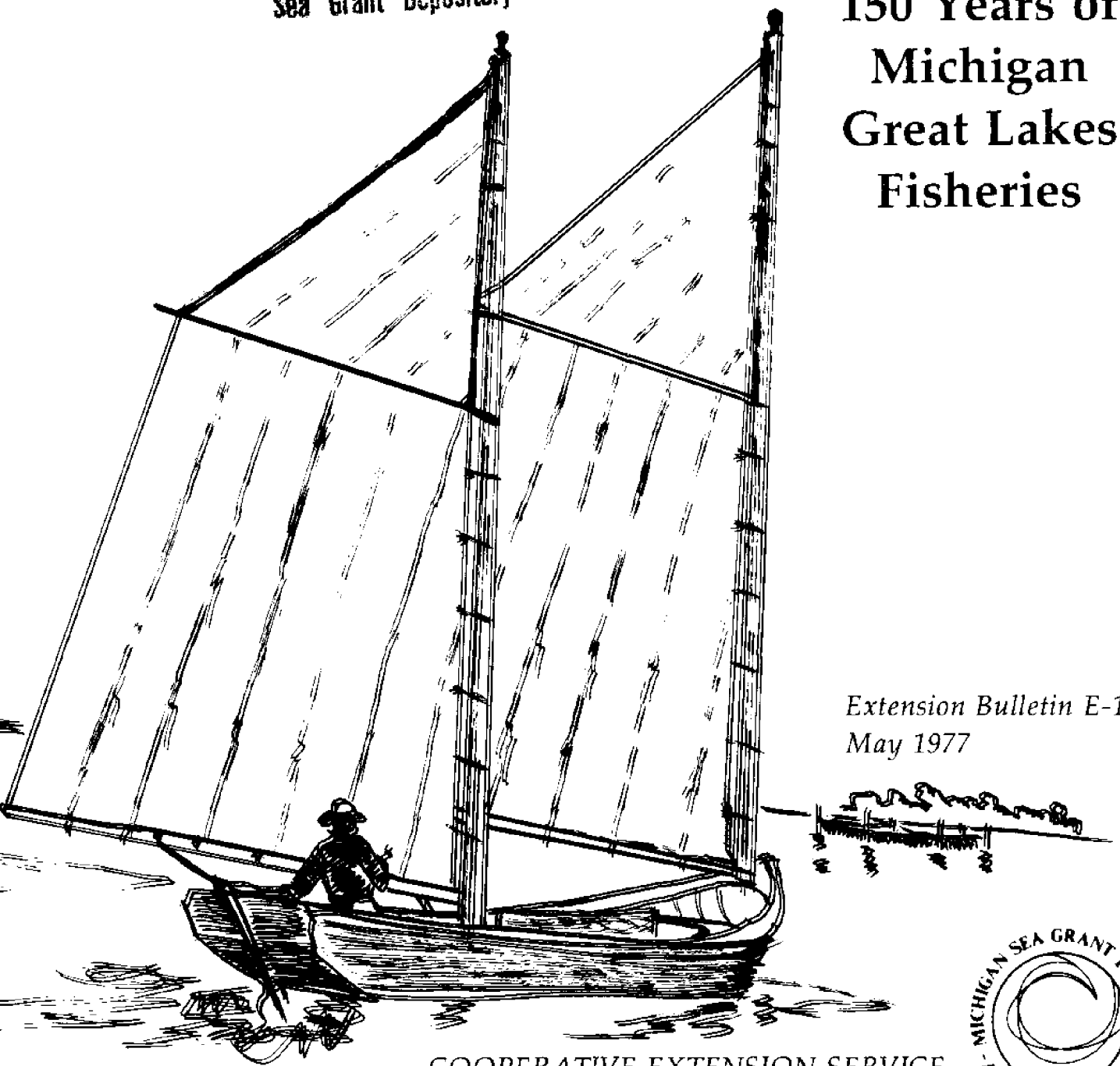
Seines to Salmon Charters

150 Years of Michigan Great Lakes Fisheries



Extension Bulletin E-1000
May 1977

COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY

MICHIGAN SEA GRANT PROGRAM - ADVISORY SERVICE

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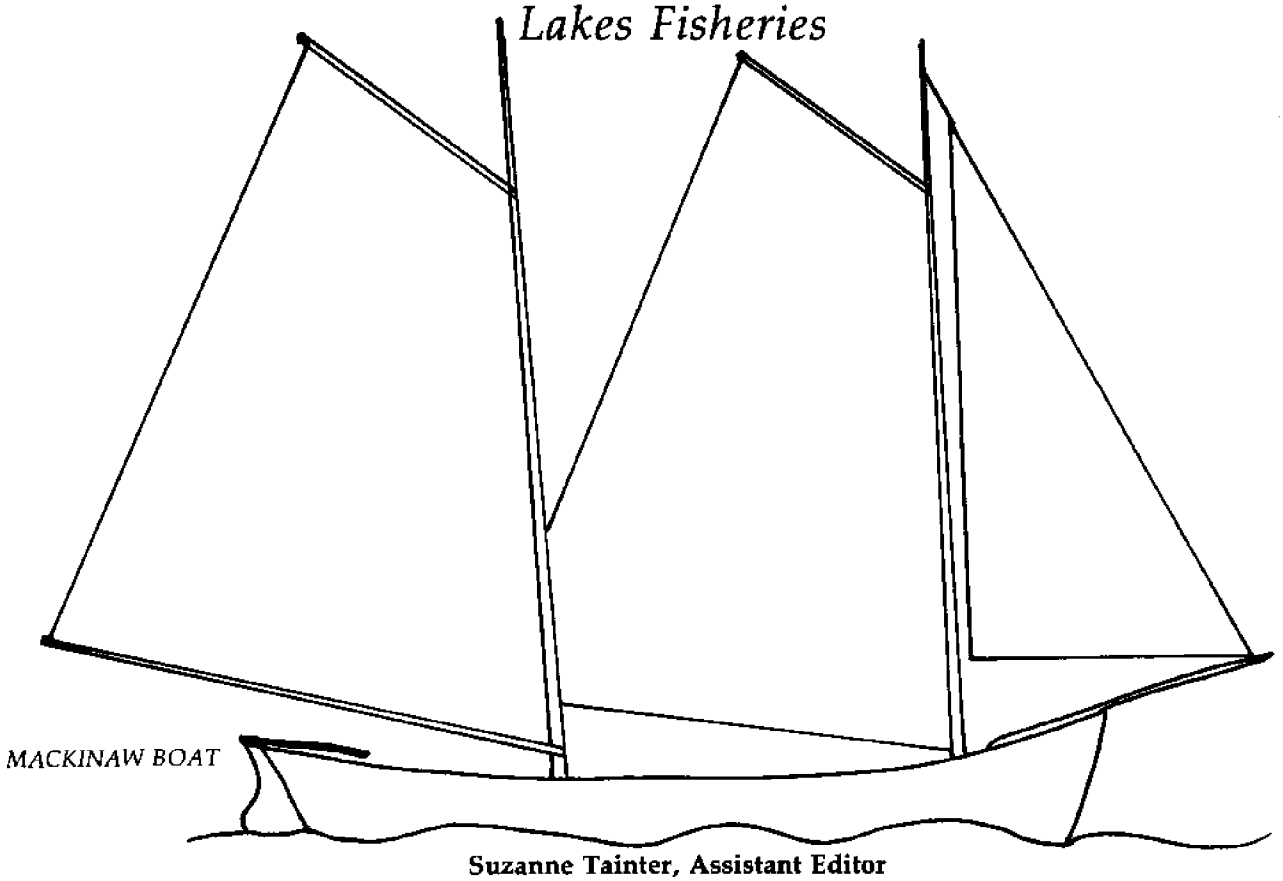

MACKINAW BOAT

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DEPARTMENT OF FISHERIES AND WILDLIFE

Acknowledgements

For this article we drew liberally on previous accounts listed in the references, and added recent information. We are particularly grateful for the help of Stanford H. Smith, National Marine Fisheries Service, Ann Arbor and John A. Scott and Wayne H. Tody, Michigan Department of Natural Resources Fish Division, Lansing.

Credits

All pictures are from the Michigan Department of Natural Resources. All drawings are after illustrations in "Fisheries of the Great Lakes, 1885" by H. M. Smith and M. M. Snell, with an Introduction and Description of Fishing Vessels by J. W. Collins. Report to the Commissioner of Fish, 1887. U.S. Bureau of Fish and Fisheries. Govt. Printing Office, 1891.

Fishing Vessels

The MACKINAW BOAT is a classic Great Lakes fishing vessel developed on the Upper Great Lakes. It is very seaworthy and is still used for recreational sailing. The Mackinaw boat was used with light gill net rigs. The boats averaged about 28 feet.

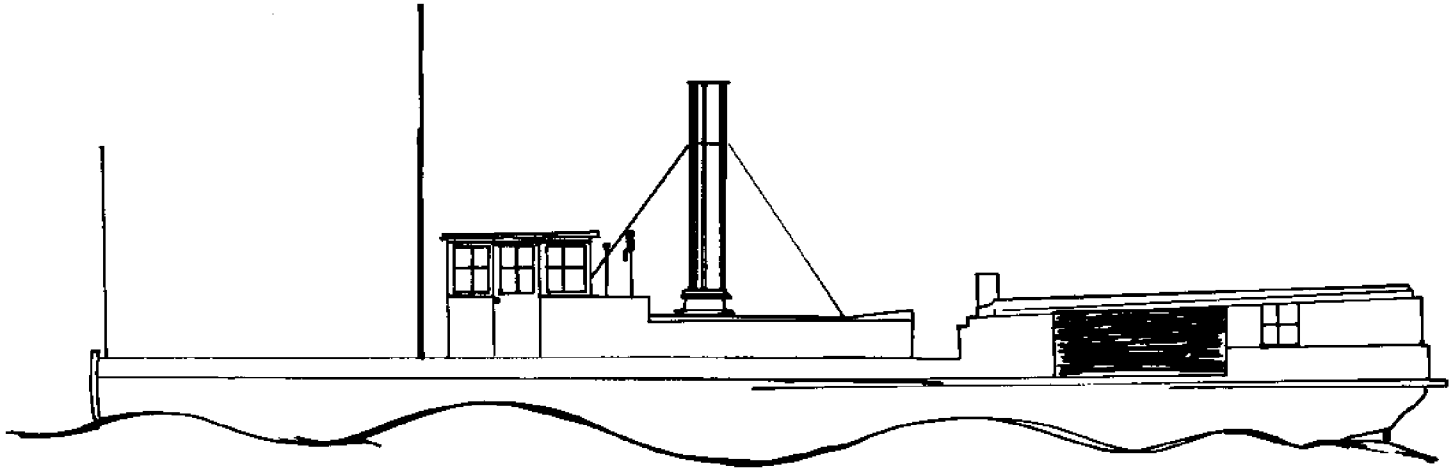
The FISHING STEAMER is the type most commonly used for lake fishing about 1885. Screw steamers on the Great Lakes were employed in the fishery for hauling the catch to Chicago and other connection points for eastern markets, and for fishing with large gangs of gill nets.

The mast (in front of the pilot house) was rarely used with sail. It was used as a derrick with gaff and tackle to lift boxes of fish, ice, and gear on and off the boat.

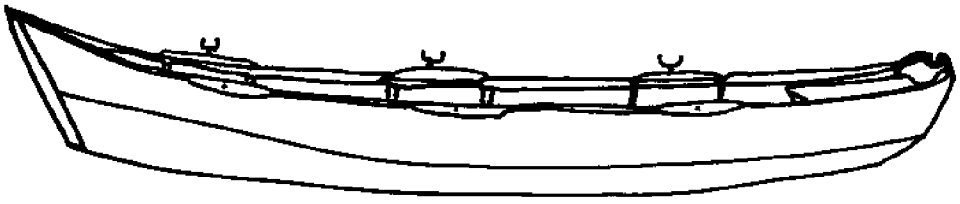
Steamers of this type averaged 75 feet in length.

The POUND NET DINGHY, propelled by oars, was commonly used to tend the nets. The dinghies were about 17 feet long.

The cover shows a Lake Erie fisherman heading toward his pound net (right background) in a typical POUND NET BOAT, approximately 1885.



FISHING STEAMER



POUND NET DINGHY

Bone hooks, dip nets and seines made of bark, spears and bare hands — simple but effective tools for catching Great Lakes fish. Long before we made the lakes into alphabet soup with PCB and DDT and other dangerous chemicals; before we cleared the forests and plowed the land; before we drained the marshes and dammed the streams, the original residents reaped the bounty of the Great Lakes.

As well as feeding fish to their families, the Indians found they could use large whitefish and hearty lake trout to barter with trappers and traders. These early European inhabitants were the advance party of the nineteenth century wave of Great Lakes settlers. This barter fishery was only the first of many profitable fisheries on the Great Lakes.

Fish sustained many a settler. As cities spread along the Great Lakes shores, residents realized the potential for a commercial or market fishery. Every port became a fishing town.

It's been said that "nobody got rich but they did get by" on the Great Lakes fishing industry. Unlike New England, the Great Lakes fishery did not influence development of the region; it developed in response to the settlement of the area. The Michigan population in 1820 was about 28,000. By 1880, the high point of the fishery, the population was 1.5 million.

Today, there are over 9 million Michigan residents. Some still fish the Great Lakes as a livelihood. Many others enjoy the Great Lakes recreational fishery. Still others make a living supplying and servicing the recreational fishery.

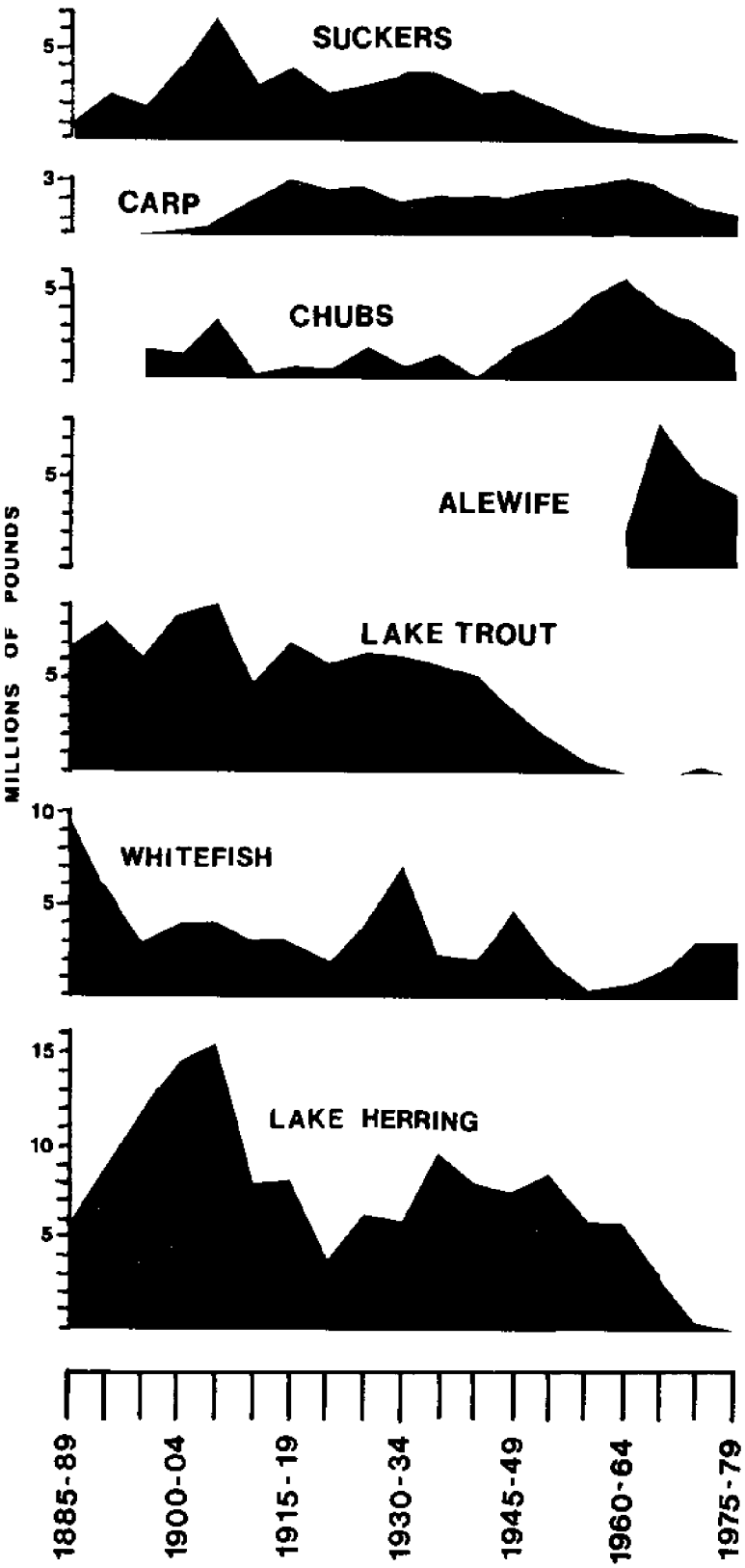
But recently, Great Lakes commercial fisherman have abandoned the life-style by the hundreds. The recreational fishery is thriving, but on salmon that come from the Pacific Northwest and lake trout that are not the original Great Lakes species. What has happened to Great Lakes fish?

The incontestable influence on the Great Lakes through the last 150 years has been human — the pressure of an expanding population and intensifying technology.

But there is new reason for hope in the fishing industries of the Great Lakes. Fish management has reduced fishing pressure and pollution abatement has improved water quality and expanded fish habitat. These advances have given the fish stocks new chances to recover.

The Great Lakes

The Great Lakes, the huge gift of the glaciers, contain one of every five cups of freshwater in the world. The chain sprawls across the northern United States and Canada, covering 95,000 square miles. The area of the state of Michigan includes one half of Lake Superior, the largest freshwater lake in the world; 60 percent of Lake Michigan, almost 40 percent of Lake Huron and 2 percent of Lake Erie. Though there are many important differences among the Great Lakes, many aspects of their fisheries and history are common to them all.



Reported catches for Michigan Great Lakes waters averaged for five year periods, 1885-1979. The 1975-1979 figure is estimated on the 1975 reported catch. This chart shows selected species.

The Early Fisheries

The early fisheries of the Great Lakes took place in shallow water — bays, tributaries and shore areas. Initially, there were many desirable fish in these areas. The gear commonly used — seines, dip nets, hook and line, spears — was well suited to relatively shallow water.

The first intensive commercial fishery developed on Lake Erie about 1820. Ten years later fishermen were working in Lake Huron and Lake Michigan and in Lake Superior by 1840.

Whitefish was the mainstay of the early fishery. It was easily taken in shore seines. Whitefish also tasted better than lake trout, especially when salted, the common perservation method. Lake trout, walleye, and lake herring were also popular in the catch.

Originally, many of the lake spawning fish also had river spawning stocks. Lake trout, whitefish, sturgeon, and lake herring that spawned in the Great Lakes tributaries were common during the 1800s. By the 1900s, these fish populations had disappeared from the major rivers which flow into Lake Huron and Lake Erie. These rivers were in the earliest settled areas.

Human settlement altered the shallow areas by damming streams, clearing forests, draining marshes and polluting waters. The fish in these shallow areas began to disappear. Fewer fish were escaping the increasing numbers of fishermen. And with their habitat destroyed, the fish that did elude the fishermen's nets found few suitable living areas.

Gill Nets Appear

After the mid-1800s, the fishery moved into deeper waters, partly in response to the decline of fish in the shallow waters. This move was made possible by the development of modern equipment, particularly gill nets.

Gill nets, still used in the 1970s, are anchored on the lake bottom or in water just above the bottom. Fish, blind to the thin threads of the nets, swim into the nets, usually entangling their gills. Fish too small for the nets pass through unharmed; fish too large for the mesh turn away. The nets are hauled onboard the boat, and the fish are removed as the nets pass over the gunwales.

Factory-made gill nets appeared about 1850. A major advance was the steam powered gillnet lifter. It allowed fishermen to haul in many more nets in a single day than had ever before been possible. Other improvements included the switch from sail to steam power craft in this century. A recent advance is the

Reported catches for Michigan Great Lakes waters averaged for five year periods, 1885-1979. The 1975-1979 figure is estimated on the 1975 reported catch. This chart compares the food market fishery to the more recent recreational fishery.

conversion from cotton and linen to nylon mesh for gill nets. Nylon is stronger and better resists rotting and abrasion. This reduces the amount of time spent repairing nets. Because nylon netting can be thinner, it is less visible to the fish. Nylon has doubled gill net efficiency.

Gear developments allowed the market fishery to harvest more and more fish through the turn of the century despite fish stock declines. But by 1900, fishermen were already spending more time, money and effort to bring home their catches. The catch per unit of effort was declining.

The Blackfin Story

An example of the destructive exploitation of that era is the story of the Blackfin cisco. Blackfin cisco is one of seven species of deepwater ciscoes, called chubs by Great Lakes fishermen. When a population of this prime, large fish was discovered in the depths of Lake Superior in 1897, an intensive fishery developed rapidly. Huge hauls — 3 tons in a single lift, containing nothing but blackfin cisco — were common. In only 10 years, the stock was so thoroughly reduced that it was no longer profitable to fish for this cisco. The population in that area has never recovered.

Such intensive fishing with modern gear had affected fish stocks in the Great Lakes as early as 1880. By 1905, the market fishery in Michigan waters was spending more effort to catch fewer fish. And the catch had to be divided among more fishermen. Between 1880 and 1885, the number of fishermen in the entire Great Lakes fishing industry doubled, the gear investment tripled, but the catch was less than half again as large.

Whitefish dominated the catch of the Michigan market fishery until about 1890 when more pounds of lake herring were caught. Lake trout, however, probably had the greatest cash value. Lake herring remained the largest part of the catch into the 1960s.

Michigan catches of lake trout, chubs, lake herring, northern pike and yellow perch peaked during 1905-1909. In those years, fishermen caught 47.5 million pounds of fish per year — the largest average for any five year period in the history of the Michigan commercial catch.

The Michigan commercial catch continued to decline into the early 1920s. The reported annual average harvest for 1920-1924 was only 21 million pounds — less than half the peak catch.

During the 1930s, the Michigan commercial fishery caught a yearly average of 29 million pounds, then during the 1940s the industry suffered the sea lamprey invasion. By the 1950s, fishermen were giving up by the hundreds. Through the 1960s, while the sea lamprey was being brought under control, the commercial industry barely survived on whitefish and chubs and began harvesting alewives. Though the market fishery has declined, the recreational fishery has been

Traditional Great Lakes commercial gear has been gill nets. A vessel might fish 20 miles of nets, lifting 8 to 10 miles of net a day. Recently, the DNR banned most gill net use. Fish entangled in the mesh usually die. Fish caught in trap nets remain alive so non-target species can be released. But conversion to trap nets requires new boats and equipment. The Michigan Sea Grant Program is coordinating tests of gear which may be less costly alternatives to gill nets than are trap nets.

The crew removes fish from meshes after the nets are lifted on board. They sort the fish according to size and species and place them in boxes or bins. Fish could be gutted, washed and iced on the boat. The nets would be re-set or packed in boxes and taken ashore where they were dried on huge reels. Whitefish, chubs, lake herring and yellow perch were the fish commonly taken in gill nets.

Changes in the Great Lakes fishery are a consequence of human activities in the Great Lakes area — some direct, such as overfishing, some subtle, like water quality changes brought about by human settlement.

growing. It now thrives on lake trout and salmon introduced in the Great Lakes after lamprey control.

Today, the major commercial species caught by Michigan fishermen is the alewife, used for fish oil and meal, particularly in pet foods; but whitefish is still an important part of the catch. Of the originial seven species of chubs, only the smallest, the bloater, remains in commercial numbers and it is in a serious decline. Most chub fishing has been severely restricted.

Where does the commercial fishing industry turn now? The Michigan Department of Natural Resources (DNR) is responsible for fish management in Michigan portions of the Great Lakes. The DNR, state universities and state and federal research facilities are looking at ways to help the industry.

But before looking at new directions in the industry, consider how the present situation developed.

Settlers Change the Land, Water

Settlers were drawn to the Great Lakes area by its abundant resources. They cut the forests, plowed the land and raised livestock. The animals broke down stream banks and removed vegetation that held the soil. Marshes were drained, removing these natural sediment traps and fish spawning areas. These changes altered the characteristics of the streams that drained the lands of the Great Lakes basin. The sediment-rich streams were shallower, therefore, more prone to spring flooding and winter freezing. The silt smothered fish eggs. Exposed streams became warmer, too warm for some Great Lakes fish.

Early tanneries, saw mills, cheese factories and slaughter houses dumped their wastes into streams. Shoals of waterlogged saw dust clogged rivermouths.

and these deposits can still be found at some coastal inlets.

Present day water pollution laws prohibit the use of Michigan waters as waste dumps, but inadequately treated household wastes, increasingly complex industrial wastes, storm water, agricultural runoff, and other pollution sources continue to make water quality deterioration a severe problem in the Great Lakes.

Pollution

Pollution of the Great Lakes and its tributaries takes three main forms.

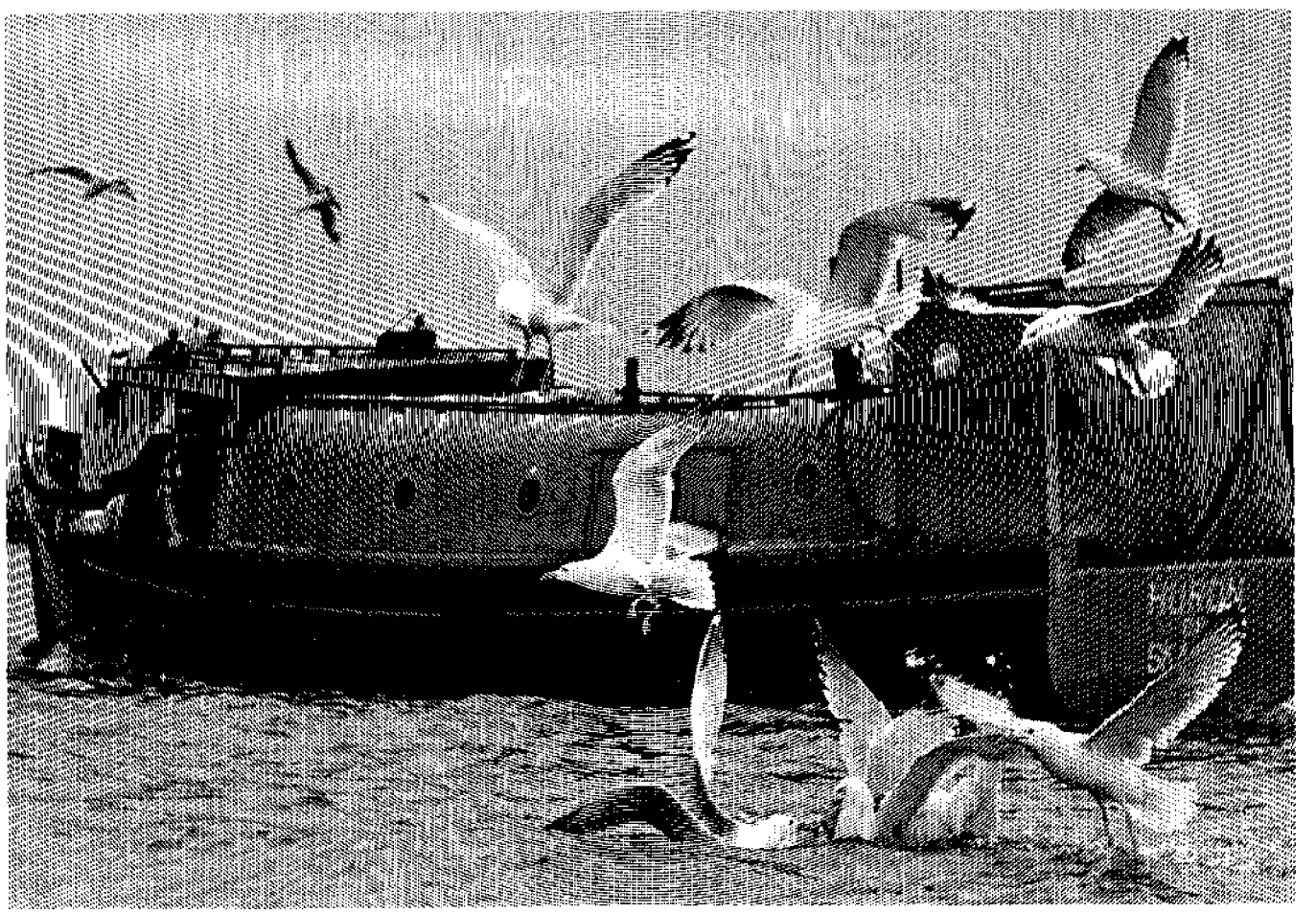
Heated water — comes from discharges of water used to cool industrial machinery and power generating equipment. Just a small rise in temperature can trigger hatching of fish eggs before their food supply has developed.

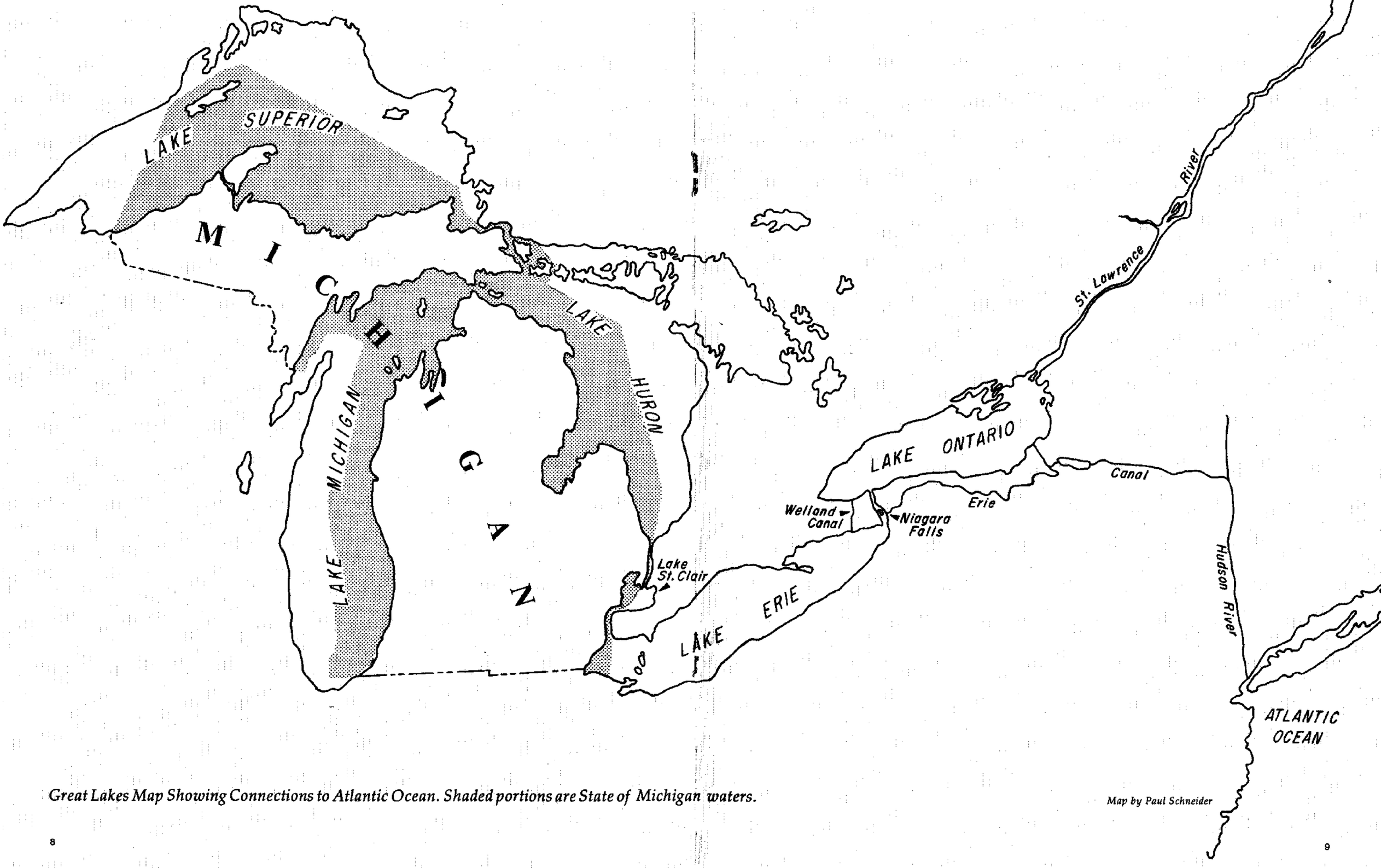
Toxic chemicals — include industrial wastes, pesticides and other synthetic and natural chemicals. Some kill organisms outright; some persist at levels low enough to let fish live but in an impaired way. They may hamper reproduction and growth. They may make fish unfit for human consumption. Levels of DDT, PCBs, and mercury in some Great Lakes fish exceed safe limits set by the Food and Drug Administration.

Organic Wastes — include household sewage and agricultural wastes. When added to water, the wastes are decomposed by bacteria that rob the oxygen dissolved in the water, depriving fish which also depend on this dissolved oxygen. The most popular sport and commercial fish — trout, salmon, whitefish — are adapted to the high levels of dissolved oxygen in cold, Great Lakes water.

The decay of organic wastes also releases plant nutrients, particularly phosphorus, to the water. Other sources of phosphorus include fertilizer runoff, storm water and air pollution washed into the lake by rain or snow. Nutrients enrich the water, producing an overabundance of algae and weeds. The enrichment process is called eutrophication. Lake Erie is an example of one of the Great Lakes affected by eutrophication. It does not mean Lake Erie is dying as one often hears; rather it is alive with too many plants. When the excess plants die, they become organic wastes. Eutrophication has led to changes in the kinds of fish inhabiting the inner areas of Saginaw Bay and Green Bay.

The turtle-backed fishing tug is characteristic of the Great Lakes gill net fishery.





Great Lakes Map Showing Connections to Atlantic Ocean. Shaded portions are State of Michigan waters.

Map by Paul Schneider

The lamprey is held mouth forward. The wound it made in the fish shows below it. Lamprey spawn in streams and then die. Lamprey control programs try to kill larval lamprey in the streams before they mature and migrate to the lakes to feed on fish.

The Invaders

Degrading water quality and altering land and tributaries had an unforeseen effect. These changes in the Great Lakes habitat favored some non-native fish over native Great Lakes inhabitants. The sea lamprey is the infamous example. Some fish were intentionally established in the Great Lakes, others were unwittingly provided access to the Great Lakes.

The carp was brought from Germany to the north-central United States in the 1870s. It appeared in the commercial catch after 1880. During the 1890s the annual statewide Great Lakes catch of carp averaged 200,000 pounds. In ten years, the average carp catch grew ten times. Carp changed shallow bays by uprooting vegetation and roiling the water. Some native plants and fish were disturbed, but carp caused little damage compared to the effects of marine species in the Great Lakes.

The smelt, the first marine species to be established in the Great Lakes, was planted in 1912 in Crystal Lake, which drains into Lake Michigan. By the 1930s, smelt had spread to all the Great Lakes. Smelt reached commercial importance in the early 1940s, suffered an epidemic dieoff and then resurged in the 1950s, becoming second only to the lake herring in weight harvested. Smelt may have caused some local population declines, but generally, native species seemed able to co-exist with the smelt.

Two other marine species, however, were not good neighbors.

Sea Lamprey

The sea lamprey, an Atlantic Ocean native, had established a thriving population in Lake Ontario by the 1860s. The Welland Canal allowed the lamprey to bypass Niagara Falls and enter Lake Erie and the upper Great Lakes (see map in center). But it was not until the 1930s that the lamprey was well established in Lake Huron and Lake Michigan. By 1946, the lamprey had negotiated the St. Mary's Locks into Lake Superior.

Because Lake Erie lacked suitable spawning areas and was too shallow for lamprey, a thriving popula-

Common and Scientific Fish Names

Common Name	Other Names	Scientific Name
lake trout		*Salvelinus namaycush*
rainbow trout	steelhead	*Salmo gairdneri*
coho salmon	silver salmon	*Oncorhynchus kisutch*
chinook salmon	king salmon	*Oncorhynchus tschawytscha*
lake whitefish		*Coregonus clupeaformis*
lake herring	shallow water cisco	*Coregonus artedi*
bloater	chubs, deepwater cisco	*Coregonus hoyi*
longjaw	chubs, deepwater cisco	*Coregonus alpenae*
blackfin	chubs, deepwater cisco	*Coregonus nigripinnis*
lake sturgeon		*Acipenser fulvescens*
alewife		*Alosa pseudoharengus*
smelt		*Osmerus mordax*
sea lamprey	lamprey eel	*Petromyzon marinus*
carp		*Cyprinus carpio*
sucker	mullet	*Catostomus and Moxostoma species*
burbot	lawyer	*Lota lota*
yellow perch		*Perca flavescens*
walleye	yellow pickerel	*Stizostedion v. vitreum*
northern pike		*Esox lucius*
emerald shiner		*Notropis atherinoides*
smallmouth bass	black or green bass	*Micropterus dolomieui*

tion never developed there. But the gravel streams and cold waters of the upper Great Lakes were well suited to the sea lamprey. Lamprey preyed on the largest fish first. Its primary victim was the lake trout. Other victims included the whitefish, chubs, walleyes, carp and burbot.

By 1950, the lake trout fishing in Lake Huron had ended, trout in Lake Michigan were reduced by 95% and the lamprey were destroying Lake Superior lake trout. Fishermen were leaving the industry by the hundreds. In 1950, the State of Michigan licensed 1,100 commercial fishing enterprises. By 1969, only 380 remained.

Sea lamprey control began in the early 1950s. Mechanical and electrical barriers built across spawning streams were later discontinued for a more effective control, the chemical "TMF". TMF poisons lamprey young without harming other aquatic inhabitants when used in the proper amount. The first round of chemical treatments of all Lake Michigan, Huron and Superior streams was completed by 1970. But, even by the mid-1960s, the lamprey population had fallen by 80 to 90 percent of its peak infestation. The lamprey control program was declared a resounding success. Some authorities point out that the lamprey had by this time severely reduced its food supply and was bound to decline. Still, they feel the lamprey control program is necessary to contain the lamprey at low levels. This means continued treatment of tributary streams.

Abundant Alewives

Following in the wake of the lamprey was the alewife. The sea lamprey removed the large predator fish, clearing the way for the growth of a huge population of alewives. This small, herring-like fish rapidly established itself in Lake Huron and Lake Michigan. Measured in pounds, alewives have dominated the market catch in the Great Lakes since the 1960s.

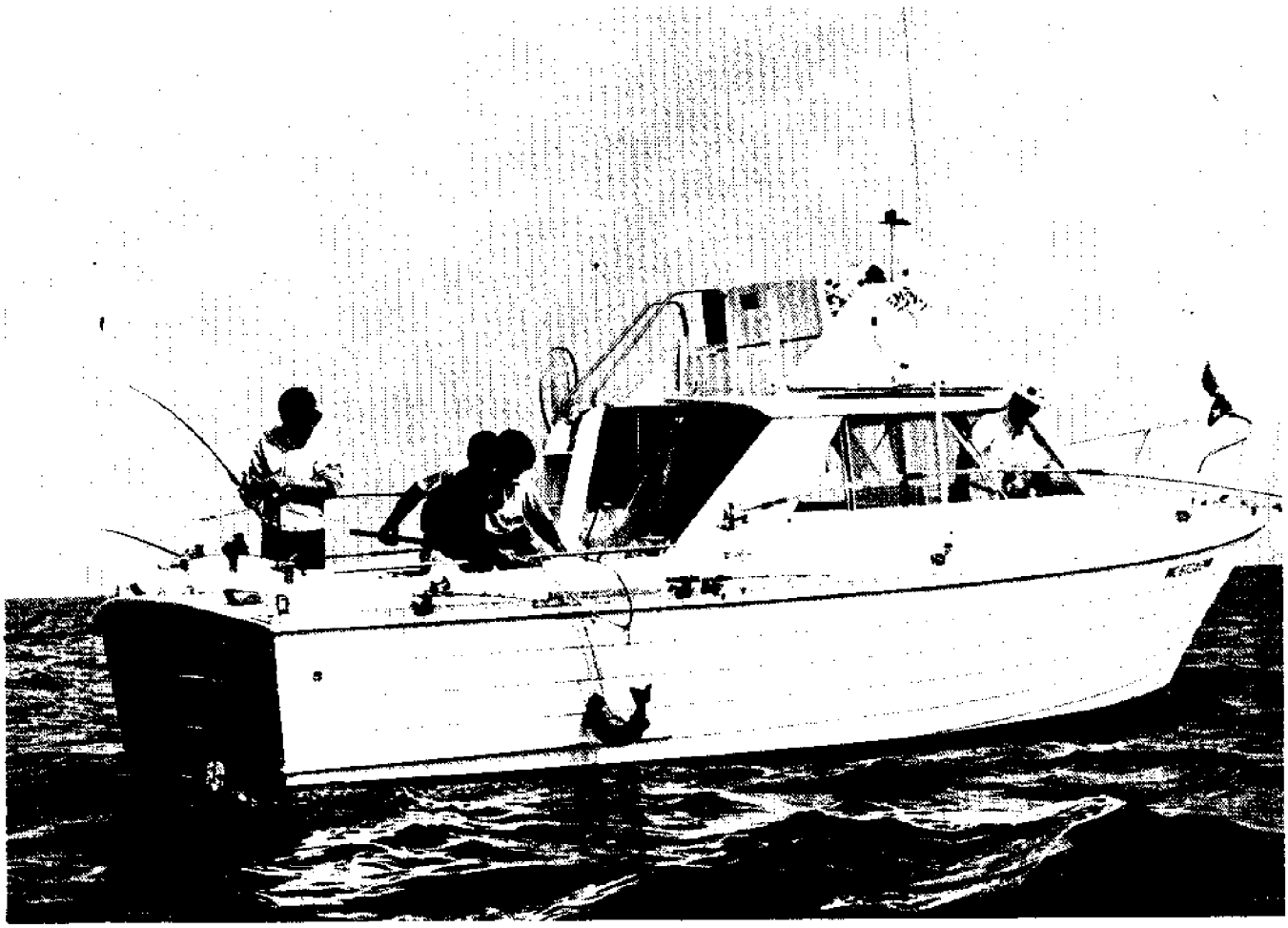
No substantial populations developed in Lake Erie because it has so little deepwater habitat and suitable spawning area. Nor did alewives become a problem in Lake Superior. More lake trout remained and the water is probably too cold for alewives.

But in Lakes Michigan and Huron the abundant alewives outcompeted native fish for zooplankton — the tiny drifting creatures that are the food of many fish. Because alewives move throughout a lake during different parts of their life cycle, they affected both shallow and deepwater fish. Alewives in Lake Michigan and Lake Huron devastated small forage fish such as emerald shiners, small market fish like lake herring, chubs, and perch, and recreational fish such as walleye and smallmouth bass. While lamprey actively preyed upon native fish, the alewife outcompeted native residents for food and living spaces, eventually replacing native fish.

Recreational Fishery

In the 1960s, fishery scientists had the lamprey under control; the large predator fish like the lake trout were wiped out; the alewife population was mushrooming. Fishery managers decided to stock lake trout, taking advantage of the abundant food supply provided by the alewives. Millions of lake trout about 6 inches long have been stocked in Lake Michigan annually since the mid 1960s. Similar releases have occurred in Lake Huron and Lake Superior. Commercial market fishing for lake trout is prohibited although some are taken in nets set for other fish. But by 1970, the recreational fishery had caught over a million pounds of lake trout in Lake Michigan alone.

Coho salmon stocking began in 1966. Almost 3/4 million small salmon were stocked in the tributaries of Lake Superior and Lake Michigan. They migrated to the lakes, and six months later returned to the



Salmon and trout, planted in the Great Lakes since the 1960s, are pursued from boats and bridges, breakwaters and other shore areas.

streams, touching off a spectacular sport fishery. By 1967, these fish averaged 10 pounds each. The state harvested a million pounds of salmon that would have died naturally after spawning. The state stopped selling this fish as human food when it was discovered that the fish flesh was contaminated with DDT and other chemical residues.

In 1967, the state began planting chinook salmon. The salmon fishery sky-rocketed and expanded to Lake Huron and the Detroit River. Fish are caught from the shore, in streams and also pursued in the lakes by boat. A charter boat industry is growing on the Great Lakes for lake trout and salmon.

The Michigan DNR estimates that in 1975, recreational anglers caught more than 20 million pounds of salmon and lake trout. The total number of Michigan Great Lakes anglers in 1975, according to a DNR postal survey, was 757,000. The combined sport and market fishery catch of all kinds of fish was over 31 million pounds. This raised Michigan's Great Lakes fishery yield to the highest level since 1930. In financial value to the state, the combined fishery far exceeds the peak years of the commercial catch in its prime at the turn of the century.

Michigan Fishery Outlook

Over the last century the Great Lakes fish were abused by intensive fishing, restructuring of the lake drainage basin, introduction of alien species, and thermal and chemical changes in the water. The mix of fish in the Great Lakes today bears little resemblance to the fish community at the time of white settlement. Those fish were adapted to Great Lakes conditions and to each other. Each species had a niche — its own place in the lake community. The adapted community had stable populations and made good use of lake resources. Ecological disorder and instability has been thrust upon the Great Lakes.

But efforts are underway to reduce human abuses of the Great Lakes and to restore fish stocks through intensive management. One aspect of management is stocking of salmon and trout. Another is the direct control of fish harvest.

DNR Management Proposals

The DNR is responsible for assuring beneficial use of Michigan fish resources. The DNR management program has four parts:

1. Lake Zone Management — This plan specifies some areas for market fishing, some for recreational fishing and some for the recovery of fish stocks. These rehabilitation areas have especially stringent controls designed to allow fish stocks to grow unhampered.

2. Licensing Operations — The DNR suggests a limit of 40-100 commercial operators in the Michigan waters of the Great Lakes. The DNR has analyzed how much it costs to catch fish, what price fish bring on the market, and how much of the fish stock can be harvested without reducing fish populations below profitable levels. They conclude that the fishery can support only 40-100 commercial operators. (In 1975, there were 159 Michigan commercial fishing licenses.)

3. Annual Quotas — Placing a ceiling on the harvest of each major fish would allow the DNR to reduce the harvest in years when a particular fish may be doing poorly, and then raise quotas and stimulate harvest as the population recovers.

4. Gear Restriction — Developments in fishing gear brought about overfishing in the past. Gear limitations may help avoid stressing fish stocks in the future.

Some anglers wade into the streams after the fish. The DNR estimates that 3/4 million anglers caught 20 million pounds of fish last year. The value of the fishery approaches $30 million annually.

The Michigan DNR management policy is aimed at allowing the maximum development of both recreational and commercial fishing while adequately protecting fish stocks. The policy recognizes the recent development of the recreational fishery and the depressed state of the commercial industry. Where conflicts arise between the two fisheries, recreational fishing will be given priority as the DNR believes this will benefit more people and provide greater economic return.

The strategy behind the management decisions is the optimum sustained yield. This is not necessarily the most pounds of fish but the sizes and kinds of fish and fishing activities deemed the most valuable by society. Optimum sustained yield considers quality as well as quantity.

Underutilized Species

One hope for revitalizing the depressed commercial industry is to promote use of fish that are currently unpopular and, therefore, bring little eco-

Pacific salmon, released in Great Lakes streams as smolts (small salmon), return to the streams to spawn after several years of dining on abundant alewives in the lakes. Salmon and trout releases restored large predators to the Great Lakes after sea lamprey depredation. The plantings have created a spectacular recreational fishery. Coho salmon are raised in hatcheries for 1 1/2 years. After release in the streams, the coho migrate to the lakes where they spend another 1 1/2 years before returning to the streams in fall to spawn. Like all Pacific salmon, coho die after spawning. Chinook salmon are raised for only 6 months in hatcheries. Chinook mature at about 4 years. They also return to the streams in fall to spawn and then die. Rainbow trout which migrate to and from the Great Lakes are called steelhead and are often confused with coho and chinook. The rainbow provide anglers with an attractive stream fishery. They spawn in streams in spring but do not die after spawning. Lake trout are also raised in hatcheries for planting in the Great Lakes. Lake trout spawn in streams in late fall. They provide a lively Great Lakes fishery year round, often being found in water less than 100 feet deep.

nomic return. Carp, suckers and burbot are examples. The Michigan Sea Grant Program and federal and state agencies are looking at ways to process and market these fish to make them a valuable addition to the American food supply.

Controversies and Complications

The history of the commercial fishery in the Great Lakes has been marked by change and controversy. The present situation is also clouded by conflicts.

One unresolved problem is the Indian rights controversy now in the courts. Indians claim ownership of substantial portions of Michigan waters. If the courts affirm Indian ownership, then fish management, including regulations and enforcement, will be carried out by the tribes rather than the state.

Another complication in fish management of the Great Lakes is the multiple jurisdiction of Great Lakes waters. Numerous state, national and international governments, agencies and commissions have a stake in Great Lakes regulation. Fish, however, respect no political boundaries.

During the last 150 years, fish stocks have undergone radical changes in all of the Great Lakes. Many commercially important fish populations have declined. Many fish species have been replaced by other stocks.

Little of this change is from natural events. The overwhelming influences are human — population pressure and intense technology. Four main forms of human disruption have occurred in the Great Lakes basin:

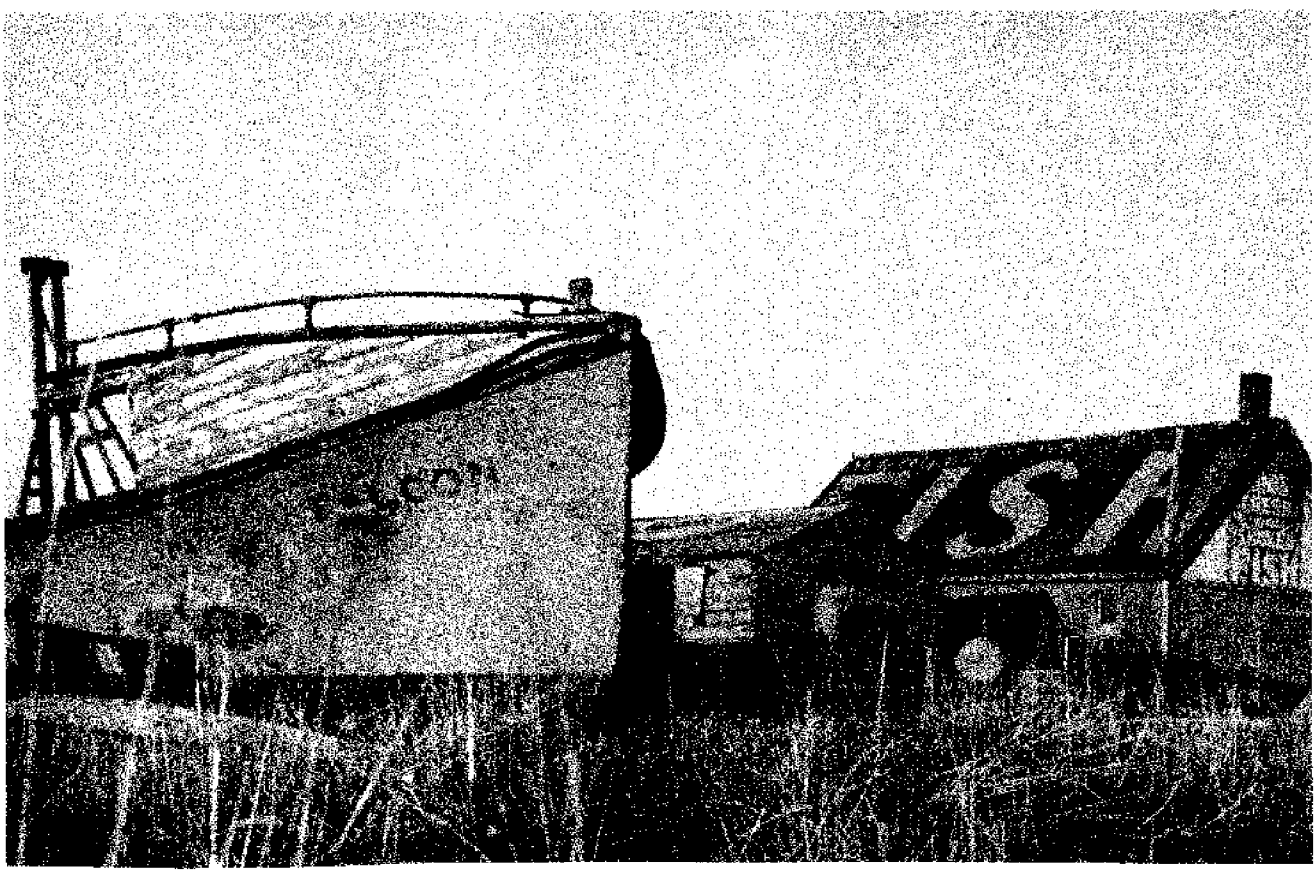
1. Intensive Fishing
2. Extreme changes in the land and tributaries draining into the Great Lakes
3. Intentional introduction of alien fish and building of waterways that allowed ocean species to enter the Great Lakes.
4. Physical and chemical changes in the atmosphere, surrounding land and the lakes themselves that are due to urban, agricultural and industrial development.

Disruption followed modern civilization into the Great Lakes wilderness. Changes appeared in the 1800s in the fish stocks of Lake Ontario, the earliest settled of the Great Lakes. During the 1900s, these changes moved successively through the other four lakes.

Despite past disruption, current progress in restoring the Great Lakes is encouraging. Lake Erie is cleaner than it was 10 years ago. The Detroit River, once orange with wastes and coated with oil, now supports brown trout and emerald shiners.

Though the bounty of the Great Lakes seemed inexhaustible, over the last 150 years human actions in the Great Lakes basin have pushed some fish stocks to their limits. Perhaps, over the next 150 years human efforts to stop pollution and to manage fish stocks can save Great Lakes resources for the sake of the fish, and the lakes and the people who enjoy them.

Relics of a once-lively industry. Great lakes agencies are taking steps to revitalize the commercial fishery.



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