

MICHIGAN, LAKE

LAKE MICHIGAN

Lake Michigan is the third largest Great Lake and the sixth largest freshwater lake in the world. Because Lake Michigan is joined to Lake Huron at the Straits of Mackinac, they are considered one lake hydrologically. Many rivers and streams flow into Lake Michigan, and the major tributaries are the Fox-Wolf, the Grand and the Kalamazoo. There is a diversion from the lake into the Mississippi River basin through the Illinois Waterway at the Chicago River. Lake Michigan's cul-de-sac formation means that water entering the lake circulates slowly and remains for a long time (retention) before it leaves the basin through the Straits of Mackinac. Small lunar tidal effects have been documented for Lake Michigan. Internal waves (upwellings) can produce a 15 degree C. water temperature decrease along the coast in only a few hours, requiring drastic alterations in fishing strategy.

The northern part of the Lake Michigan watershed is covered with forests, sparsely populated, and economically dependent on natural resources and tourism, while the southern portion is heavily populated with intensive industrial development and rich agricultural areas along the shore. The world's largest freshwater dunes line the lakeshore. Millions of people annually visit the dunes/beaches at state and national parks and lakeshores. A circle tour guides highway travelers around the lakeshore.

WATER USE

The Great Lakes provide water for many purposes: residential, commercial and institutional facilities; agricultural operations; industrial processes; electric power generation; navigation; sanitation; recreation; and habitat for fish, waterfowl and other aquatic organisms. In 1987, the Great Lakes states and provinces established at the Great Lakes Commission a regional water use data base for the Great Lakes basin and the individual lakes. However, as of 1989, it was not yet possible to obtain accurate information for all categories of water use in Lake Michigan.

ECONOMIC IMPORTANCE

Agriculture: The Lake Michigan basin contains the most farmland of all the Great Lakes basins. It is a

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economic impacts, and aquatic system disturbances. Coliform bacteria: human health risks, taste and odor problems, and economic losses from reduced tourism.

Improvements: In 1985, the Great Lakes states and provinces agreed to clean up and restore the AOCs in the basin. Each jurisdiction is developing "remedial action plans" (RAPs) to control and stop existing sources of pollution and restore water quality in its AOCs. The governments will report to the IJC regularly on progress in developing and implementing the RAPs. All state governments and industries have taken action to reduce or eliminate sources of pollution, and public and private investment in wastewater treatment plants totals billions of dollars. The level of several toxic substances in Lake Michigan fish has declined.

SPONSORS/INFORMATION SOURCES

MICHIGAN SEA GRANT COLLEGE PROGRAM

Michigan State University
334 Natural Resources Building
East Lansing, MI 48824-1222 (517) 353-9568

or

The University of Michigan
2200 Bonisteel Boulevard
Ann Arbor, MI 48109 (313) 764-1138

International Joint Commission
Great Lakes Regional Office
100 Ouellette Avenue, Eighth Floor
Windsor, ON N9A 6T3 (519) 256-7821

or

P. O. Box 32869
Detroit, MI 48232-2869 (313) 226-2170

CANADA-ONTARIO AGREEMENT

Environment Canada
Communications Directorate
25 St. Clair Avenue East, Room 600
Toronto, ON M4T 1M2 (416) 973-6467

or

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Public Information Centre
135 St. Clair Avenue West
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States. Michigan produces 74 percent of the nation's tart cherries and, as the country's fifth largest producer of grapes, the state is developing a wine industry. The Lake Michigan basin produces the greatest number of cattle and calves in the Great Lakes region, and Wisconsin is one of the nation's leading dairy production areas.

Industry: 38 percent of 1987 U.S. steel production.

Forestry: 17 percent of the 1987 U.S. paper production occurred in Lake Michigan states. Michigan alone produces \$98.4 million in hardwood and softwood products and is a major Christmas tree grower. Chicago is an important printing and publishing center.

Shipping: Iron ore, coal, steel, limestone, grain and farm products are shipped through Lake Michigan ports.

Fishery: Commercial fishing — 1986 value in U.S. was \$16.4 million for more than 50 million lb (22.68 million kg). Major species caught were yellow perch, whitefish, bloater chubs, rainbow smelt and alewives. Sportfishing — 9.7 million angler days spent fishing on Lake Michigan in 1985, making it the second largest sport fishery of the Great Lakes. Major species sought are salmon (chinook, coho and pink) and steelhead (rainbow) trout, yellow perch, lake trout and brown trout. The sport fishery has an estimated economic impact of \$332 million (U.S.).

Mining: Sand and gravel, limestone, dolomite.

Tourism: A multimillion dollar outdoor recreation industry, including fishing, diving, boating and coastal park visitation.

RESOURCE ISSUES

Problem: Urban flooding and shoreline erosion.

Source: Development in floodplain areas without adequate planning or regulation.

Effects: Property damage, safety risks, economic losses, loss of wetlands.

Improvements: Some legislation and government incentives for relocating jeopardized structures. At least one state has passed legislation to protect fragile dune environments, which comprise some of the most attractive coastal areas. National lakeshores have set aside some especially valuable dune environments.

Problem: Loss of wetlands.

Source: Drainage for agriculture, areas filled for development.

Effects: Loss of wildlife habitat, recreation areas and erosion protection, as well as groundwater replenishment and toxic purification.

Improvements: Passage of rules to implement a state wetland protection act in the state of Michigan.

Problem: Water quality. Industrial, navigational, municipal and recreational uses of the Great Lakes add pollutants to the ecosystem. Some of them may stay in the water or lake sediments for hundreds of years and affect other uses of the water. Pollution is usually most severe in major population centers on Great Lakes rivers, harbors and connecting channels. The types of problems include: toxic substances in water, sediments and fish; damage to other organisms living in or depending on the water; elevated levels of bacteria; high levels of phosphorus and other nutrients; heavy metals; and aesthetic problems.

The types and severity of water quality problems vary throughout the Great Lakes basin. However, the International Joint Commission (IJC) and Great Lakes jurisdictions have designated 42 "areas of concern" (AOCs) because of their special water quality problems. Lake Michigan's water quality problems are more difficult than those of some of the other Great Lakes because the lake is a cul-de-sac. Therefore, water cycles slowly through the basin. Deteriorated water quality has been a major problem in Lake Michigan's 10 AOCs.

Sources: More than 20 pulp and paper mills, agricultural and urban runoff, wastewater treatment plants, overflow from combined storm and sanitary sewers, steel plants, and marine engine and chemical companies.

Effects: The effects of water quality problems vary with the types of pollutants in the area. Toxic organic substances: human health risks, fish and wildlife contamination, and economic losses (particularly to the sport and commercial fishery). Suspended solids (soil and other materials suspended in the water): increased turbidity (lack of water clarity), adverse aesthetic, recreational and

400 Fourth ree
Ann Arbor, MI 48103-4816 (313) 665-9135

Institute of Water Research
Michigan State University
334 Natural Resources Building
East Lansing, MI 48824-1222 (517) 353-3742

The Center for the Great Lakes
435 North Michigan Avenue - Suite 1408
Chicago, IL 60611 (312) 645-0901

or

The Centre for the Great Lakes Foundation
320 1/2 Bloor Street, West, Suite 301
Toronto, ON M5S 1W5 (416) 921-7662

Other publications in this series are: Great Lakes Basin (E-1865, MICH-SG-89-503); Lake Superior (E-1866, MICHU-SG-89-504); Lake Huron (E-1868, MICHU-SG-89-506); Lake Erie (E-1869, MICHU-SG-89-507); and Lake Ontario (E-1870, MICHU-SG-89-508). For additional copies, contact one of the organizations listed above, your county Extension office, or the MSU Bulletin Office, 10-B Agriculture Hall, East Lansing, MI 48824-1039.

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Lake Michigan

Lake Michigan is the only Great Lake located entirely within the United States.

LAND AND SHORELINE USE

The percentages below were calculated in the 1970s, based on information collected by the former Great Lakes Basin Commission. A study group formed by the International Joint Commission began to assemble current shoreline use information in 1987.

LAND USE (Percent of total)

Agricultural	44
Residential/Industrial	9
Forest	41
Other	6

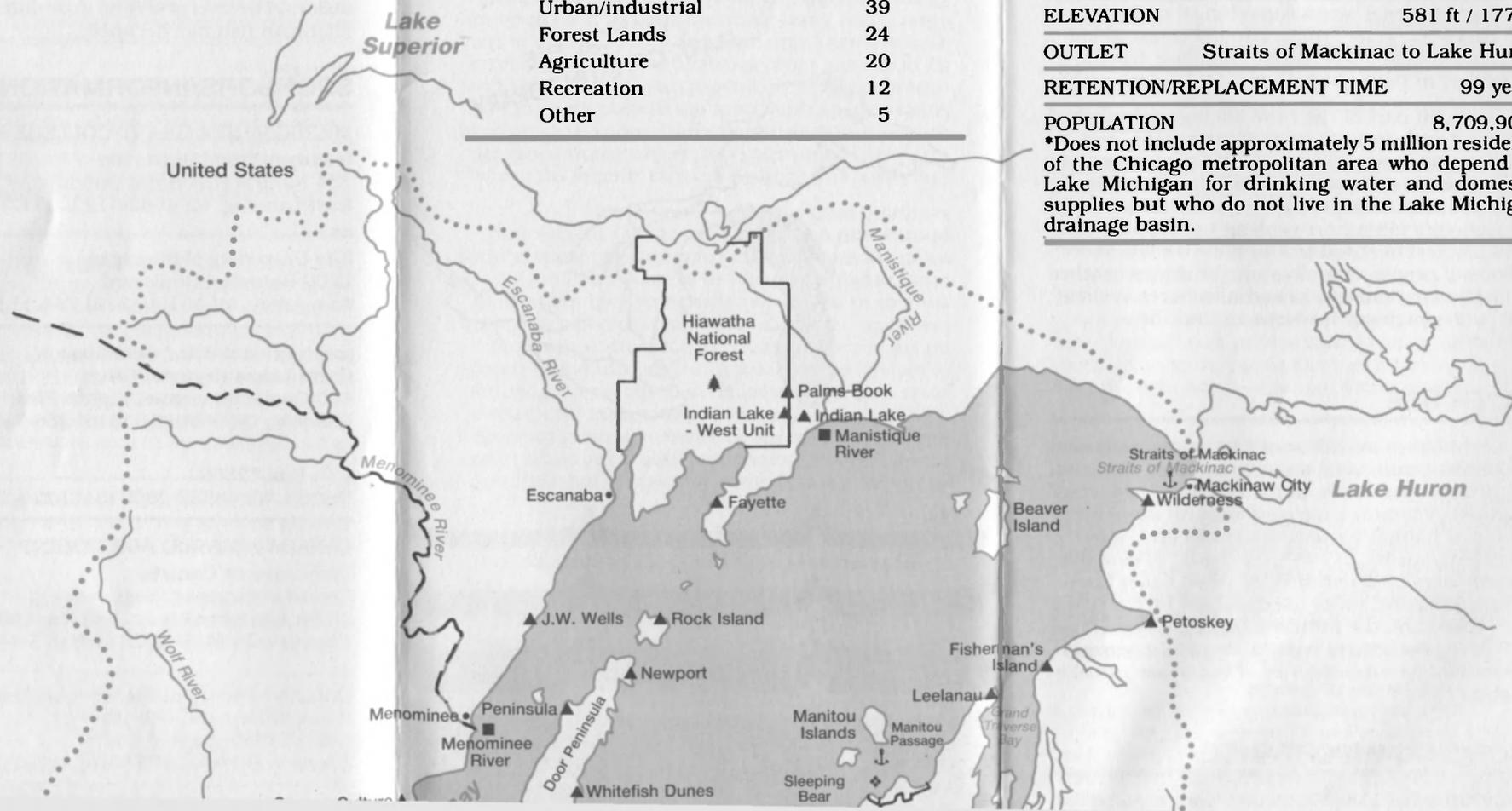
SHORELINE USE (Percent of total)

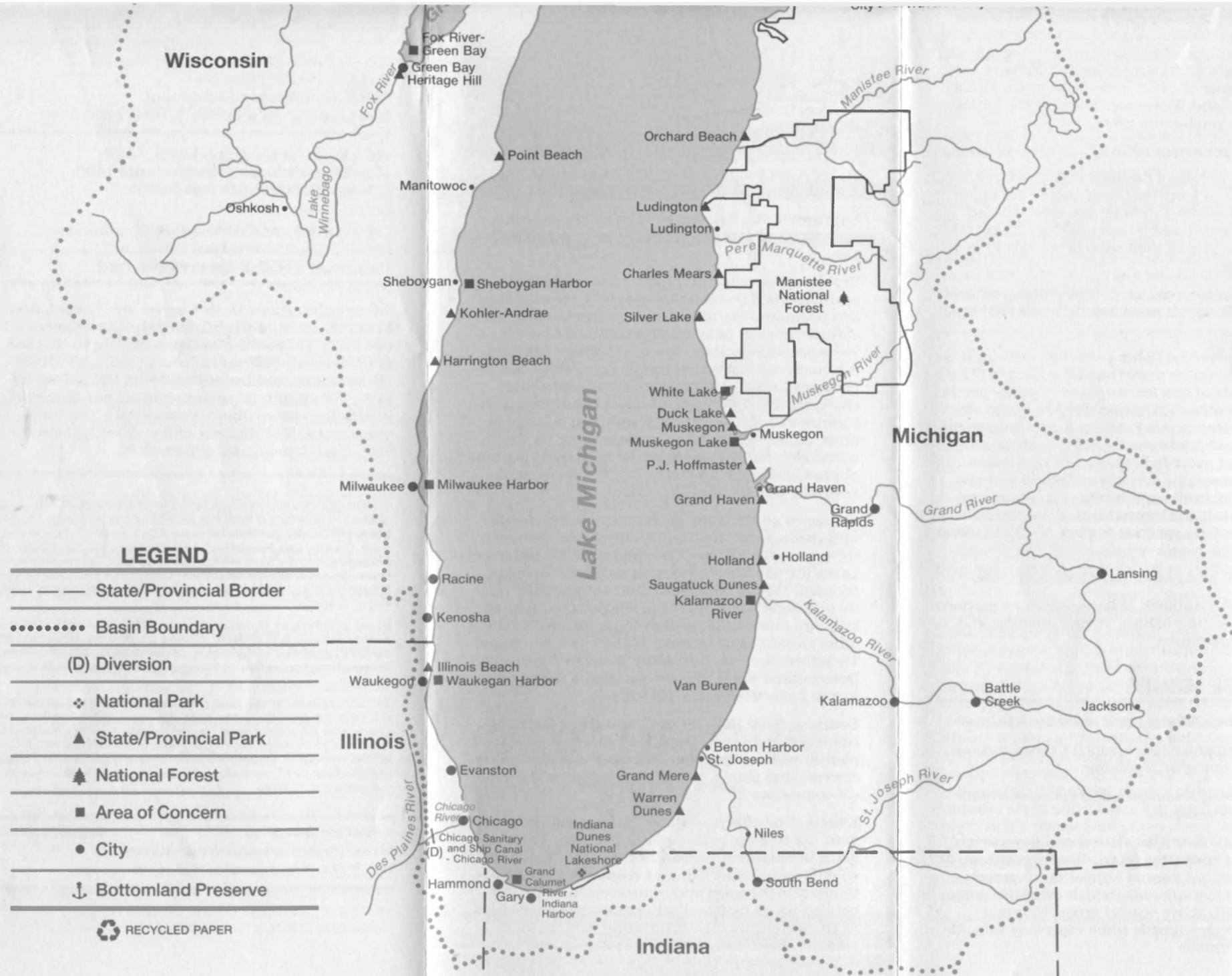
Urban/Industrial	39
Forest Lands	24
Agriculture	20
Recreation	12
Other	5

LAKE MICHIGAN DIMENSIONS

LENGTH	307 mi / 494 km
BREADTH	118 mi / 190 km
DEPTH	279 ft / 85 m average; 925 ft / 282 m maximum
VOLUME	1,180 mi ³ / 4,920 km ³
WATER SURFACE AREA	22,278 mi ² / 57,750 km ²
DRAINAGE BASIN AREA	45,598 mi ² / 118,100 km ²
SHORELINE LENGTH	1,659 mi / 2,670 km (including islands)
ELEVATION	581 ft / 177 m
OUTLET	Straits of Mackinac to Lake Huron
RETENTION/REPLACEMENT TIME	99 years
POPULATION	8,709,907*

*Does not include approximately 5 million residents of the Chicago metropolitan area who depend on Lake Michigan for drinking water and domestic supplies but who do not live in the Lake Michigan drainage basin.





- LEGEND**
- — — State/Provincial Border
 - Basin Boundary
 - (D) Diversion
 - ❖ National Park
 - ▲ State/Provincial Park
 - ▲ National Forest
 - Area of Concern
 - City
 - ⚓ Bottomland Preserve

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