A PROFILE OF LAKE ST. CLAIR

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Cover Photo – *Lake St. Clair and surrounding areas.*
The southern tip of Lake Huron is visible at the upper right. The St. Clair River flows south from Lake Huron and through the St. Clair Delta, where it divides into several channels before entering Lake St. Clair. The inflow from the river can be seen as a light blue plume extending from the delta down along the western shore of the lake and then entering the Detroit River. The most heavily developed portion of the Detroit-Windsor metropolitan area is evident as a large light blue area along the shorelines of the Detroit River and Lake St. Clair. The plume from the Detroit River is clearly visible where it enters western Lake Erie.

Photograph by Environmental Research Institute of Michigan (ERIM), Ann Arbor, Michigan.

David Jude

"To satisfy even our ordinary wants,
all this wild and attractive scenery,
all this natural growth,
had to be disturbed and substantially swept away. . .
so much has man, though calling himself civilized,
yet to learn! Today he does one thing.
Tomorrow his former act is regretted and recalled."

-- Charles K. Dodge (1912)
St. Clair County Naturalist

A Profile of Lake St. Clair is an informational guide for residents, visitors, local officials, and others interested in Lake St. Clair. It is intended to help you gain a better understanding of the lake and participate more effectively in decisions that will preserve it for future generations. The profile is one of a series being prepared on the Great Lakes and their large embayments and connecting channels.

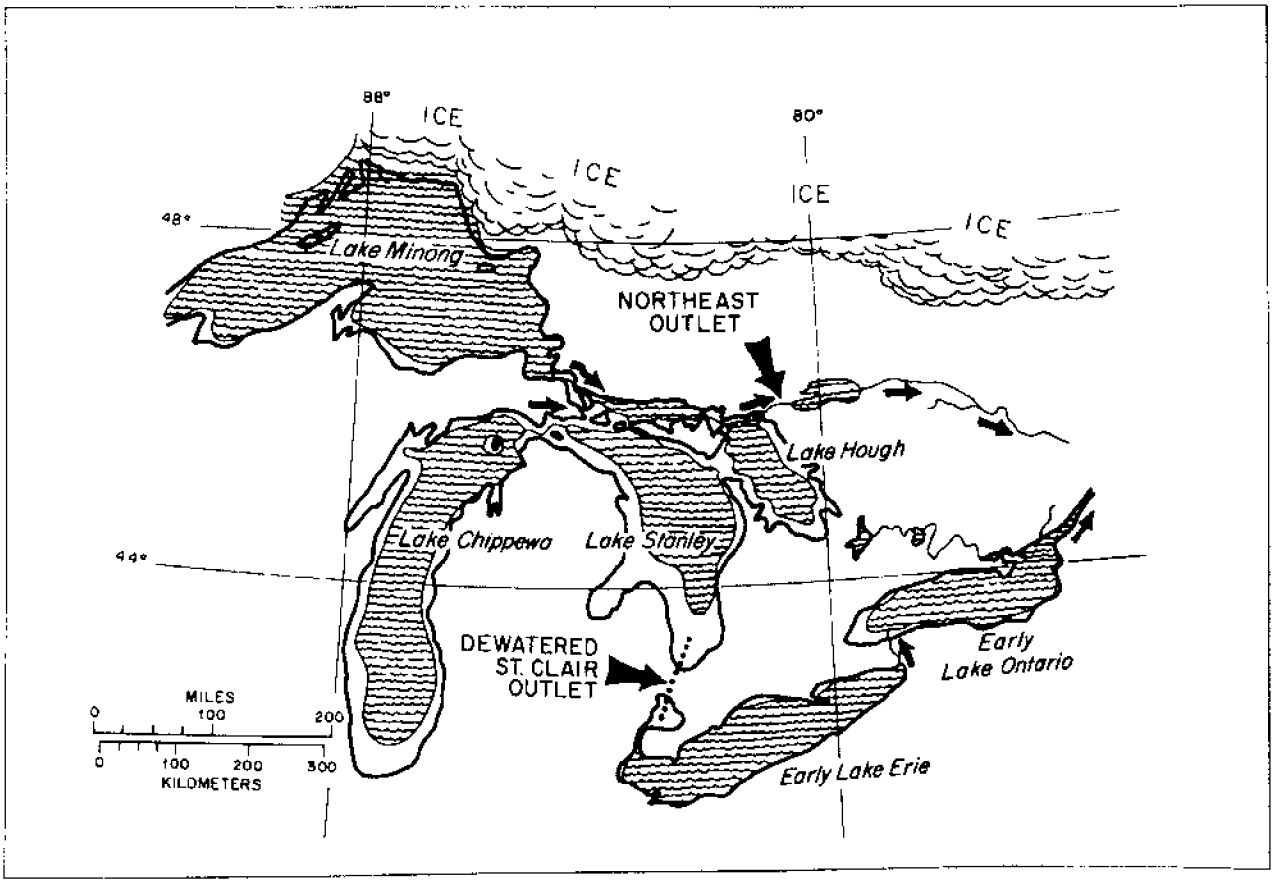
Lake St. Clair is an important natural resource shared by the U.S. and Canada. The lake and its wetlands provide high quality, close-to-home recreational opportunities for the residents of the densely populated Detroit-Windsor metropolitan area. The lake is used intensively for boating, and it supports a recreational fishery valued at more than ten million dollars (U.S.) annually. However, toxic substances have been found in the lakebed sediments and in fish and waterfowl. Other concerns are the loss of wetlands, excess phosphorus and other nutrients stimulating the growth of algae, and water-level fluctuations adversely affecting lake shore property and recreational uses of the lake.

A Profile of Lake St. Clair addresses both the lake's assets and its problems. It includes information on Lake St. Clair's early history, including geology and human settlement; today's features, including water quality and the fishery; and tomorrow's challenges, including guidelines for citizen participation. We hope you find it interesting and useful.

Geological History

Lake St. Clair is the newest and smallest of the six glacially formed lakes that compose North America's 1,000-mile-long Great Lakes System. Lake St. Clair lies in a sandy plain and is partially ringed with low, elongated sand and gravel ridges or moraines—the Port Huron Moraine to the north and the Detroit Moraine to the west and south—that were left by the retreating glacial ice sheet.

The St. Clair-Detroit River System, including the St. Clair River, Lake St. Clair, and the Detroit River, served as one of several outlets for the upper Great Lakes (Superior, Michigan, and Huron) as the last glaciers retreated about 12,000 years ago. As the glaciers continued their retreat, a new outlet for the upper lakes was created at the northeast end of what is now Georgian Bay, in Lake Huron. The level of Lake Huron dropped substantially and the St. Clair River was dewatered. About 5,000 years ago, when the weight of the glaciers on the land to the north was further reduced by melting, the earth's surface uplifted or rebounded, closing the northeast outlet. Lake levels rose, and water again flowed down the St. Clair River. The river gradually deepened its channel, and about 3,200 years ago the St. Clair-Detroit River System became the sole outlet for the upper Great Lakes.



The Great Lakes Drainage System during the last retreat of the glaciers. The northeast outlet was dominant while the St. Clair River outlet was dewatered.

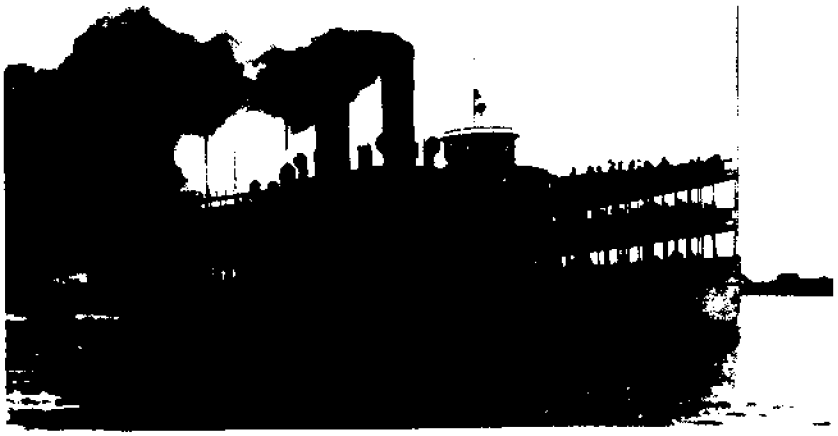
Settlement and Development

The lands adjacent to Lake St. Clair and the St. Clair and Detroit Rivers were inhabited as early as 100 B.C. by Woodland Indians. The lake, rivers, and surrounding land provided these early aboriginal inhabitants with an abundance of fish, wildlife, and plant fiber to meet their needs for food, clothing, and trade, while the waterway served as an important transportation corridor.

The earliest European settlers along the St. Clair waterway were French traders, who constructed Fort St. Joseph in 1688 near the outlet of the lake. The French were followed by English-speaking settlers, who became dominant in the area in the late eighteenth century.

These early European settlers found dense forests of large trees in the uplands surrounding Lake St. Clair, penetrated only by paths and trails. Vegetation was diverse and included white pine on sandy ridges and plains and rich woods of oak, maple, and beech in lower, damp areas. Dense swamps and marshes covered the lowest areas, especially near the lake shore and along tributaries to the lake. Sizable pockets of grassland, representing the most eastward extension of tall-grass prairie in North America, were interspersed throughout the upland forests, especially on the eastern side of the lake and on the islands of the St. Clair Delta.

The early French inhabitants were primarily involved in trade with the Indians and did little to change the landscape. The English, however, logged the forests, built numerous dams and water-powered mills on tributary streams, and farmed the forest clearings and prairie grasslands.



Burtlett Historical Library

Passenger ship Tashmoo *- circa 1910. The* Tashmoo *carried 300,000 passengers annually from Detroit to resorts on Lake St. Clair until she burned at her dock in 1936.*

During most of the nineteenth century, agricultural development occurred throughout the region and resulted in the draining of large tracts of land between Detroit and the Clinton River to the north. Railroads and passenger ship service established in the 1800s improved access to Lake St. Clair and the St. Clair Delta and facilitated the development of recreational facilities and the exploitation of fish and wildlife resources of the lake and bordering wetlands. Industrial development, which began in the region at the end of the nineteenth century, largely by-passed the lake and located instead along the St. Clair River and Detroit River shorelines, where the deeper channels provided better access for commercial ships.

Agriculture near the U.S. shoreline began to decline in the 1920s and 1930s as the area became urbanized, but recreational uses remained important. By 1935 summer cottages were prevalent along the west side of the lake. In Ontario, agriculture remained the dominant use of the lands near the lake until well into the twentieth century.

Wetlands

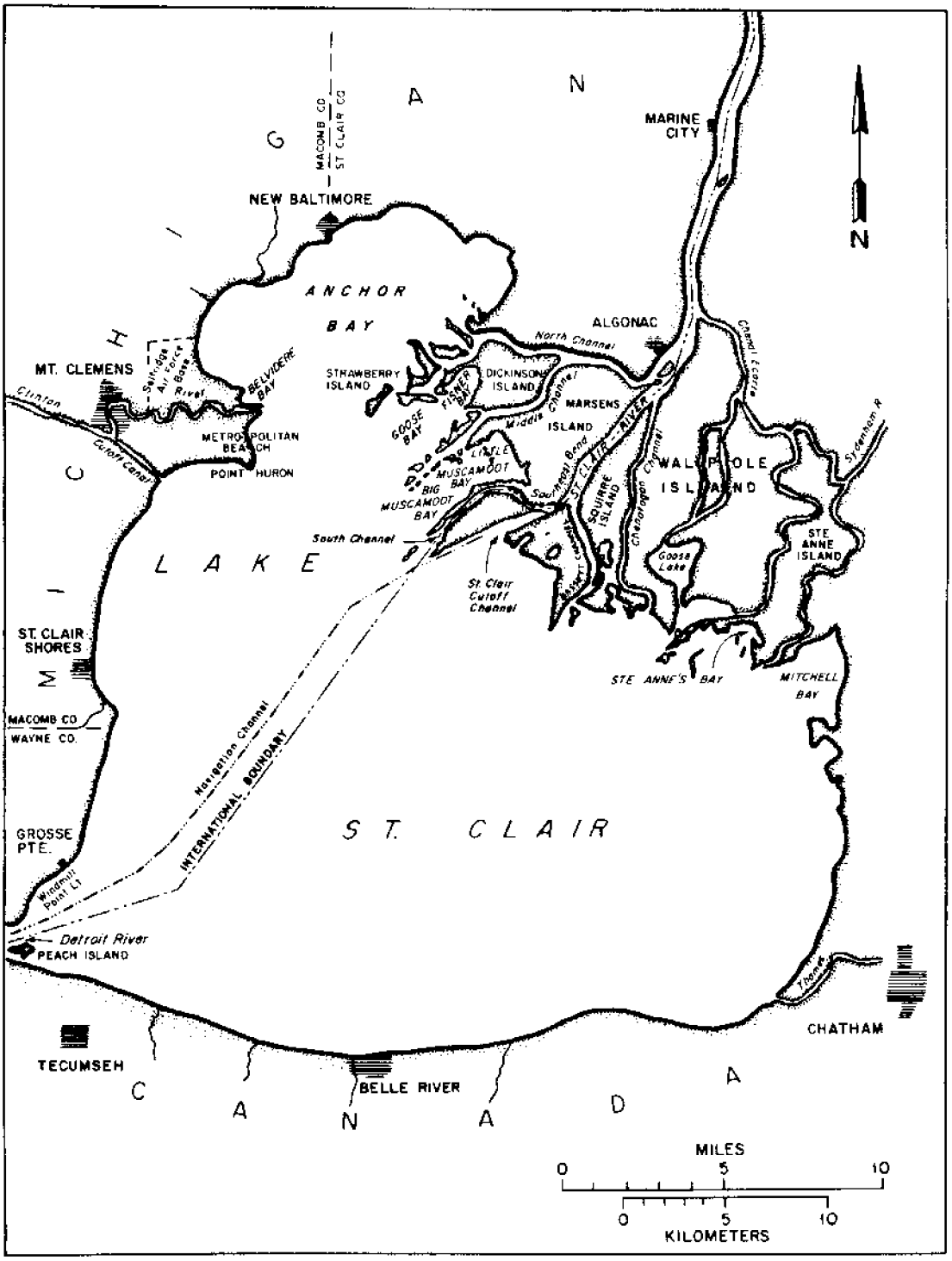
Wetlands were a prominent feature of the Lake St. Clair shoreline and were highly suited for the production of fish, waterfowl, and other wildlife. Some coastal wetlands, particularly those north of the Clinton River, were apparently drained for agriculture in the 1860s, but in 1873 there were still more than 1,133 acres of wetlands remaining around the U.S. shoreline of Lake St. Clair. However, in the following 100 years, nearly 800 acres of wetlands were converted to other uses. Significant losses occurred not only in the St. Clair Delta and St. Johns Marsh at the north end of the lake, but also along the east and west margins of the lake. Near the Clinton River, diking, dredging, and backfilling for urban development occurred both along the lake and along the upland margins of the wetlands, isolating the wetlands from the lake.

In Ontario, much of the coastal zone north of the Thames River was once a wetland, but decades of agricultural development and cottage and marina construction claimed large areas. Many dikes were constructed, and the enclosed wetlands that were not converted to agriculture became less diverse as they became colonized largely with cattails. Although some wetlands persisted along the Lake St. Clair shoreline, they were no longer continuous with the wetlands inside the diked areas, and with the non-diked wetlands farther inland. This fragmentation probably had a major negative impact on fish populations that historically spawned in these areas.

Losses of submerged wetlands in the shallow waters around the perimeter of the lake are not well documented, but more than 648 acres of this important fish and wildlife habitat were probably affected adversely or lost since the late 1800s, due to dredging, filling along shorelines, and eroded soil that washed into the lake from agricultural areas. The dredging of a 27-foot-deep navigation canal from the St. Clair cutoff channel in the St. Clair Delta to the head of the Detroit River has probably also contributed to the loss of submerged wetland habitat.

Steve Stewart

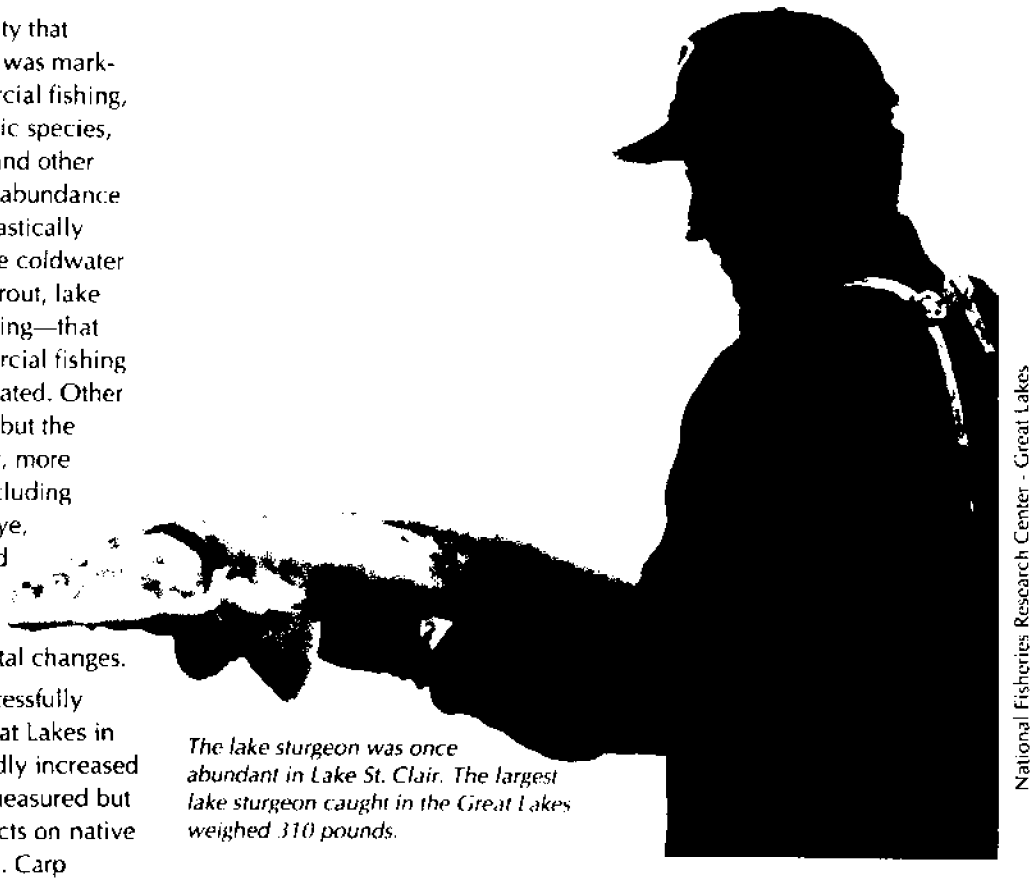
A typical wetland on the St. Clair Delta shoreline.



Contemporary Lake St. Clair, the St. Clair Delta, and tributaries.

The Early Fishery

The early fish community that occupied Lake St. Clair was markedly altered by commercial fishing, the introduction of exotic species, and by wetland losses and other habitat alterations. The abundance of lake sturgeon was drastically reduced, and runs of the coldwater fishes—including lake trout, lake whitefish, and lake herring—that once supported commercial fishing in the lake, were eliminated. Other native fishes remained, but the abundance of the larger, more sought-after species, including smallmouth bass, walleye, and muskellunge, varied significantly over time in response to fishing and environmental changes.



National Fisheries Research Center - Great Lakes

The lake sturgeon was once abundant in Lake St. Clair. The largest lake sturgeon caught in the Great Lakes weighed 310 pounds.

Carp were successfully introduced into the Great Lakes in the late 1800s and rapidly increased in abundance with unmeasured but assuredly adverse impacts on native fishes and their habitats. Carp became a major item in the commercial catch in Lake St. Clair by the turn of the century and thereafter were prominent in the fishery.

The commercial fishery in Michigan waters of the lake was closed permanently in the early 1900s in response to pressure from expanding recreational fishing interests, but the Canadian commercial fishery continued to operate successfully for several more decades. Early records of the recreational fishery are virtually nonexistent, but a creel census conducted in Michigan waters of Lake St. Clair and the St. Clair and Detroit Rivers in 1942–43 showed that about 319,000 angler-days of effort yielded about 198,000 fish. Although these records indicate that a substantial fishery existed, they are conservative because they do not include fishing conducted through the ice. During winters of good ice cover the ice fishery may have produced as many fish as the summer fishery.

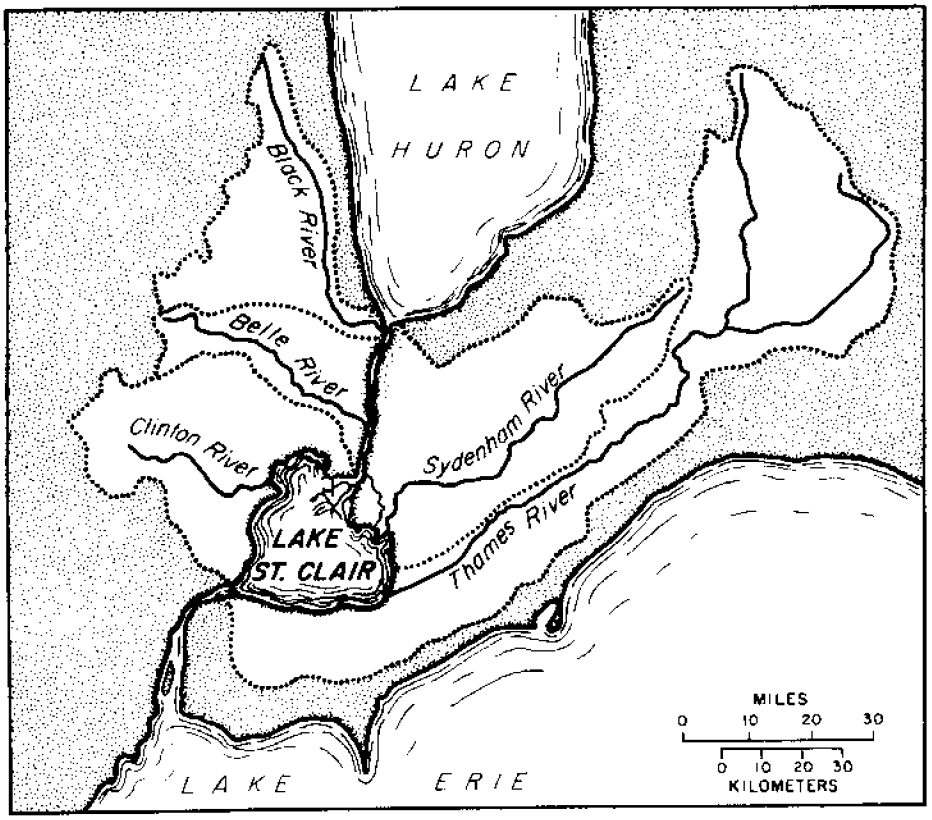
High levels of mercury discovered in Lake St. Clair fish in 1969 closed the Ontario commercial fishery in the 1970s. This closure and a subsequent decision to reserve the more desirable species for the recreational fishery effectively eliminated the Ontario commercial fishery in the lake. The high levels of mercury in Lake St. Clair fish also resulted in a brief closure of the recreational fishery in 1970 and warnings were issued against the consumption of certain fish. However, a viable recreational fishery persisted, and in 1972 Lake St. Clair offered one of the most productive muskellunge fisheries in North America, with 1,017 days of angler effort yielding 1,273 fish. The levels of mercury in most fish in Lake St. Clair fell rapidly after the input of mercury was stopped, and by 1975 the recreational fishery had recovered fully. In 1975–77 the fishery in Michigan waters of Lake St. Clair was estimated to be worth more than ten million dollars annually.

The Lake and its Watershed

The size and shape of Lake St. Clair has probably changed little since the first humans reached its shores. The lake is about 26 miles long and 24 miles wide, has a maximum natural depth of 21.3 feet, an area of about 670 square miles, a volume of 2.2 cubic miles, and a shoreline of 62 miles. The St. Clair Delta covers more than 240 square miles and extends prominently into the lake at the mouth of the St. Clair River.

The inflow to Lake St. Clair averages 17,159 cubic feet per second. Nearly 98% of the total inflow enters from Lake Huron through the St. Clair River, and the rest enters from five watersheds, covering 9,300 square miles, that are tributary to the St. Clair River or to Lake St. Clair itself.

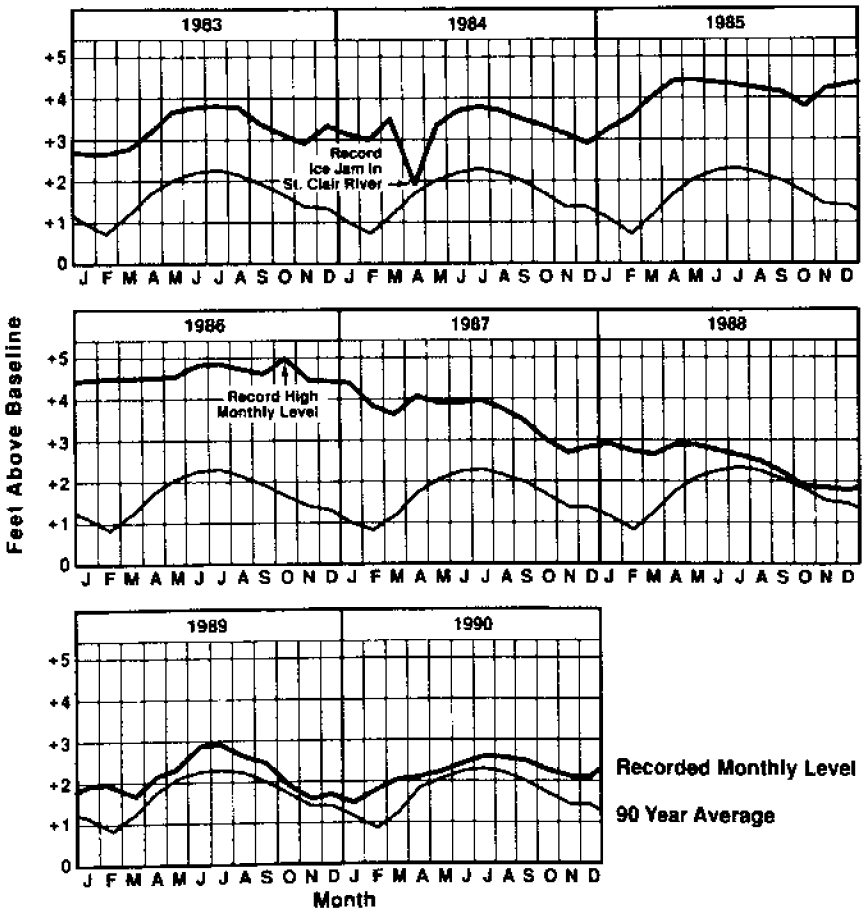
The large inflow relative to the volume of the lake causes the water in the lake to be exchanged completely every 5 to 7 days. The shallow, saucer-like shape of the lake basin allows strong winds to mix the lake water thoroughly and to resuspend fine-grained sediments that accumulate on the lake bed during periods of calmer weather. As a result, only 2 to 3 inches of fine-grained sediments have accumulated on the coarser sands and gravels that were deposited on the lake bed by the glaciers.



The Lake St. Clair watershed. River basin areas in square miles are: Black 746; Belle 971; Sydenham 2,043; Clinton 1,206; and Thames 4,330.

The water level in the lake varies only about 1.6 feet seasonally and typically is lowest in winter and highest in spring and early summer (see figure below). Water levels in 1983–86 were considerably above the long-term average due to greater than normal precipitation in the upper Great Lakes Basin, and an all-time record high (+4.9 feet) was recorded in October 1986. Subsequently, precipitation was below normal and in the fall of 1988 water levels approached the long-term average. Natural water-level fluctuations, although troublesome to landowners in low-lying areas, regenerate wetlands and thus create new habitat that is beneficial to fish and wildlife production.

Agriculture is still predominant in the watershed but is giving way to residential development as suburban sprawl continues to expand beyond city and village limits. Moreover, lake shore dwellings originally built for summer use are being converted to year-round occupancy, and permanent homes compose most of the new construction. In spite of improved wetland protection laws in the U.S. and Canada, the piecemeal conversion of wetlands to residential and agricultural uses continues, posing a threat to fish and wildlife. The threat is probably most severe for populations of mallard and black ducks, Canada geese, tundra swans, and significant portions of the North American populations of canvasback and redhead ducks, which use the lake and its wetlands during their annual migrations.

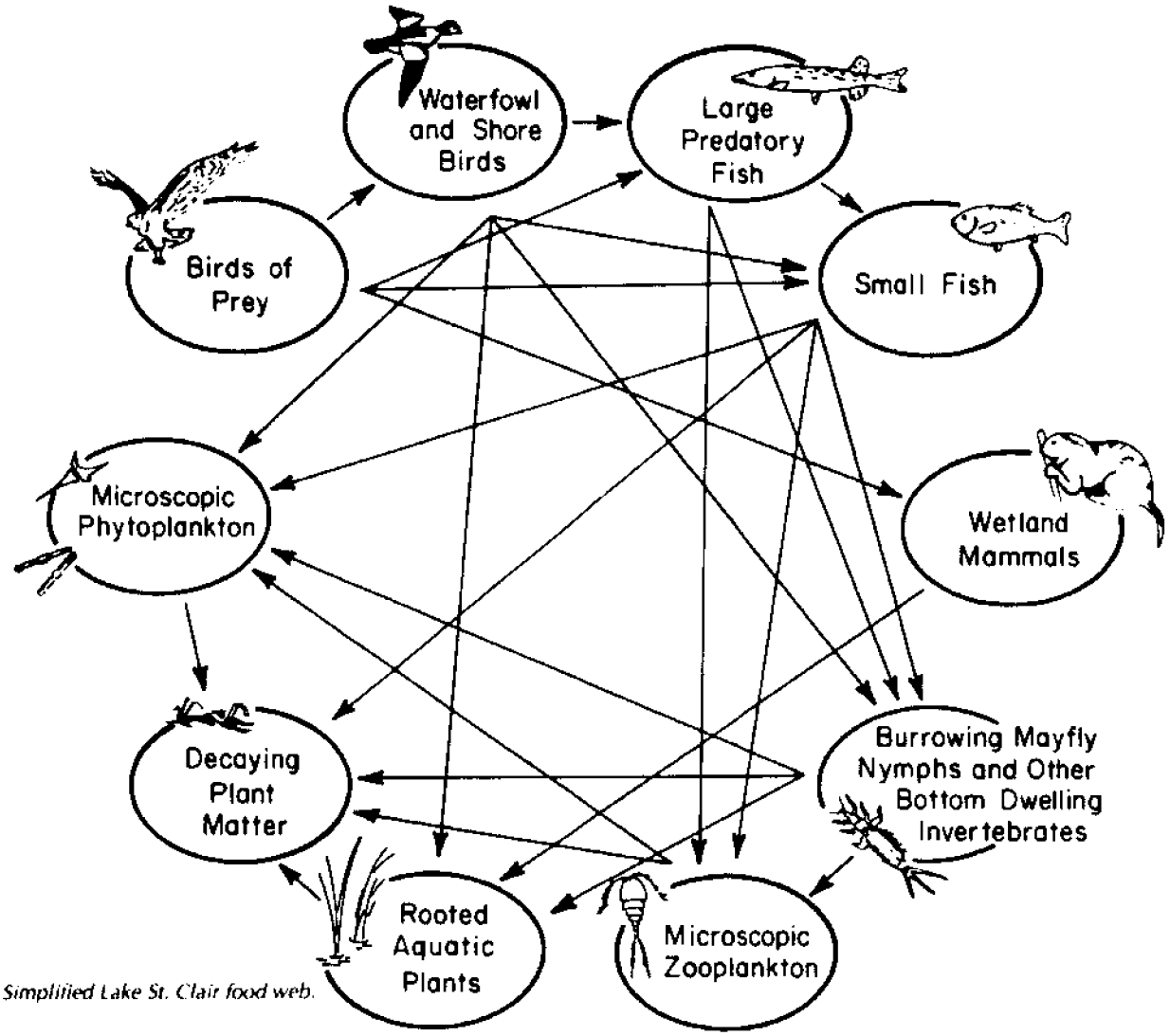


Lake St. Clair water levels, 1983-90. Note the large drop in recorded monthly water level in April 1984, when an ice jam in the St. Clair River reduced the inflow to the lake.

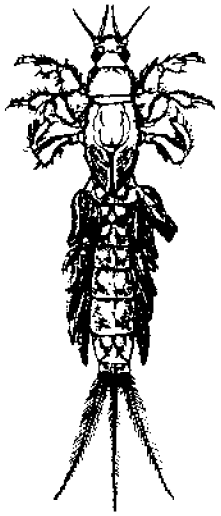
The Food Web and Natural Production

A complex food web supports fish and wildlife production in Lake St. Clair and adjoining wetlands. A simplified version of that food web is shown below. Aquatic plants, including microscopic phytoplankton (drifting algae) and the larger, rooted plants such as cattails, trap sunlight and grow. These plants are eaten by aquatic animals, including microscopic zooplankton (weakly swimming or drifting animals) and larger, bottom-dwelling invertebrates such as burrowing mayfly nymphs, shrimp-like scuds, midge larvae, snails, and clams.

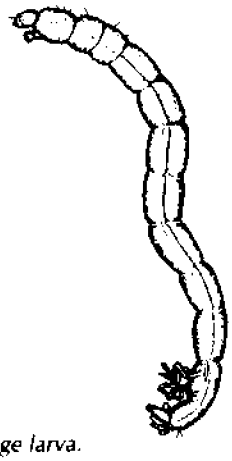
These small aquatic animals are in turn eaten by fish, birds, and mammals. Birds and mammals also feed directly on aquatic plants and on fish. An important example of food web linkages in Lake St. Clair is the production of rooted aquatic plants, the decay of that plant matter, feeding on that decayed plant matter by nymphs of the burrowing mayfly, and feeding on the mayfly nymphs and winged adults by fish and birds.



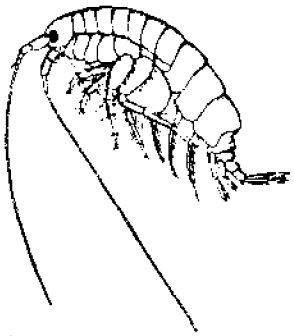
Simplified Lake St. Clair food web.



Burrowing mayfly nymph.



Midge larva.

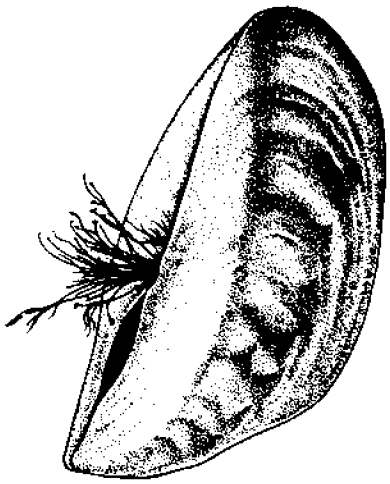


Scud.

The estimated production of aquatic plants in the lake exceeds 3.3 million tons annually, of which about half is phytoplankton and half is rooted plants. About 80% of the rooted plant production occurs in wetlands as cattails and other emergent plants that extend above the surface of the water; the other 20% occurs in the nearshore submerged wetlands and includes wild celery, pondweeds, stoneworts (*Chara*), and other plants that grow largely beneath the surface of the water. Because the waters of the lake are exchanged about every 5 to 7 days, the microscopic phytoplankton and zooplankton that drift freely with currents probably spend only a few days in the lake. As a result they contribute substantially less to fish production in the lake than do the rooted vegetation, the bottom-dwelling insects, and other invertebrates that may remain in the lake for one to two years.

Lake St. Clair supports an abundance of bottom-dwelling invertebrate species usually found only in relatively unpolluted waters. The shrimp-like scuds are numerous, more than 900 burrowing mayfly nymphs per square foot of bottom are present in some areas, and snails and stonefly nymphs are abundant in other areas. Almost a century ago the lake supported about 20 species of large mussels, and recent surveys show at least 18 species are still present. Five species of these native mussels are listed as threatened or endangered by the State of Michigan. Two species of small fingernail clams are also native to the lake. Young mussels and the fingernail clams are important food for some fishes and ducks in Lake St. Clair.

A new addition to the benthic community of Lake St. Clair is the small, prolific zebra mussel that is native to some freshwater areas in Europe. This mussel was probably transported into Lake St. Clair in 1986 in the ballast water of an ocean-going ship. Unlike the mussels native to the Great Lakes, this invader secretes hold-fast elements (byssal threads) that enable it to attach to hard surfaces. The zebra mussel has become extremely abundant in some areas of western Lake Erie and appears to be significantly altering those habitats and adversely affecting native mussels, while providing an increased food supply for diving ducks. By the summer of 1990, the zebra mussel was firmly established in Canadian waters in the southern quarter of Lake St. Clair, and was expected to quickly become abundant throughout the lake.



Close-up of zebra mussel showing byssal threads that enable it to attach to hard surfaces.

The Fishery Today

A 1983–85 survey of recreational fishing in Michigan waters of Lake St. Clair found that anglers spent nearly 2 million hours annually fishing from shore, from boats, and through the ice, and caught nearly 1.2 million yellow perch, walleye, white bass, and drum. In Ontario the recreational fishery in Lake St. Clair is substantial, but considerably smaller than in Michigan. In 1980–85 anglers in Ontario fished about 506,000 hours annually and caught about 322,000 yellow perch, walleye, smallmouth bass, and muskellunge. The value of the recreational fishery in Lake St. Clair in the 1980s was not determined, but undoubtedly exceeded by a substantial margin the ten million dollar annual value that was reported for 1975–1977.

Several exotic fishes now compete successfully with native species in Lake St. Clair. Carp are common in the lake and contribute to the catch by anglers. Rainbow smelt and alewives seasonally dominate the forage fish population and help support the fishery. White perch have invaded the Great Lakes from eastern North America, and have become abundant in the angler catch in the Detroit River in 1982, and may soon become abundant in Lake St. Clair. The potential effect of this invader on the fishery is unknown. It does not attain a large size, but hybridizes naturally with the larger white bass, producing a fish of intermediate size.

Another exotic fish of concern in the Great Lakes is the Eurasian ruffe, a small, spiny, perch-like fish that recently has become established in the extreme western end of Lake Superior in a habitat resembling that of Lake St. Clair. This species apparently was brought into the Great Lakes in the ballast water of ships from European ports. In its natural range the ruffe has little recreational or food value and is a serious predator on eggs and young of more desirable fishes. Attempts are underway to eradicate or limit the spread of the ruffe in the Great Lakes. U.S. or Canadian fishery agencies should be notified if it is caught in Lake St. Clair.

Thomas A. Edsall

The Eurasian ruffe, a recent invader of the Great Lakes.

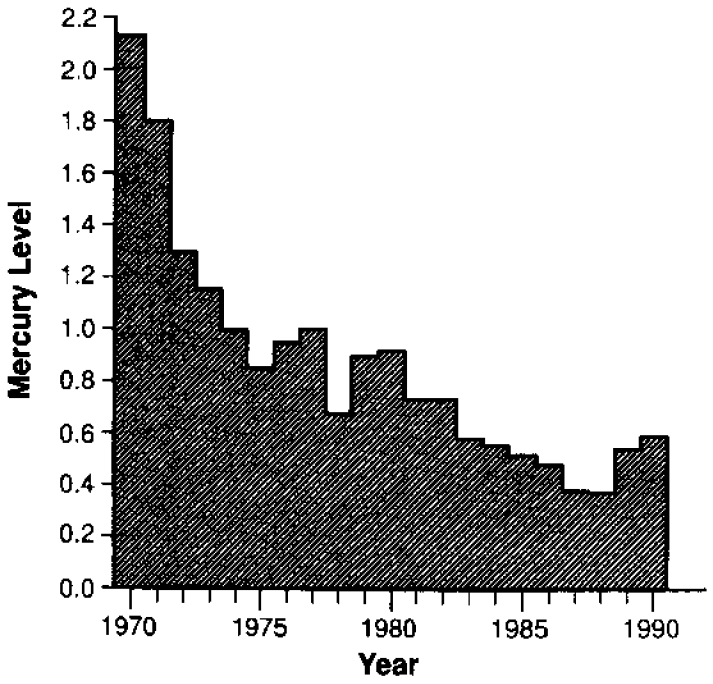
Effects of Contaminants on the Lake and Its Fish and Wildlife

A recent study conducted jointly by the U.S. and Canada revealed that the industrial complex in the Sarnia-Corunna area in Ontario, along the St. Clair River, is the source of most of the pollutants that enter Lake St. Clair, including metals, cyanide, oil and grease, and toxic organic compounds. Other major pollution sources are the Clinton River in Michigan and the Thames and Sydenham Rivers in Ontario.

The study also revealed that water quality in Lake St. Clair was high and that lake sediments as a whole were only lightly polluted, despite the continuing input of pollutants. About 20% of the lake bottom was moderately polluted by nickel, chromium, copper, and zinc, and 5% was still heavily polluted by mercury. Sediments collected in the vicinities of the Clinton River, Thames River, and the south central portion of the lake were moderately to heavily polluted by phosphorus, but elsewhere in the lake phosphorus was not a problem. The generally high quality of the water and sediments in the lake resulted mainly from the massive inflow of clean Lake Huron water which diluted and flushed pollutants from the lake.

Although the concentration of pollutants in Lake St. Clair water and sediments was low, some of these pollutants accumulated in high concentrations in fish and wildlife, with largely unmeasured effects on the health and survival of these populations. An especially obvious fish health problem in Lake St. Clair involves the unsightly growths on walleyes that have been observed in recent years. These growths are most common on the older, larger fish caught in spring and fall. It is not known if the growths cause mortality, but they indicate a debilitated state of health and are a significant concern for anglers who wish to eat their catch. Some of these growths are attributed to a disease called lymphocystis, and others are dermal sarcomas, or tumors. Both types of growth appear to be caused by viruses which sometimes manifest themselves in contaminant-stressed environments.

Of potentially even greater concern is the health risk posed for humans that consume contaminated fish and wildlife. For example, the study found that potentially harmful amounts of PCBs, hexachlorobenzene, and octachlorostyrene were present in fish and duck flesh. In addition, the concentration of mercury in the flesh of some fish still exceeded the level considered safe for human consumption (0.5 parts per million) set by the U.S.–Canada 1978 Great Lakes Water Quality Agreement. As a result, in 1987-88, a Public Health Fish Consumption Advisory was issued for 17 species of fish for both Michigan and Ontario waters of Lake St. Clair. A waterfowl consumption advisory is being considered. The current fish consumption advisory for Michigan and Ontario waters of Lake St. Clair can be found in the fishing regulations pamphlets available where angling licenses are sold.



Average mercury levels (parts per million) in Lake St. Clair walleye. The sharp drop in mercury levels reflects the virtual elimination of discharges of mercury into the St. Clair River in the early 1970s. (A. Johnson, Ontario Ministry of the Environment).

Problems and Solutions

Lake St. Clair and its wetlands are a complex natural system that can support a variety of beneficial uses, including fish and wildlife production and water-oriented recreation. As the human population increases in the region, the demand for more intensive development of the shoreline of the lake will increase. More nutrients with the potential to disrupt key food web linkages may find their way into the lake via tributaries, septic system drainage, and sewage treatment plant effluents. Spills and permitted discharges of persistent toxic contaminants may continue to impose large loadings on the system and adversely impact fish and wildlife and render them unfit for human consumption.

Remedial Action Plans designed to guide restoration of the Great Lakes from the effects of pollution and habitat alteration are scheduled for completion in the 1990s by the Great Lakes States and Ontario. The Sarnia-Corunna area on the St. Clair River and the Clinton River mouth in Lake St. Clair have been identified as Areas of Concern for which Remedial Action Plans are being prepared. The future of the Lake St. Clair ecosystem will be strongly dependent on the adequacy of these plans and the degree of resolve with which they are implemented.

To protect the more sensitive elements of the Lake St. Clair ecosystem we need to:

- monitor the lake and its plants and animals closely to provide early warning of any adverse changes,
- continue to study the natural processes that support fish and wildlife production so that we can better understand these processes and predict and prevent harmful changes, and
- develop and institute remedies to correct past and present abuses of the system.

What Can You Do?

- Enjoy Lake St. Clair and encourage others to do so. Your use of the lake puts you in an ideal position to influence the management of this valuable resource.
- Support actions, including pollution control at residential, municipal, industrial, and agricultural sources, that will improve the quality of the lake environment and its living resources. Public support for the Remedial Action Plans being developed for the St. Clair-Detroit waterway is required if the plans are to be effectively employed to correct abuses and protect the system.
- Become informed about the lake's resources and the conflicts among different users and voice your concerns to resource managers and decision-making agencies so that they are aware of your concerns.
- Support land-use controls that protect wetlands and other environmentally sensitive areas.
- Contact and support organizations dedicated to natural resources protection and wise use of Lake St. Clair, such as:

Eastern Michigan Environmental Action Council
21220 14 Mile Rd.
Birmingham, MI 48010

Citizens Against Chemical Hazards
1503 Clinton St.
Algonac, MI 48001

Lake St. Clair Advisory Committee
7245 Audubon Dr.
Algonac, MI 48001

Citizens Coalition for Clean Water
115 Forham St.
Wallaceburg, Ontario N8A 3R5

Essex County Field Naturalists
Box 35421
Tecumseh, Ontario N8W 3C4

Kent Nature Club
114 Park Ave. West
Chatham, Ontario N7M 1V9

Additional Reading

Dodge, C. K. 1912. Flora of the County, Chapter V, p. 30-41, In: Jenks, W. L. (ed), St. Clair County, Michigan, Its History and Its People, Vol. I, Lewis, Chicago.

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Conversion Table - U.S. Customary to Metric

Multiply	by	to obtain
inches	2.54	centimeters
feet	1.829	meters
miles	1.609	kilometers
acres	0.4047	hectares
square miles	2.59	square kilometers
cubic miles	4.168	cubic kilometers
pounds	0.4536	kilograms
tons	0.9072	metric tons

John E. Gannon

"By a very slow process nature has brought together and developed all we have. The very meat of this idea of conservation is to use with moderation, not to waste, and to preserve what has been developed and seemingly laid up for us by Mother Earth."

— Charles K. Dodge (1912)

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