

The act has focused public attention on the severity of problems related to the ongoing invasion of exotics, but some suggest that it relies largely on voluntary compliance and is only a beginning step in reducing the risk of future invasions. Given interstate commerce protections under the U.S. Constitution, international trade agreements, and the geographic scope of the Great Lakes, many believe that more stringent federal action is required to address this issue.

Water Diversion

The present means of managing diversions from the lakes are the Great Lakes Charter, a voluntary agreement signed in 1985 by the Great Lakes governors and Ontario and Quebec premiers, and the U.S. Water Resources Development Act (WRDA), enacted in 1986.

Great Lakes Charter

The charter and a recently adopted amendment (Annex 2001) set out a diversion notice-and-consultation process by which no Great Lakes state or province will proceed with any new or increased diversion or consumptive (human) use of Great Lakes water exceeding five million gallons/day average over 30 days without notifying, consulting, and seeking the consent of all affected states and provinces. The amendment provides a framework through which new agreements may be reached among the states/provinces to take such actions as changing the water-withdrawal limit, collecting water-use data by jurisdiction, implementing environmentally sound and economically feasible water-conservation measures, and resolving disputes regarding proposed diversions and consumptive uses of Great Lakes water.

Water Resources Development Act

The WRDA requires that the eight Great Lakes governors unanimously approve any diversion from the lakes or their tributaries for use outside the basin. In reviewing proposals subject to the act, the governors consider whether the proposed diversion (1) is necessary to protect the requesting locality's public health, safety, and welfare, (2) is consistent with water resource planning and existing uses of basin waters, (3) has incorporated environmentally sound and economically feasible water-conservation practices, and (4) is necessary because there is no reasonable alternative.

Lake Levels

Great Lakes water levels have fluctuated for thousands of years. Unlike oceans, where the ebb and flow of tides are constant and predictable, Great Lakes fluctuations rarely are regular, and they cannot be predicted accurately for the long term. The major influences on the hydrology of the lakes and their connecting channels are weather and climate. Water enters the system via precipitation, runoff, and groundwater inflow. It leaves the system via surface evaporation, groundwater outflow, consumptive use and diversion, and the St. Lawrence River. Because most of these factors cannot be controlled or accurately predicted for more than a few weeks, humans' ability to regulate the lake levels is very limited. Nature has the last word.

Recent years have seen a drop, to lows not experienced since the mid-1960s, in lake levels, particularly in lakes Michigan and Huron. This is due partly to low precipitation in the Lake Superior region during the winter of 1998–99, which reduced runoff into the lake, and partly to higher air temperatures throughout the region in 1999–2000, which warmed the water and increased evaporation. Any dramatic change in lake levels or temperatures causes problems. For example, high water causes erosion, and low water affects boaters and the marine industry; in addition, the recent warmer weather (and, thus, warmer water) has resulted in more algal blooms than usual.

The rapid increase in atmospheric carbon dioxide (CO_2) concentrations and greenhouse gasses in the last century is believed to have resulted in a significant rise in the global average temperature, and a warmer climate with either more or less precipitation could result. The potential effects on Great Lakes water levels could be significant. Large fluctuations have important impacts on wetlands, fisheries, habitats, and human use of the shoreline.

Habitat Loss

Adequate high-quality physical and chemical habitat is necessary to ensure the successful growth, survival, and reproduction of plants and animals that make up a healthy ecosystem. A decline in ecosystem health often may be attributed directly to the loss of critical habitat.

The Great Lakes system is home to hundreds of thousands of plant, fish, and wildlife populations, a good many of which depend on near-shore habitat—that is, they breed, grow, and/or live some or all of their life on the land or in the water along the shoreline of the big lakes and the connecting rivers, streams, and channels. These areas are greatly affected by both water level changes and human use.

Human activity contributes to habitat degradation and loss through agriculture, urban and industrial development, exotic species introduction, mining, nonpoint-source pollution and sedimentation, solid waste disposal, recreation, air emissions, water discharges, and water-level management.

The full picture of the state of Great Lakes habitat is insufficiently documented and largely anecdotal, but many researchers and experts contend that loss and degradation are severe—indeed, existing data collection and research, which are largely local and piecemeal, support this view. The biennial State of the Lakes Ecosystem Conference (SOLEC, hosted by Environment Canada and the EPA to deliver a bi-national, science-based review of the state of the basin ecosystem without assessing agency programs), reviews research and papers on habitat health but there currently is no funding or plan in either country to tackle the big picture.

Directional Drilling

Directional drilling—that is, drilling that begins in one location (e.g., on land) and angles to reach an oil or gas deposit in another location (e.g., under a lake)—is used when it is undesirable or impossible to position a wellhead directly above the mineral deposit. Until recently, Michigan was the only state that permitted such drilling in the Great Lakes, and it was a matter of considerable controversy. The practice was banned in Michigan with enactment of Public Act 148 of 2002. The act prohibits the Michigan Department of Natural Resources from entering into a contract that allows drilling operations for the exploration or production of oil or gas beneath Great Lakes bottomlands, connected bays or harbors, or connecting waterways.

Great Lakes Conservation Task Force

In January 2002, the state Senate's bipartisan Great Lakes Conservation Task Force released *The Citizens' Agenda: An Action Plan to Protect the Great Lakes*, presenting 17 issue briefs as well as findings and recommendations. The plan is expected to provide the basis for legislative

proposals to address the matters raised in public meetings and through other input that the panel received.

See also Air Quality; Water Quality.

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FOR ADDITIONAL INFORMATION

Citizens' Agenda: An Action Plan to Protect the Great Lakes
Michigan Senate Great Lakes Conservation Task Force
(2002), *www.senate.state.mi.us/gop/greatlakesreport/index.html*

Great Lakes Commission
400 Fourth Street
Ann Arbor MI 48103
(734) 665-9135
(734) 665-4370 FAX
www.glc.org

Great Lakes Environmental Research Laboratory
National Oceanic and Atmospheric Administration
2205 Commonwealth Boulevard
Ann Arbor, MI 48105
(734) 741-2235
www.glerl.noaa.gov

Great Lakes Information Network
400 Fourth Street
Ann Arbor, MI 48103
(734) 665-9135
(734) 665-4370 FAX
www.great-lakes. net

Great Lakes National Program Office
U.S. Environmental Protection Agency
77 West Jackson Boulevard
Chicago, IL 60604
(312) 886-4040
(312) 353-2018 FAX
www.epa.gov/glnpo

Great Lakes United
P.O. Box 3040
Ann Arbor, MI 48106
(734) 998-0760
(734) 998-0821 FAX
www.glu.org

International Joint Commission
Great Lakes Regional Office
100 Ouellette Avenue
Windsor, Ontario N9A 6T3
Canada
(519) 256-7821
(519) 256-7791 FAX
www.ijc.org

Michigan Environmental Science Board
Michigan Department of Environmental Quality
Constitution Hall
P.O. Box 30680
Lansing, MI 48909
www.michigan.gov/mesb

Michigan Sea Grant College Program
Natural Resources Building, Room 334
Michigan State University
East Lansing, MI 48824
(517) 353-9568
(517) 353-6496 (FAX)
www.miseagrant.org

Office of the Great Lakes
Michigan Department of Environmental Quality
Lansing, MI
(517) 335-4056
(517) 335-4053 (FAX)
www.michigan.gov/deq