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A Brief History of Commercial Fishing in Lake Erie

UNITED STATES DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

Fishery Leaflet 630

UNITED STATES DEPARTMENT OF THE INTERIOR
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Abstract

Salient features of the development of the industry from about 1815 to 1968, changes in fishing gears and methods, changes in the kinds and abundance of fishes caught, and the attendant effects of disappearing species on the stability of the fishery are described. The history and present status of the walleye, yellow perch, and eight other fishes, still taken in commercial quantities, are presented in more detail and are considered in the context of their effect on the current moribund state of the U.S. fishery. Past and present contributions of Lake Erie's tributaries and northerly connecting waters to the fishery are outlined briefly. The "outlook" for the fishery under present conditions of selective overfishing for high-value species, excessive pollution, ineffective and uncoordinated regulation, and antiquated methods of handling, processing, and marketing fish are discussed, and possible solutions to these problems are suggested.

INTRODUCTION

Commercial fishing is one of the oldest industries in the Lake Erie basin. Historical records show that it began as a seine fishery in the Maumee River, Ohio, about 1815, only a few years after Commodore Perry's defeat of the British Fleet in 1813 helped clear the Midwest for settlement.

In the more than 150 years that have passed since this event, the lake became an important source of food for the increasing population around its shores and the fishing industry became one of great economic significance in many lake port communities. Concurrent with the growth of the fishing industry, Lake Erie also played other important roles in the settlement and development of the Middle West. At first an avenue of travel for emigrants moving westward during the early history of the country, it later became a major link in a water transportation system that connected the ocean with the entire midcontinent via the St. Lawrence River-Great Lakes system.

In recent times, the lake has become even more important in human recreation as increased leisure time has become available for sport fishing, boating, and other water sports. Unfortunately, the growing use of the lake for human recreation was accompanied also by the discharge of increased amounts of wastes and refuse into the water by the expanding population and the industrial complexes that were built along its shores. Today, after serving as a "dumping grounds" for over a century, major areas of Lake Erie are either grossly polluted or altered greatly by deposits on the lake bed. These many and diverse uses may or may not be responsible for some of the dramatic changes in modern times in the fish populations in the lake and in the fishing industry that depended on them. We do not propose in this report to define any cause and effect relation that may account for the changes that have taken place. Rather, we intend only to present an account of the fishing industry as it has been recorded by historians, by data-gathering public agencies, and by scientists, and to suggest those activities of man that may have affected the abundance of certain fishes. The most comprehensive sources of information we have used and which contain many further citations to the voluminous literature about Lake Erie are given in a list of selected references at the end of this report.

To understand better the commercial fishing industry and its history in the lake as we recount it, it is necessary first to describe

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briefly the physical characteristics of the lake and the varied habitats that it has provided for the fishes.

THE LAKE

Lake Erie (fig. 1) is the 12th largest lake in the world. The waters of Lake Huron discharge into Lake Erie's western basin through the St. Clair River, Lake St. Clair, and the Detroit River at an average flow of 177,600 c.f.s. (cubic feet per second). This volume is about equal to the average discharge of the Mississippi River at St. Louis. Lake Erie empties into Lake Ontario through the Niagara River. The flow through the Niagara River can vary from 162,000 to 330,000 c.f.s. within a week; the mean discharge is 195,800 c.f.s. Lake Erie is 241 miles long and has a maximum width of 57 miles. The drainage basin is 32,490 square miles, including 9,930 square miles of water surface. The relationship between water surface and drainage basin is rather unusual among lakes, since the water surface accounts for almost one-third of the drainage area. Lake Erie is the shallowest of the Great Lakes--over 90 percent of its total area is less th 80 feet deep. This characteristic probably a counts for its being the warmest of the Gr Lakes; summer surface temperatures are fr quently above 75° F.

The lake is divided naturally into thr basins (see fig. 1). The western basin exter from the southern tip of Grosse Ile, Mich., a line connecting the tip of Point Pelee, C tario, and the tip of Cedar Point, Ohio. T central basin extends from this line to a li connecting the base of Long Point, Ontar and the base of Presque Isle, Pa. The easte basin includes the remaining area to the he of the Niagara River.

The three basins differ physically. T western basin contains many shoals and i lands with the deeper areas lying close to t Canadian shore. Its average depth is lit more than 24 feet. Most of the islands a situated in the eastern portion of the weste basin and are surrounded by shallow wat East of the islands the broad central ba deepens to 60 to 78 feet. A shoal, or ridg that extends from the base of Long Point within 15 miles of the southern shore divid the central basin from the eastern basin. Ea

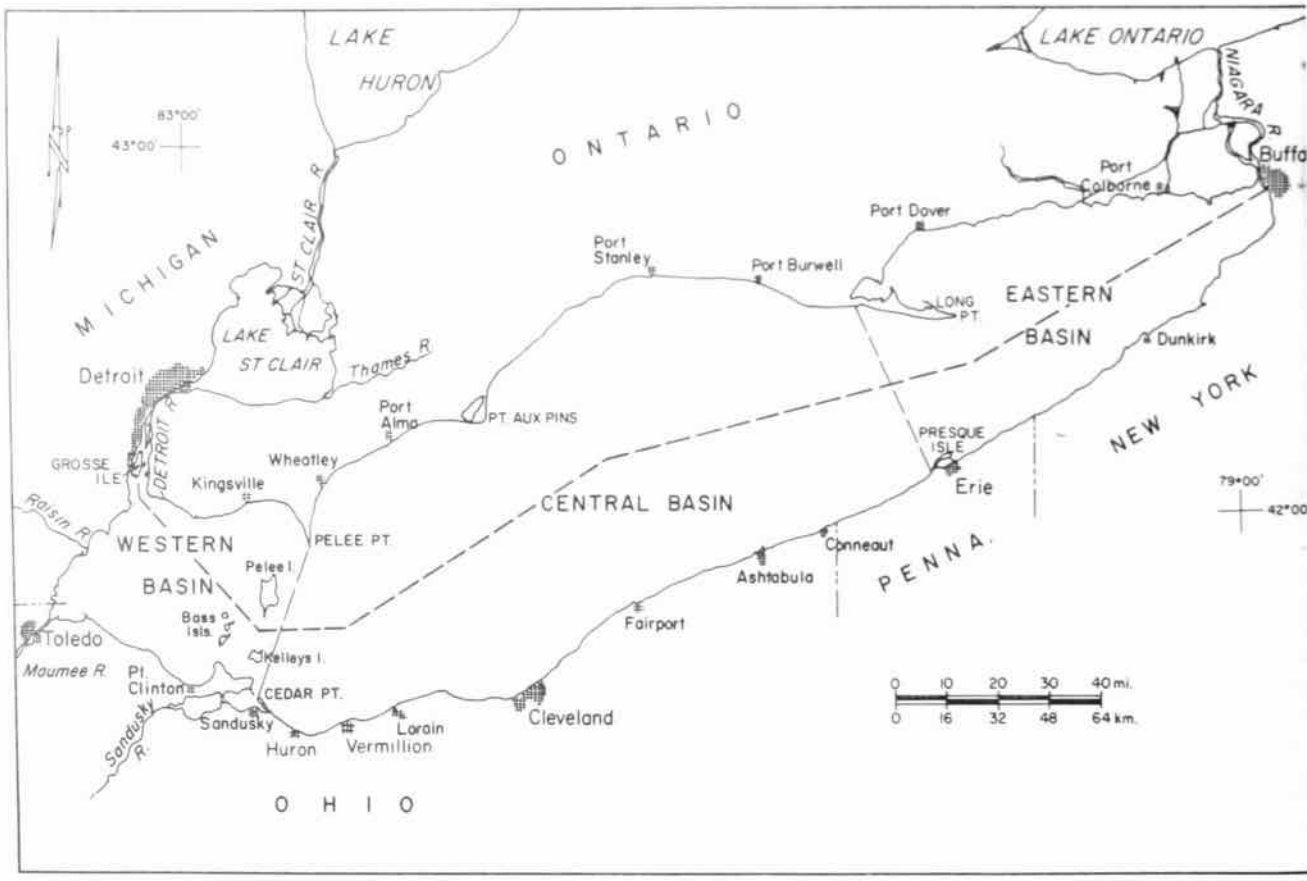


Figure 1.--Map of Lake Erie and its connecting waters showing key geographic and cultural features. Political boundari that divide the lake into many segments and key fishing ports of both the past and of the present are shown.

of this shoal is a depression with a maximum depth of 210 feet. Elsewhere in the eastern basin, depths are generally greater than in the rest of the lake. Most of the western basin has a mud bottom, although extensive areas of sand exist south of the Detroit River and east of Pelee Island. A narrow band of clay follows the Ohio shore, and rock and gravel shoals, which are spawning grounds for many fishes, abound in the island area. A large gravel area lies near the Ohio shore midway between Sandusky and Toledo. The central and eastern basins have a predominantly mud bottom with sand, clay, or rock ledges near shore and in bays.

ORIGIN OF THE INDUSTRY AND EVOLUTION OF THE FISHING METHODS

Early methods of fishing were extremely crude by present standards and were generally the primitive techniques used by the native Indians. Weirs and drag nets, contrived of brush, were used in bays and tributary streams. Since virtually no facilities were available for packing, shipping, or preserving the catch, only about one-twentieth of the fish caught could be used or sold. Once enough fish were removed to supply the area markets, the rest of the catch was released.

The rapid growth of the Midwest after the War of 1812 was also reflected in the fishery, which by 1830 had attained some importance in the economy of the area. Twine nets and seines, first put to commercial use about 1815, soon began to replace the primitive brush gear, but until about 1850, commercial fishing was only in the shallow areas near shore, and in bays, marshes, and rivers. Deep-water fishing was seldom undertaken and was limited to the use of trotlines and hook and line. Types of gear used during 1830-50 were seines and drag seines made of brush or twine, brush weirs, brush dams, spears, trotlines, and hook and line. The fishery was only in April, May, and June. In the mid-1800's many mills were built along the rivers and streams to use the water power. Pools below the dams concentrated the fish migrating upstream, and mill owners often leased seining rights in the pools to commercial fishermen. Some dam owners are also reported to have built cribs on the aprons of their dams, and by directing the water flow into the cribs, caught many downstream-migrating fishes.

About the middle of the 19th century, pound nets were introduced in the western basin and gill nets in the eastern basin of Lake Erie. There is some disagreement as to exactly when and where these nets first were fished, but it is generally conceded that the introduction of these more advanced gears transformed commercial fishing into a substantial industry. Pound nets did not become numerous until 1856-57, when some 40 to 50 nets were reportedly in use. The Civil War increased the demand for fish so rapidly that fishing became a very profitable venture. The number of pound nets fished in the lake increased until more than a hundred were in use by 1870.

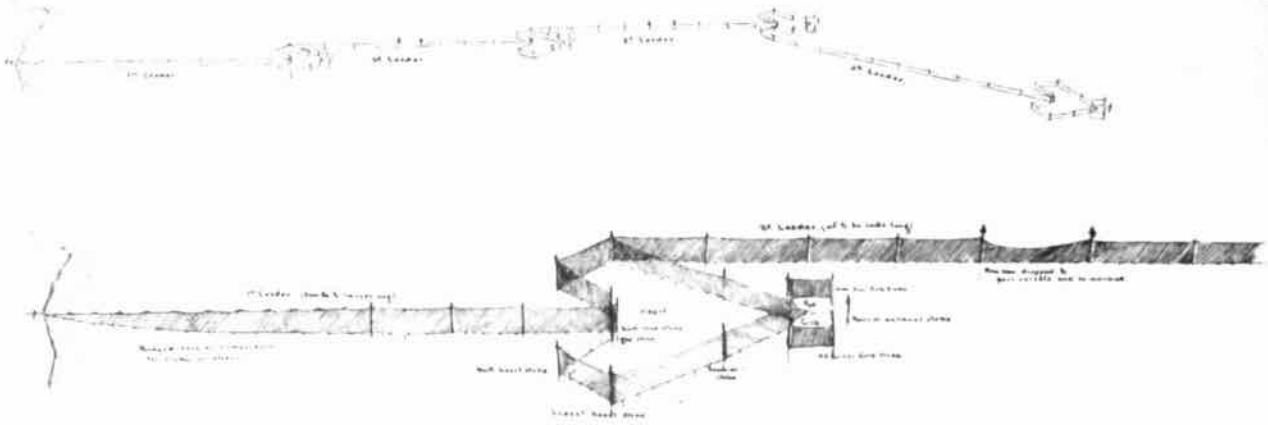
By the 1870's, pound nets, gill nets, fyke nets, seines, and some trap nets were reported in use on the American shore of Lake Erie. Similar gears were fished along the Canadian shore, with the exception of the trap net, which was not permitted.

Until 1879 most gill nets were fished east of Ashtabula, Ohio, and almost all pound nets were fished west of that port; after 1879 gill nets were fished in conjunction with pound nets; and by 1899 most of the gill nets were also being fished west of Ashtabula. Most whitefish, sturgeon, blue pike, and lake trout were taken with gill nets. Cisco (lake herring), walleye, sauger, yellow perch, catfish, and practically all other species[2] were taken with seines and pound, trap, and fyke nets.

The introduction of the steam net lifter, about 1899, greatly strengthened the gill net fishery because many more nets could be handled than was previously possible. By 1903, gill netting had begun to move back to the east, and by 1922, gill nets were again the principal gear of the eastern fishermen. During this same period, the practice of "canning" or floating gill nets off the bottom of the lake was revived. This method was alleged to have developed by accident in Lake Erie, although it had been in use in Europe and on the western shore of Lake Superior before 1900. The technique of floating nets gave rise to the "bull net" about 1905. This net, essentially a very deep gill net (typically 100 meshes deep), would, when set off the bottom, take fish in an area of netting many times that of the average gill net. Criticism of this gear caused it to be outlawed in Ohio in 1929 and in Pennsylvania several years later.

Fishing with pound nets more or less steadily declined after 1920, and by 1936 their use was completely discontinued in the Ohio waters of Lake Erie. This abandonment of pound nets was not a result of legal action but simply an evolutionary process brought on by the greater mobility and efficiency of trap nets and gill nets.

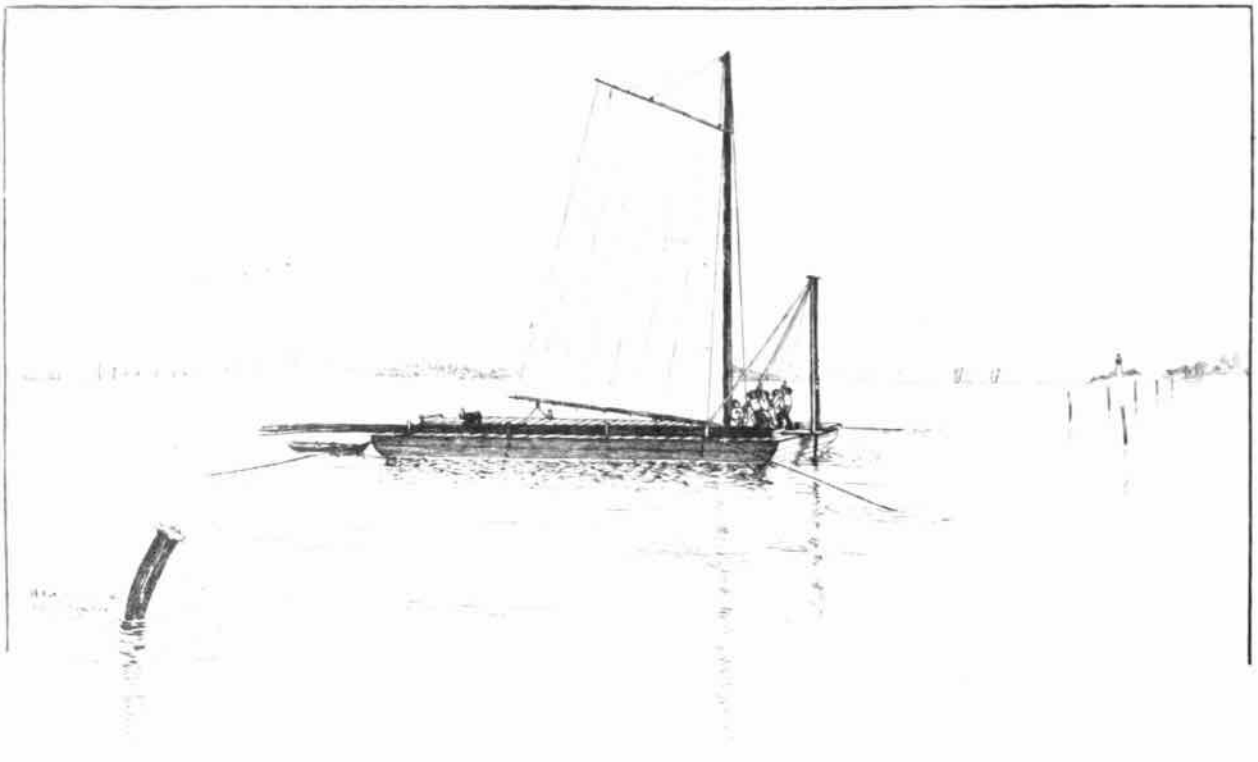
[2] Common and scientific names of fish mentioned in this report are given in the appendix.



THE FISHERIES OF THE GREAT LAKES.

Drawing by H. W. Elliott.

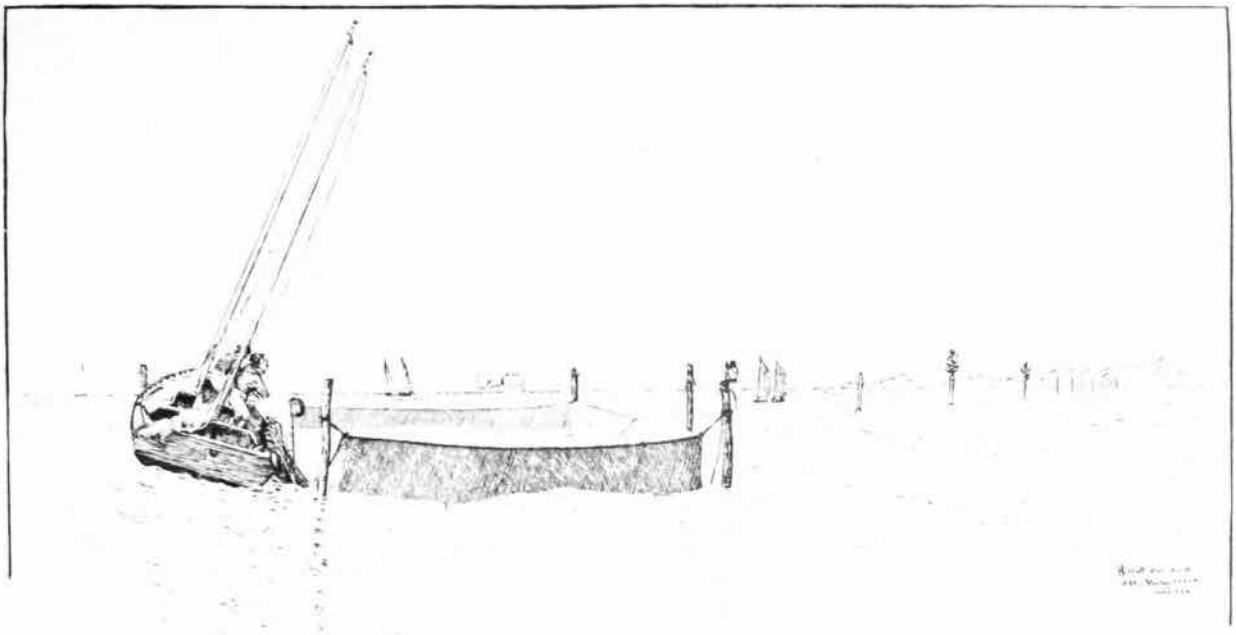
Photo 1.--Diagram of typical pound net used in western Lake Erie about 1870 (from Goode, 1887).



THE FISHERIES OF THE GREAT LAKES.

Drawing by H. W. Elliott.

Photo 2.--Stake-boat setting poles for pound nets in western Lake Erie sometime in the period of 1865-70 (from Goode, 1887).



THE FISHERIES OF THE GREAT LAKES.

Lifting the pot" at Kelley's pound-net, Lake Erie. (Sect. V, vol. I, p. 760.)

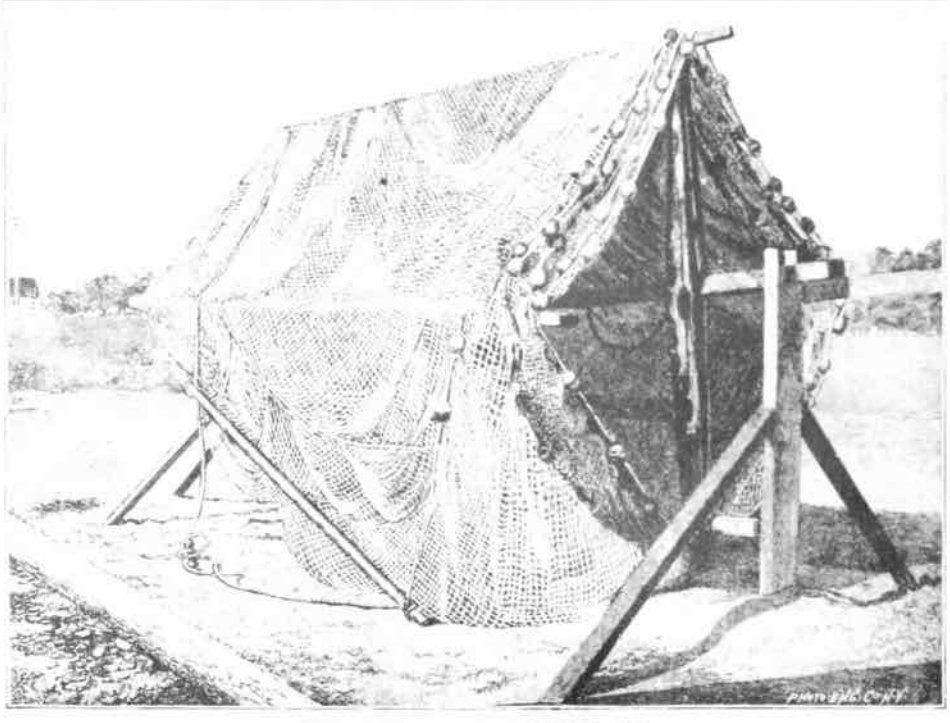
Drawing by H. W. Elliott.

Photo 3.--Lifting the pot of a pound net in western Lake Erie in about the year 1875 (from Goode, 1887).

Photo 4.--Pound net fishermen at "fish house" at Huron, Ohio, about 1895 (photo courtesy of Ed Weigand).

THE FISHERIES OF THE GREAT LAKES

Photo 5.--Overhauling a seine at a fishery on the Detroit River sometime before 1880 (from Goode, 1887).



THE FISHERIES OF THE GREAT LAKES

Photo 6.--Cotton gill nets on typical drying reel as used in the late nineteenth century (from Goode, 1887).

Photo 7.--Steam tug used for fishing gill nets out of Vermilion, Ohio, about the year 1915 (photo courtesy of Ed Weigand).

Photo 8.--Trap net boats leaving Huron, Ohio, in 1912. Buildings in the background are twine houses where nets were built and repaired (photo courtesy of Ed Weigand).

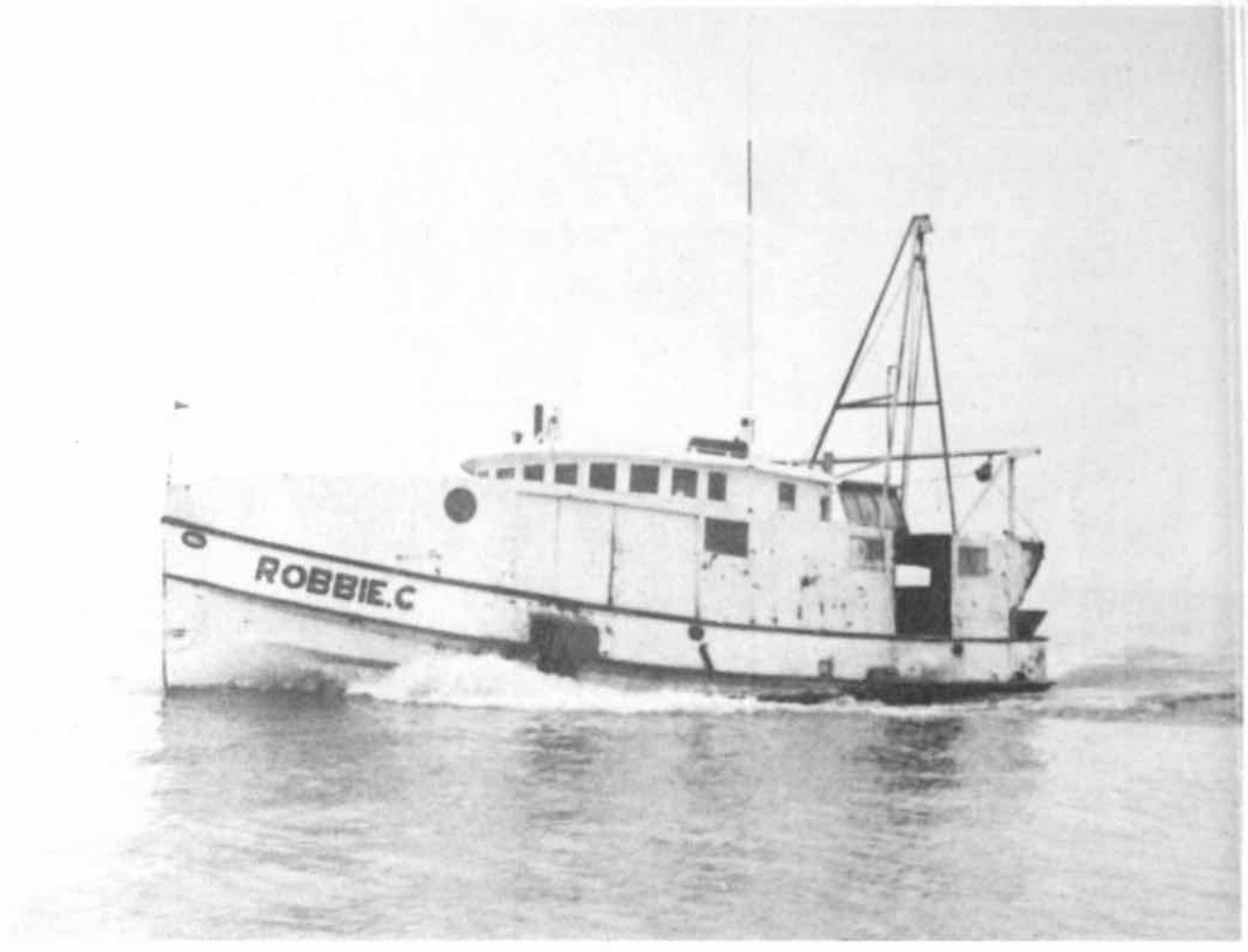


Photo 9.--Modern Canadian trawler out of Wheatley, Ontario, used for catching smelt (photo courtesy of R. Ferguson).

From 1935 to 1968, the methods of fishing in the American waters of the lake have changed little, although the catches of various species have fluctuated considerably. In 1958 trawling was introduced on an experimental basis in Ohio and Pennsylvania. Legislative action in 1960 made it lawful to take smelt by trawling in these States, except that in Ohio trawling was allowed by special permit only. Little interest has been shown in smelt fishing in Ohio, but a modest production of trawl-caught smelt has been landed at Erie, Pa., each year since 1961. Conversely, the trawl fishery for smelt developed rapidly in Canada and now accounts for the bulk of the production of this fish from the lake.

THE FISHERIES

Before the early 1870's, only a few records of catches are available that might be used to measure trends in commercial fishing in the early and middle 19th century. Available historical documents provide us only with references to the kinds of fish caught and a generalized account of the growth of the fishery. Beginning in 1871, however, the Province of Ontario began recording the annual landings for "all species" taken by their fishermen along the north shore. Several years later, the United States also began to record landings. At first, the records were sporadic and were for total catches of all species and individual catches of high-priced fishes; later,

wever, records were kept for all years and re accompanied by separate records for st commonly caught species. By the turn the century, production statistics had be- ne progressively more accurate and de- led in the United States and Canada; they ve continued to improve to the present time. se records of commercial landings provide suitable means of determining the composi- n of the commercial catches and a rough easure of abundance for many of the individ- l species caught in the late 19th and 20th turies.

Traditionally, Lake Erie has produced the eatest variety of commercially important nes of any of the Great Lakes. No less than species have been significant in the land- ings at one time or another in the more than 150 years since fishing began (see Appendix). Annual production in the past 50 years has averaged about 50 million pounds and has often equaled the combined production of the remaining four lakes (fig. 2). In all years where complete or nearly complete records exist, Lake Erie has accounted for at least a third of the total Great Lakes fish production. Presumably, the shallow, warm character of the lake and its diversity of habitats have been responsible for its high productivity.

The following history of the fisheries has been divided into five eras. These were selected by us as periods characterized in some distinct way by the development of the industry, changes in fishing gears and methods, changes

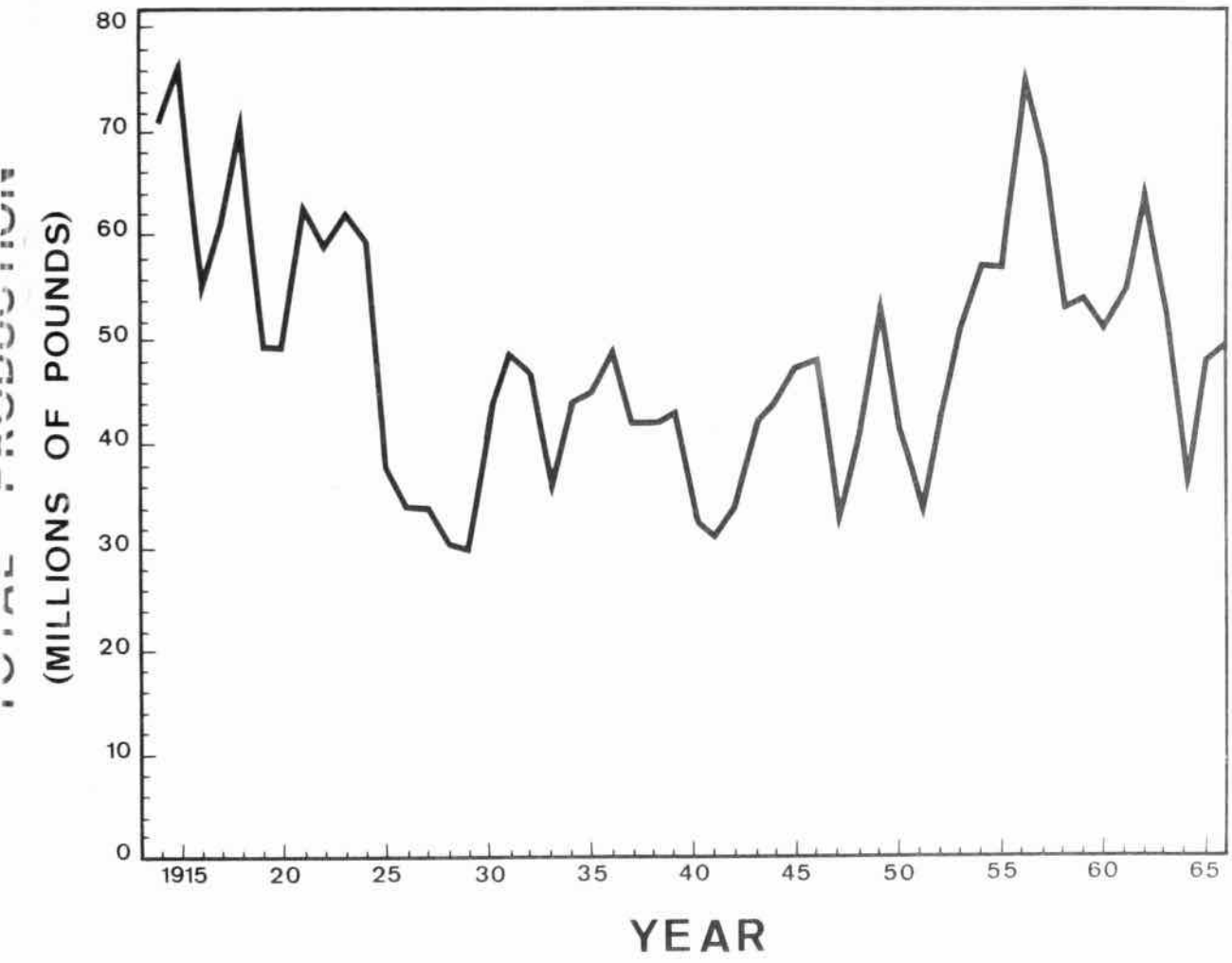


Figure 2.--Total production of all species of fishes from Lake Erie, 1914-66.

in the kinds and abundance of species landed with attendant effects on the stability of the fishery, or some combination of these events. The periods chosen, if nothing else, provide a convenient method of summarizing the complex and changing picture of commercial fishing in Lake Erie.

The fisheries between 1815 and 1871

The lack of consistent, reliable catch records makes difficult any detailed description of the commercial fisheries during this period. Early references for these years show variations in the abundance of certain species, particularly those of the inshore waters, bays, streams, and marshes. For example, a report published in 1851 states that the muskellunge was one of the first species to become commercially important in Lake Erie and further describes a decrease in abundance before that date. Concurrently, the northern pike was also plentiful but, unfortunately, it was not separated from the muskellunge in the production records and its relative abundance cannot be estimated. Shortly after the turn of the century, the muskellunge evidently was the first species of record to become a rarity in Lake Erie (a substantial population still is present in adjoining Lake St. Clair).

During this period, other less desired species taken by fishermen included sturgeon, white bass, and yellow perch. Still other species, such as burbot, suckers, catfishes, and sheepshead (fresh-water drum), were also common but even at this early date were regarded as "soft" or "trash" fishes and were not deliberately sought for commercial use.

The so-called "deep-water fishes," including the cisco, whitefish, and lake trout, became commercially important after the mid-19th century. The introduction of gill nets at about this time made offshore fishing for these species feasible, particularly in the eastern basin. Little is known of the abundance of these three deep-water species, except that the cisco and the whitefish persisted in substantial numbers until modern times, whereas the lake trout became commercially insignificant before the time of reliable production records.

Despite the lack of dependable production statistics, other historical records allow us to trace the history of the lake trout in Lake Erie. The lake trout was apparently restricted to the deep waters of the eastern half of the lake. Historical records dated before 1900 suggest a moderately large population in this area. The fish were reported to be scarce in the western part of the lake, uncommon in the deeper waters off Cleveland, and most numerous in the deepest portions of the eastern basin. The earliest production datum shows that 171,000 pounds were landed in Ontario in 1873. Subsequently, New York, Pennsylvania, and Ontario reported a combined catch of 107,700 pounds in 1885; 122,920 pounds in 1890; but (with Ohio's catch also included) only 32,324 pounds in 1899. All of these fish were from the eastern end of the lake. After 1900, the lake trout was of little or no importance in the commercial fishery although good to fair catches were sometimes made, even as late as 1925 and 1930. (None of these landings, however, was large enough to appear in official production records that recorded total annual landings in units of 1,000 pounds.) Abundance of lake trout decreased markedly after 1930 and few, if any, have been seen or positively identified by trained observers since that time.

The disappearance of the lake trout unquestionably will remain a matter of speculation, although the theory that it became commercially extinct through overfishing is most logical. The scanty records lead us to the conclusion that the population was never large. It was very likely a relict population that would have inevitably disappeared in a matter of centuries, as the natural aging of the lake progressed and suitable conditions for the survival of this species disappeared. Modern concepts of fish population dynamics and "allowable rates of harvest" suggest that even the relatively light fishing pressure and crude, inefficient fishing methods of the 1850-1900 era were sufficient to reduce drastically, in a short period of time, the numbers of this slow-growing, late-maturing, long-lived fish. The ultimate disappearance, or biological extinction, of the lake trout was, on the other hand, most likely due to the loss of suitable environmental conditions for its survival. Enrichment of the lake with the ever-increasing wastes of the growing population along its shores and the accelerated aging of the lake that this enrichment produced undoubtedly destroyed the last semblance of suitable habitat for the species.

The fisheries between 1872 and 1913

Early catch records, admittedly fragmentary, suggest a fairly stable lakewide production until 1913 and show the loss of only one major species--the sturgeon.

Although historical accounts indicate some cyclical changes in abundance of the sturgeon before 1872, substantial catches were made (in years where records are available) until at least 1895, when over 5 million pounds were caught. Thereafter, commercial landings declined, rapidly at first to less than 100,000 pounds in 1912, then slowly and steadily until the present time. Today the sturgeon is considered something of a rarity in Lake Erie,

ıd annual landings seldom exceed a few ıousand pounds.

When the sturgeon was abundant, the flesh ıually was not marketed. The roe was used ır caviar, the bladder for the manufacıre of isinglass, and the carcass for roduction of oil. Little concern was exressed by the fishermen over the decline f the sturgeon--many, in fact, viewed its isappearing numbers with approval. A large nd powerful fish, it was destructive to ıshing gear, which added to the problems nd costs of the fishermen's operations. Many fishermen deliberately destroyed all turgeon that they captured. Today persons re still living along Lake Erie who can ecall seeing sturgeon piled like cordwood ın the beaches, drenched with flammable iquids, and burned.

Little doubt exists that deliberate overfishng, if not wholesale slaughter, of this very ong-lived, slow-growing fish was the primary cause of its decline. Among other circumstances that may have contributed to the destruction of this species were the increasing numbers of dams in the lake's tributaries that obstructed spawning migrations and the destruction of the sturgeon's lake bottom habitat by industrial, agricultural, and domestic pollution. All of these factors, probably acting in sequence, have eliminated, at least for the present, any possibility that the sturgeon will recover its former abundance in the lake.

The fisheries between 1914 and 1929

The United States and Canadian catches declined steadily from 1914 to 1929. This decline is attributed largely to changes in the yield of lake herring or cisco, which decreased markedly in 1925 and never recovered except for a brief improvement in 1945-46 (Appendix Table 1 and fig. 3). Since 1957 this species has

Photo 10.--A Canadian fishing boat with a typical catch of ciscoes, taken about 1911 (photo courtesy of Edward Lay).

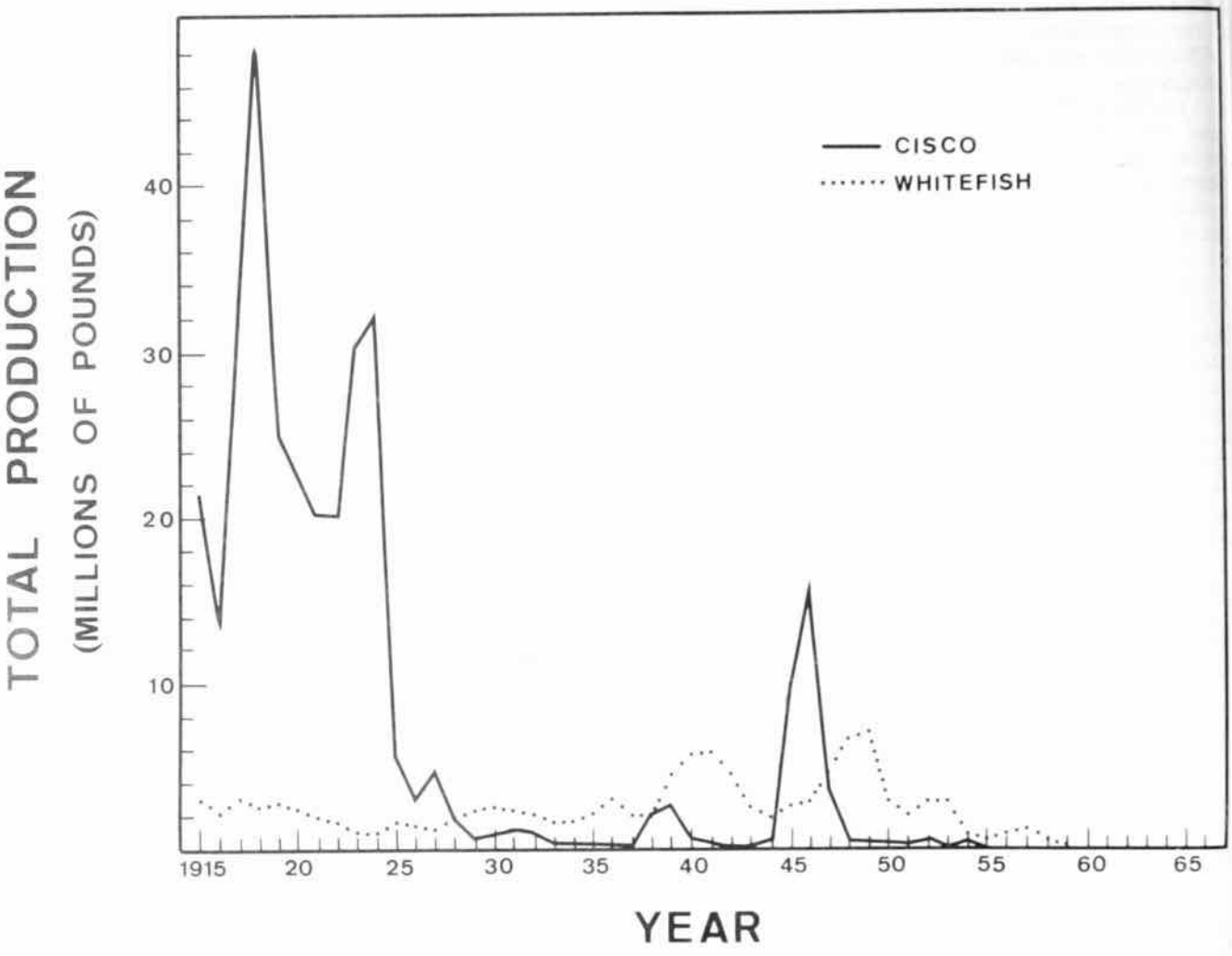


Figure 3.--Total production of ciscoes and whitefish from Lake Erie, 1915-66.

become, for all practical purposes, commercially extinct. No definite reason for the disappearance of the cisco has been established, mainly because knowledge of the factors responsible for the levels of abundance during the earlier years of normal production was lacking and because no detailed investigations were made in the years of the collapse. Some contemporary theories on the loss of the cisco are given in the discussion of a later period during which other important commercial fishes declined to insignificance or disappeared.

The northern pike also began to disappear from commercial catches after an abrupt decline in abundance in 1915. Present-day catches of this species by sportsmen are negligible; commercial fishing for northern pike was prohibited in Michigan waters from 1940 to 1947 and has been illegal in Ohio waters since 1957. It seems most likely to us that the northern pike was more the victim of loss of its natural spawning grounds than of overfishing. In addition to the increasing number of dams built in Lake Erie's tributaries after the turn of the century, many of the marshes of the south shore in the western basin were drained to create farmlands, and others were blocked with dikes to maintain private duck-hunting preserves. Historical records of land and stream use in northwest Ohio and commercial catch statistics suggest that by the 1920's, the northern pike had been denied access to most of the areas they required for reproduction.

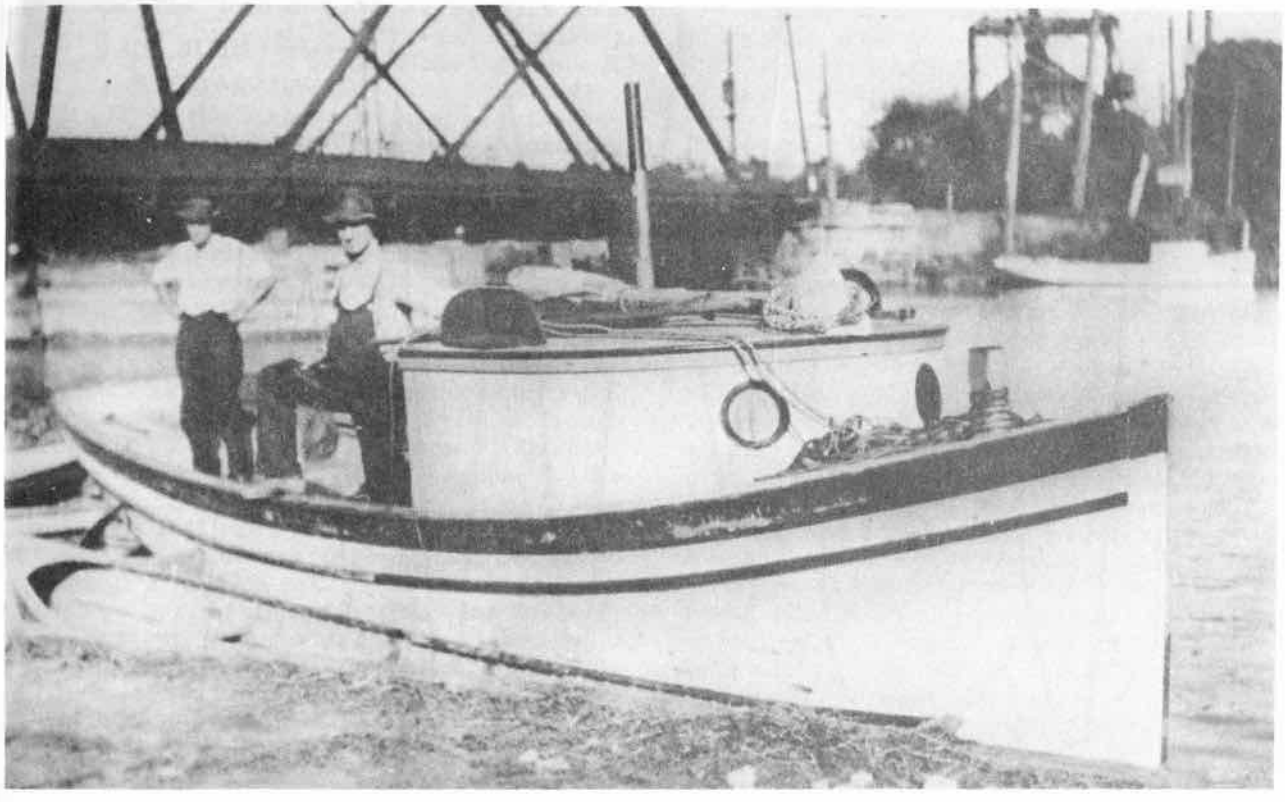


Photo 11.--A trap net boat of the 1915 era, fishing out of Huron, Ohio (photo courtesy of Ed Weigand).

The fisheries between 1930 and 1949

The lakewide production of fish from Lake Erie began to level off in 1930-49. During this period no major losses to the fishery were evident although the numbers of already declining species like the sturgeon, cisco, northern pike, and suckers continued to dwindle. The diminishing abundance of these fishes was offset to a great extent by erratic but generally upward trends in the production of walleyes, blue pike, white bass, and whitefish. Even among the less important species, the declining catches of some (for example, the suckers) were compensated for by increased catches of others (for example, white bass). Also, a drop in the numbers of one species in a particular year was frequently, and unpredictably, accompanied by an increase in another species.

Fishing effort was also relatively stable during this time. Although the numbers of fishermen employed and vessels operated declined somewhat toward the end of the period, fishing intensity, as reflected by types and quantity of licensed gear used, remained about the same or increased slightly.

Factors that probably favored the stabilization and maintenance of the commercial fishery during this period include the depression, which encouraged continued employment in an industry producing a cheap and readily available protein food, and World War II, during which rising prices and increased demand made fishing profitable for any and all species that could be taken.

The fisheries between 1950 and 1968

A period of great instability began in the Lake Erie fish population in the early 1950's. Lakewide production of fish rose in 1951-60, largely because of increased efficiency of gear (introduction of nylon gill nets) and intensified fishing effort in Canada. Much of the increase in effort was directed toward the smelt, which first appeared in commercially important numbers about 1953. Production of smelt increased markedly in Canada throughout the rest of the decade. Concurrent with this rise in efficiency, effort, and production in the Canadian fishery, United States landings were reduced as abundance of the three high-value species--whitefish, blue pike, and sauger--declined.

Between 1915 and 1954 whitefish production fluctuated somewhat cyclically between 1 and 7 million pounds per year (fig. 3), but landings declined abruptly in 1955 and continued sharply downward in subsequent years. Annual catches have remained below 1,000 pounds since 1961.

In 1915-57 blue pike production in Lake Erie displayed no long-term departure from average although annual yield fluctuated violently (fig. 4). At no time, however, did production fall below several million pounds. After an

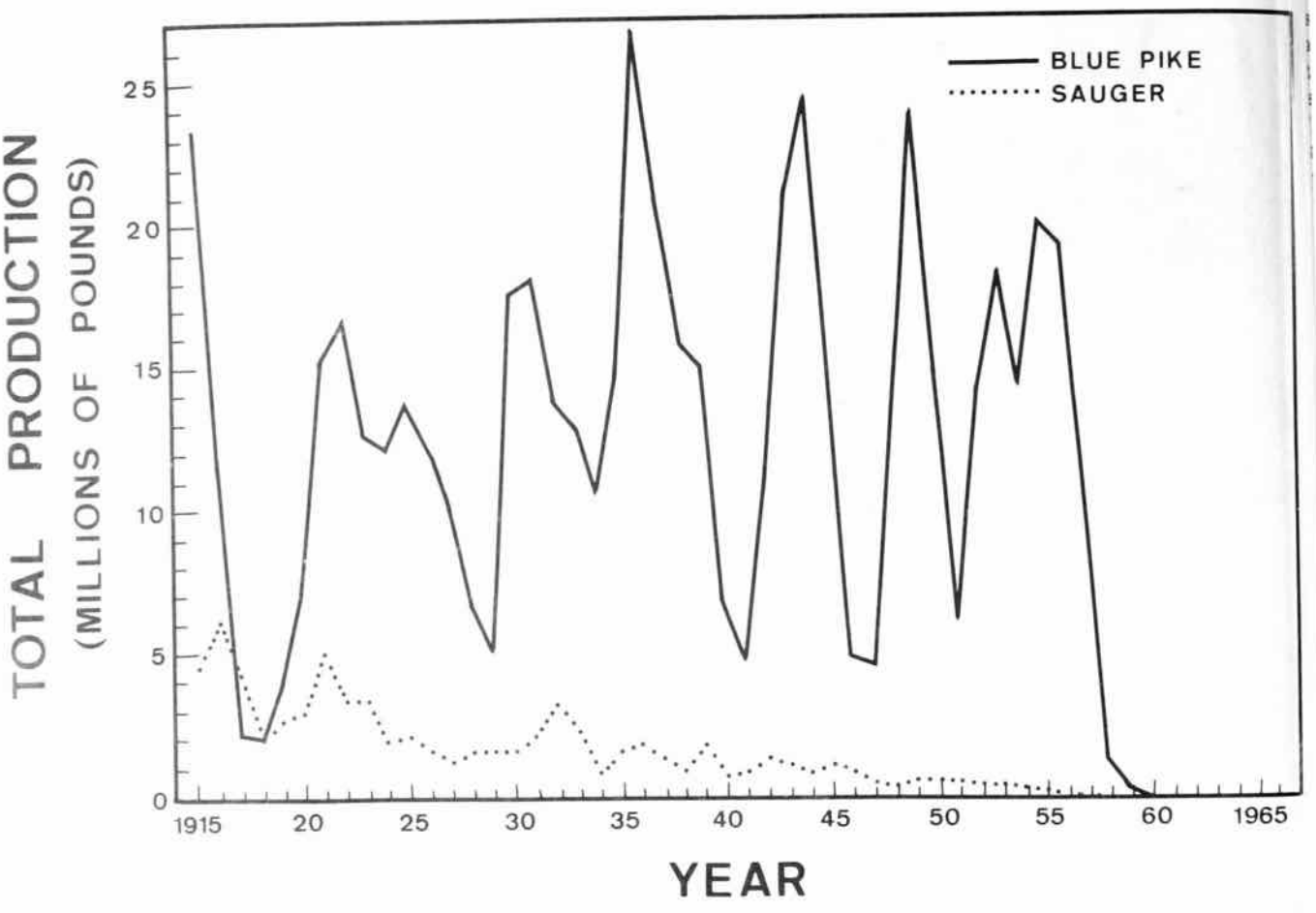


Figure 4.--Total production of blue pike and saugers from Lake Erie, 1915-66.

unprecedented drop in landings to 1.4 million pounds in 1959, the fishery collapsed completely when catches fell to 79,000 pounds in 1959. Wholesale fish dealers reported less than 200 pounds sold in 1964 and whether all of these were, in fact, blue pike is questionable; some were alleged to be small, dark-colored walleyes and others are known to have been walleye-blue pike hybrids.

Deterioration of the stocks of saugers, with an accompanying decrease in commercial production, preceded the decline of whitefish and blue pike (fig. 4). Like those of the blue pike, annual yields of sauger were characterized by violent fluctuations, but until about 1945 no long-term departure from average was evident. Between 1946 and 1958, however, commercial production declined steadily and rapidly, and less than 1,000 pounds per year have been landed since 1960. The sauger is now commercially extinct, and may also be approaching biological extinction in Lake Erie.

As with the cisco fishery some decades earlier, no definite reason for the disappearance of the whitefish, blue pike, and sauger stocks has been established. Blame for these losses has been cast in many directions with much emotion but with little factual substantiation. Long-term cyclic changes in abundance due to equally long-term changes in climate, irreversible changes in the environment that affected a particular life history stage, excessive exploitation (overfishing) of cyclically low populations, and the effects of interbreeding among closely related fishes like the blue pike, sauger, and walleye have all been suggested as the cause. We now believe that two or more of these circumstances, acting simultaneously or consecutively, may have been responsible for the loss of these fishes.

By the 1960's the species composition of the commercial landings from Lake Erie had obviously changed considerably from that of earlier years (Appendix Table 1). More than two-thirds of Canada's contribution to the catch was composed of yellow perch and smelt. U.S. fishermen depended solely on the walleye and yellow perch as "money species." To bolster their incomes, if not simply to remain in business, they found it necessary to seek larger markets for less valuable but still abundant species such as the sheepshead, white bass, carp, suckers, bullheads, and catfish. Production of these medium- and low-value species in the past was governed largely by demand rather than availability of the fish. With the exception of the channel catfish, now bringing a good price as live fish for "pay pond" use, ample

stocks of the aforementioned species are available for harvest but it seems unlikely that new markets can be developed in time to save many U.S. fishermen from bankruptcy. The plight of the fishermen has been further aggravated in all recent years by continuing poor catches of walleyes. Although yellow perch remain abundant, this species alone cannot keep the industry solvent.

The history and present status of the walleye and of the yellow perch and the other species still abundant in the lake follow:

(1) Walleye.--Historically, the walleye has provided one of the important commercial (and sport) fisheries in Lake Erie. Although characterized by pronounced annual fluctuations in yield, no long-term trends in the catches were evident until the mid-1930's (fig. 5). At that time annual landings began to increase from about 1 to 2 million pounds to more than 3 million pounds. In the ensuing 20 years the trend of production was upward, slowly at first, then rising rapidly in the 1950's to an unprecedented catch of 15.5 million pounds in 1956. Since that date production has dropped abruptly to pre-1935 levels.

Study of samples of commercial landings from the western and central basins shows that strong hatches were generated by the walleye population in nearly all years from 1943 to 1954. These undoubtedly account for the rise in commercial harvest that reached its peak in 1956. In 1955-58 comparatively weak year classes were produced followed by one of modest strength in 1959. In 1960 and 1961 hatches and survival of young were very poor. A relatively strong year class in 1962 was followed again by poor hatches in 1963 and 1964, a moderately strong year class in 1965, and poor hatches in 1966-68.

Because good year classes were produced in most years in 1943-54, the commercial take at any given time was composed of significant numbers of six or more year classes. Thus, if a year class failed, the fishery could depend on the other year classes to sustain production. Since 1955, however, hatches and survival of young have been generally poor, and under these conditions the commercial fishery must depend on only one or at best two year classes to make up the bulk of the catch. Because of the disappearance of nearly all other high value species in the lake, fishing for the few

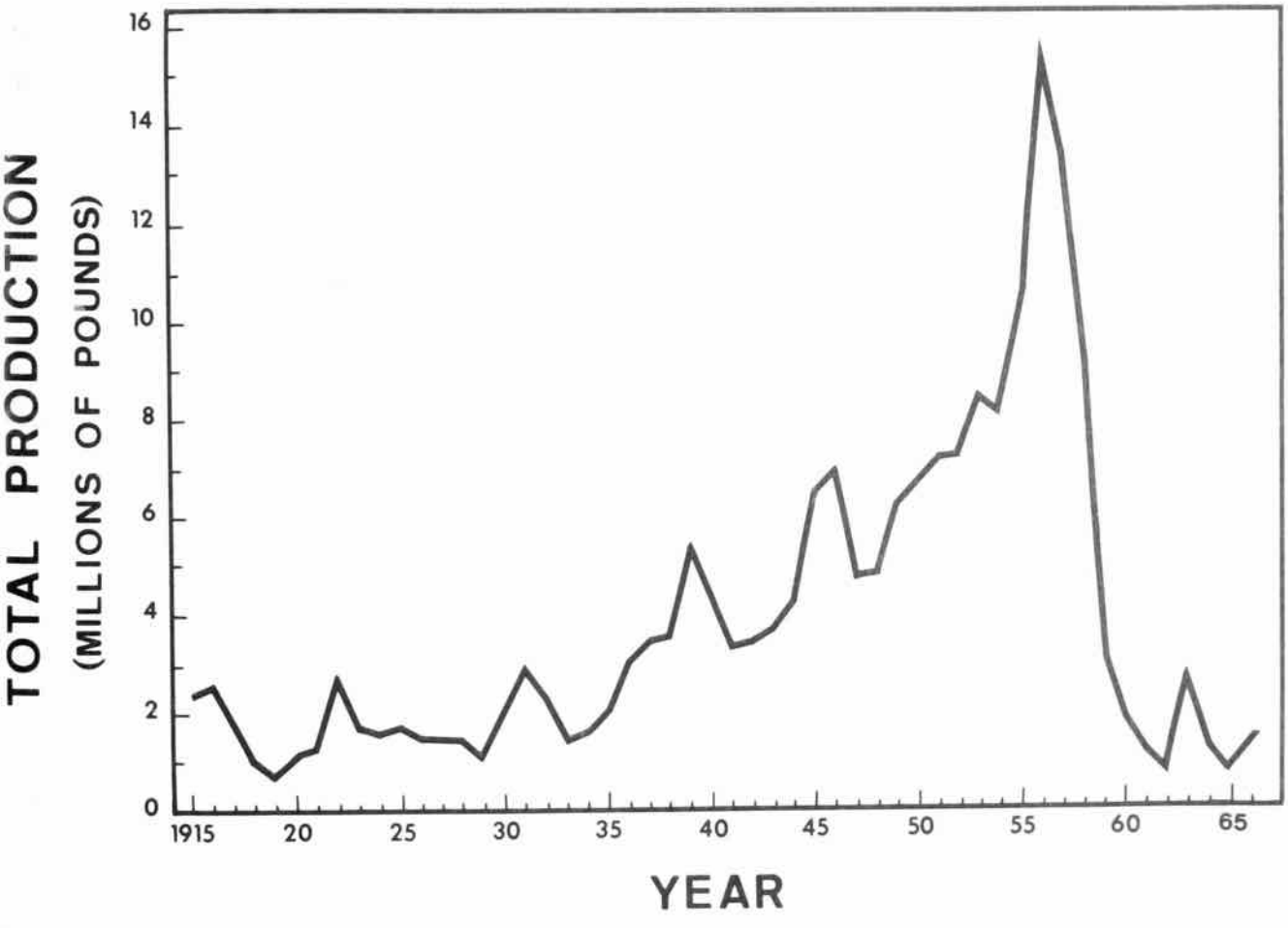


Figure 5.--Total production of walleyes from Lake Erie, 1915-66.

relatively successful year classes of walleyes that have appeared in the past decade has become intense. The rapid exploitation of these few good year classes as soon as the fish reach legal size, and before most are mature, may have had a destructive effect upon the ability of the remaining stocks to reproduce with success.

It is not clear yet what has brought on this long period of generally unsuccessful walleye hatches. All of the causes suggested for the decline of the whitefish, blue pike, and sauger have been proposed for the decline of the walleye.

The recent downward trend in the walleye population and the commercial harvest has taken place entirely in the western and central basins of the lake. Contrary to the circumstances in these areas, catches at ports of the eastern basin have increased. Annual landings of walleyes in New York and Pennsylvania waters of the eastern basin of Lake Erie fluctuated rather widely in 1913-55 but always within the very modest range of 2,000 to 24,000 pounds. A sharp upward trend, unprecedented in the history of that fishery, began in 1956, and in 1963-68 about 100,000 pounds have been landed annually.

At least seven and sometimes as many as nine year classes were represented in samples of walleyes caught in the eastern basin in 1962-64. Age group representation in these catches indicates a normally structured population, if such a condition can be said to exist for this species. These facts, plus the slower growth rate and other biological differences observed for fish in the eastern basin indicate strongly that they are an independent, self-sustaining substock. This hypothesis is further supported by a lack of evidence in tagging studies of significant intermixing of walleyes between the eastern basin and the central and western basins.

(2) Yellow perch.--Long a significant species in the fish population of Lake Erie, the yellow perch has contributed consistently to the commercial landings from the earliest days of the fishing industry. Annual landings for the past 50 years have averaged about 7 million pounds (fig. 6). Until the 1950's, however, the yellow perch was considered of

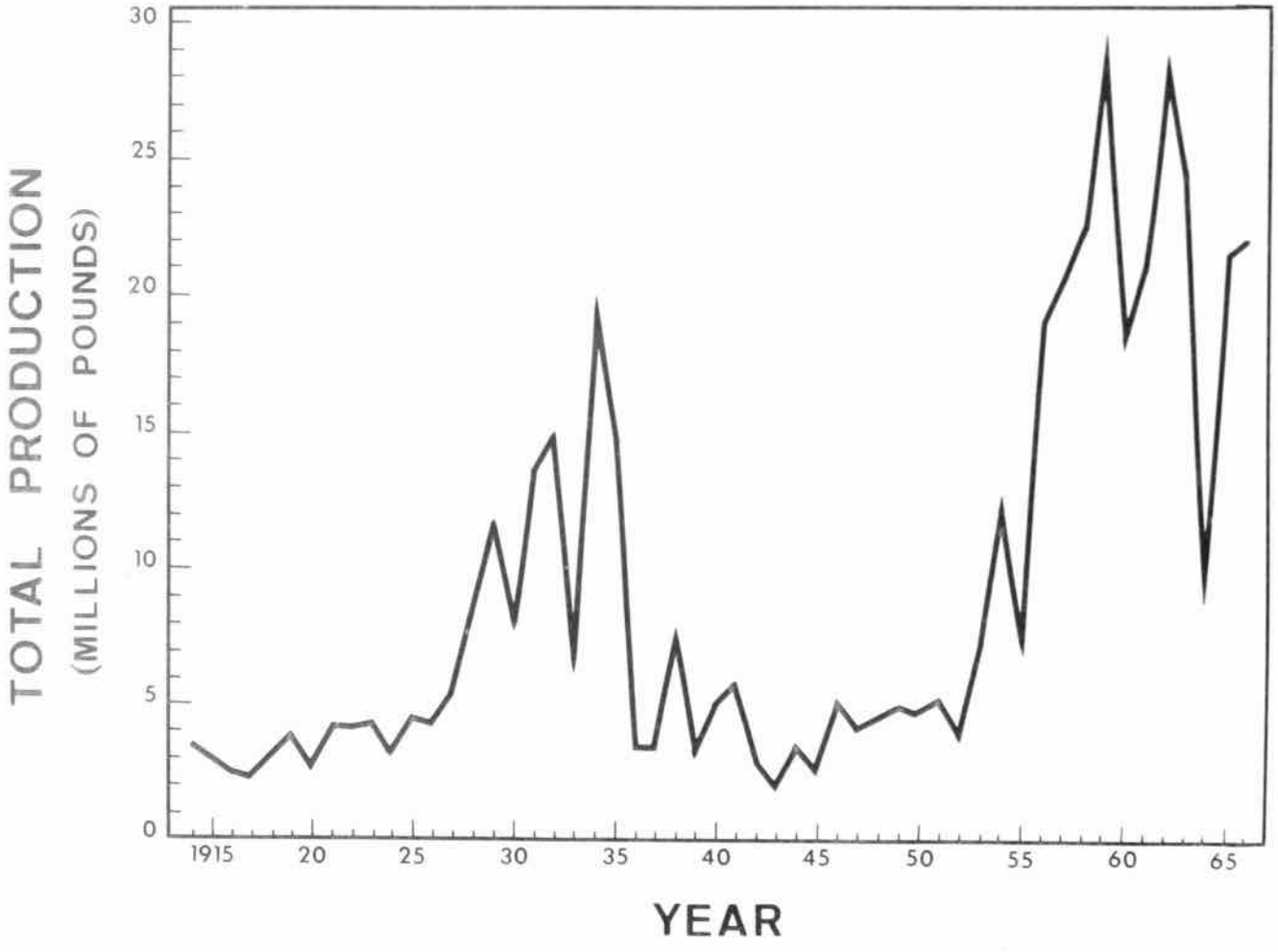


Figure 6.--Total production of yellow perch from Lake Erie, 1914-66.

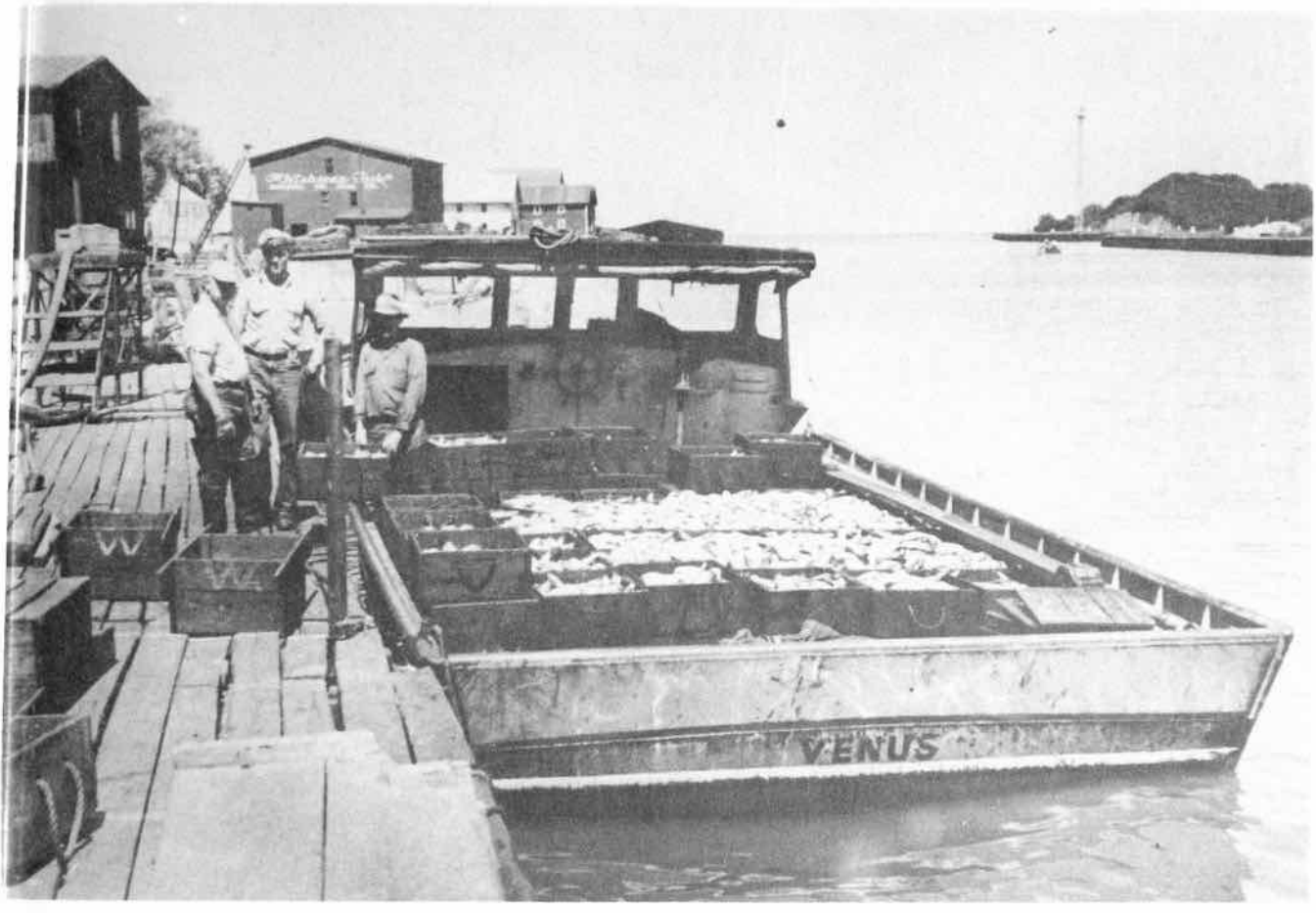


Photo 12.--Fish tug at Huron, Ohio, with load of yellow perch and walleyes caught in 1954.

secondary value when compared with such species as the whitefish, blue pike, and walleye. Only since the disappearance or sharp decline of these other species in recent years have producers come to depend increasingly upon the yellow perch to stay in business.

Relatively strong year classes of perch produced in the mid-1950's culminated in an exceptionally good hatch in 1959. The yield from these combined year classes brought production to record high levels that continue to be sustained. The all-time record production was in 1959 when over 28 million pounds were landed.

The increase in abundance of yellow perch has been accompanied by some reduction in the growth rate of the fish. Furthermore, the success of recent consecutive hatches has fluctuated widely. Although production has been affected by these factors, it still remains above the 50-year average.

The sport fishery for yellow perch must also be recognized, particularly since ice-fishing has taken on almost commercial overtones. Biologists estimate the annual sport catch of yellow perch to be equal to, or greater than, the commercial production.

(3) Smelt.--The smelt in Lake Erie apparently owe their origin to fish stocked in an inland Michigan lake in 1912. These fish subsequently escaped into the Great Lakes. First reported in Lake Erie in 1932, the smelt was not present in sufficient numbers to be commercially important until the early 1950's and even then, as now, they were largely available only in the Canadian waters of the lake (fig. 7). In the early 1950's most fish were caught by pound nets during the peak of their spawning season.

By 1959, after the introduction of trawl fishing, smelt became a prime source of animal-farm food, and at the same time its value for human consumption also increased. Since 1959 Canadian fishermen have harvested over 10 million pounds annually. U.S. fishermen have made only meager landings; they are alleged to be handicapped solely by restrictions in the several States on gear and character of the catch. There is some evidence, however, that trawling grounds are less suitable on the United States side of the lake and that the smelt population is less abundant there than in the Candian waters.

Normally the smelt frequents the deeper water of the central and eastern basins. The fish migrate into the western basin only during the winter and early spring. Studies by Canadian biologists have demonstrated a

Photo 13.--Trap net tug with deck load of yellow perch landed during period of good catches in the 1960's. (Ashbolt, Cleveland Plain Dealer.)

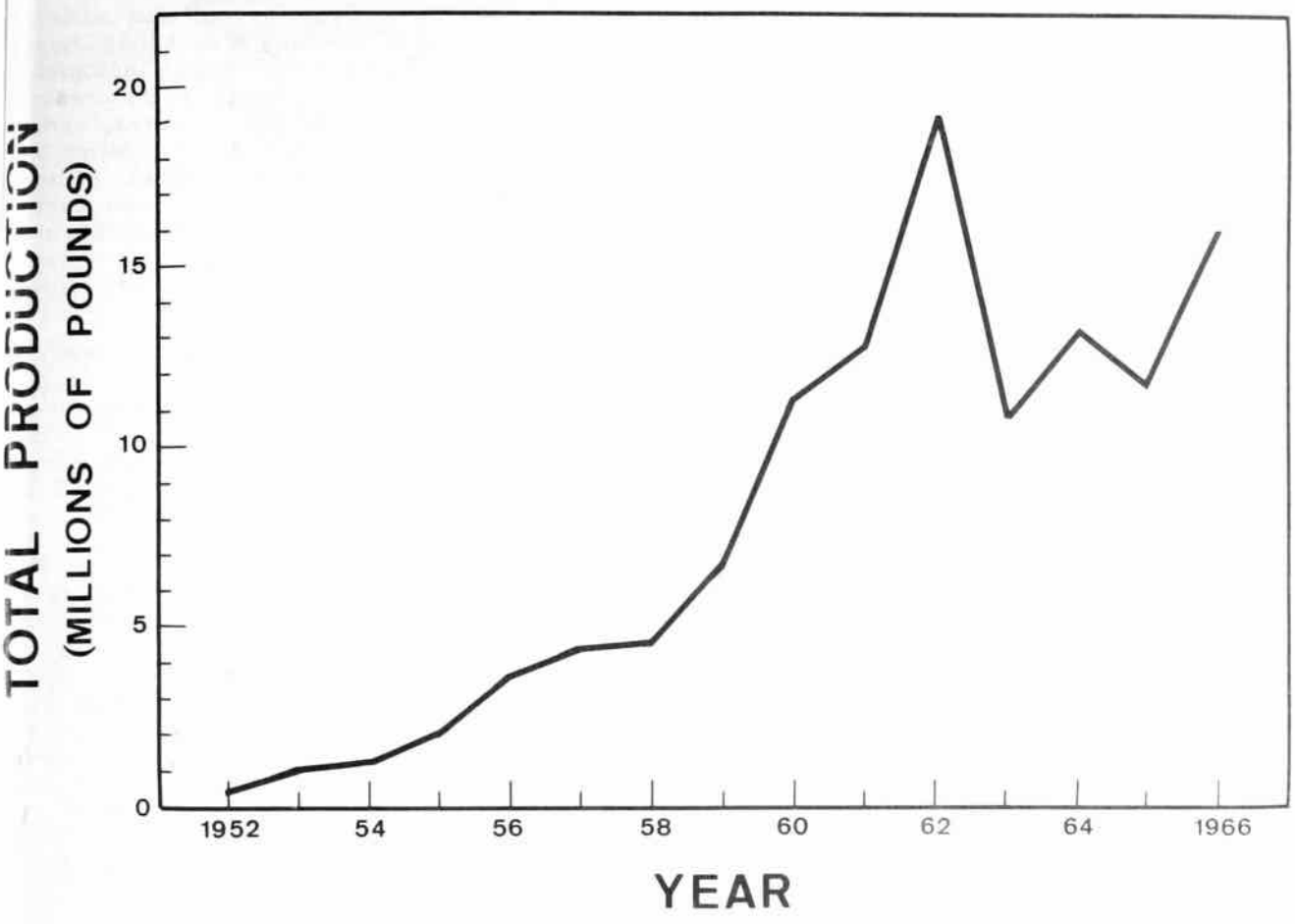


Figure 7.--Total production of smelt from Lake Erie, 1952-66.

variable but generally good hatch and survival of smelt in all recent years. Consequently, in spite of substantial annual production, a sizable population of fish is still available to the fishery.

(4) Sheepshead.--Early historical records and the catch statistics of recent times suggest that the sheepshead has always been plentiful in Lake Erie. Commercial landings have averaged over 3 million pounds annually since the early 1900's. None of these records, however, reflect the actual abundance because sheepshead were usually sought by the fishermen only when other more valuable species were unavailable and were often assigned a poundage quota by buyers. Classified for many years as a noxious fish, the sheepshead has been difficult to establish as a palatable item for human consumption. In recent years some increase in landings has been made to meet a demand for animal-farm food but the demand is not great enough to use the available stocks fully. Conservative estimates have been made that landings could be tripled and sustained at the increased level. Furthermore, greater landings could be made without much additional fishing effort, since large quantities of sheepshead are returned directly to the lake by the fishermen when their nets are lifted. At the present time, the sheepshead probably constitutes the largest underexploited fish population in Lake Erie. The development of new markets for this species would not only benefit the fishermen economically but also might conceivably benefit the more desirable stocks of fishes in the lake. We suspect that the sheepshead competes for space and food with such species as the walleye, yellow perch, and white bass.

(5) White bass.--Although catch records for white bass are lacking for the earlier years, the fish is known to have made significant contributions to commercial landings throughout the history of the fishery. An early biological study of the Lake Erie fisheries disclosed no long-term trends in the abundance of white bass during 1913-38. Short-term fluctuations in abundance were evident, however, and appeared to be cyclic. Biological studies since 1959 have shown a continuous series of successful year classes and a rapid growth rate for the species. Since 1952 (when complete production figures were first available for this species), total landings have been 2

to 9 million pounds annually. In the earlier years of the Lake Erie fishery, the white bass was considered an incidental species and was not actively sought by the fishermen. Nevertheless, its relatively stable production has usually found a ready market and thus added to the fishermen's income.

Although the white bass inhabits all areas of the lake, the western basin has always provided the greatest catches. Furthermore, catches have been consistently larger in Canadian waters than in the United States. Whether this can be attributed to greater fishing effort for the white bass or greater availability of stocks in Canada is not known. At present there is every indication that the white bass will become increasingly important to the fishery as the abundance of high-value species declines.

(6) Channel catfish.--The channel catfish has supported a relatively stable fishery for the past 15 years; annual landings have been 1.2 to 2 million pounds. Very recently, an increasing number of part-time trotline fishermen have entered the fishery for catfish. This gear requires a minimum of time, equipment, and money, is very efficient per unit of effort, and is highly selective for the species. The price paid for the landed catch fluctuates little. A good live-fish market is not only always available but also continually demands more fish than can be supplied. Although biological studies have shown consistently successful hatches and survival in recent years, some evidence is available that the population is now being overfished. Channel catfish require 6 to 7 years to attain the legal minimum commercial length of 14 inches in Ohio and Michigan where most of these fish are taken. Recent investigations have shown a significant decline in the number of legal-sized catfish.

(7) Carp, goldfish, suckers, and bullheads.--These fishes are frequently classified as coarse or noxious. Although the aggregate production of all has been substantial in some years, the marketing of them has been burdened by low demand and unstable prices. It is unlikely that commercial production in recent years has ever fully used the available stocks of any of these species.

The "German carp," introduced into this country in the late 19th century, established itself and increased rapidly in Lake Erie. Early catch records show annual commercial landings as great as 13 million pounds (1913). In the past decade, yearly landings have been 3 to 5 million pounds (fig. 8). Seine fishermen

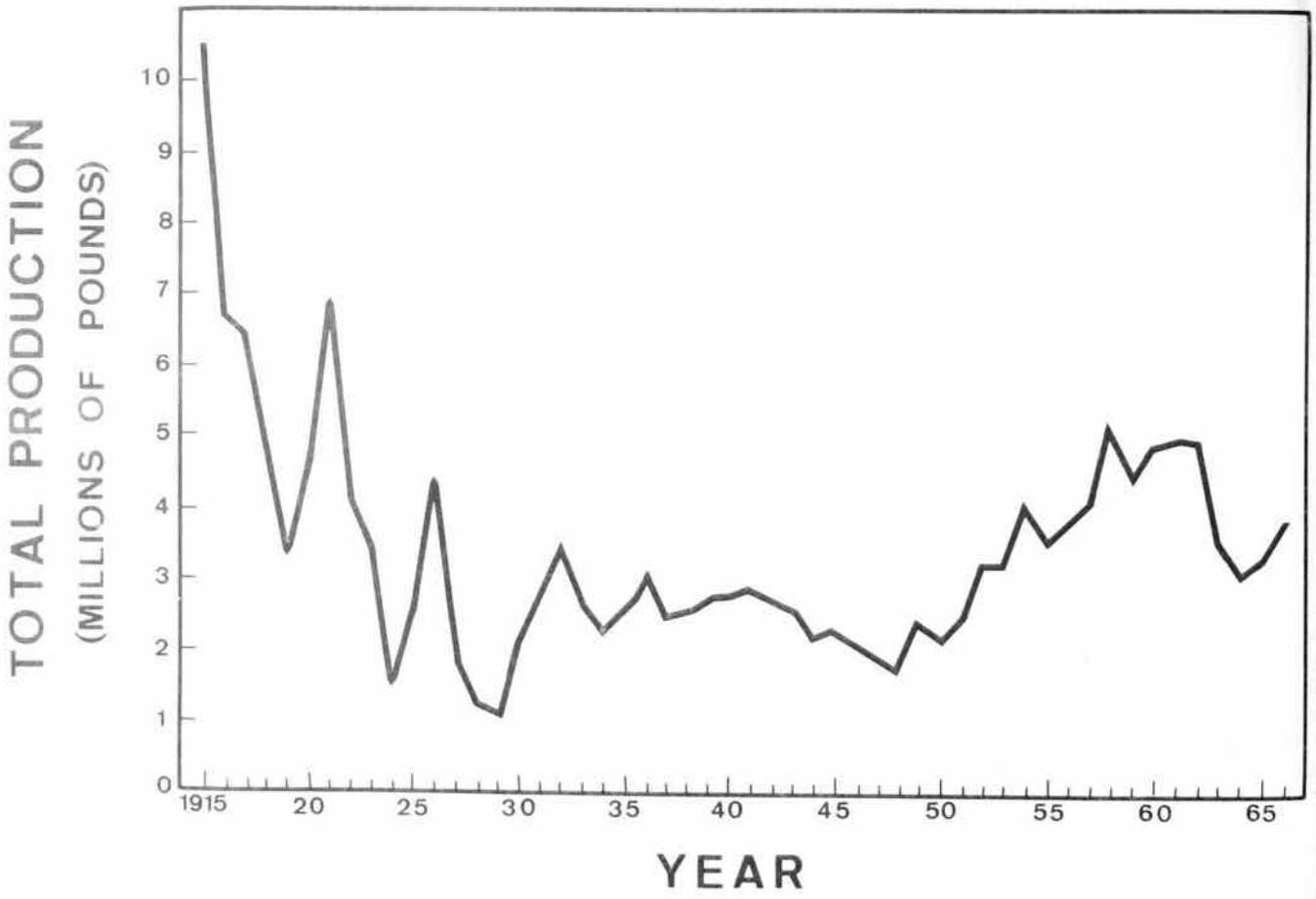


Figure 8.--Total production of carp from Lake Erie, 1915-66.

Photo 14.--Beach seiners hauling net to shore in Sandusky Bay, summer of 1966.

ike most of this catch in the bays and along ie shallow, warm south shore of the western asin. Some of these carp are sold as live fish or use in "pay lakes."

Authentic details are not known concerning ne introduction of the goldfish in Lake Erie. ome of the present stock undoubtedly origiated from the disposal of unwanted aquarium ets. During the years for which records are vailable between 1929 and 1968, annual landngs have usually been less than 200,000 ounds. Although not as widely distributed as ne carp, the goldfish has similar habitat references and is generally caught by the ame means where both are found. Hybrids of ne two species are also common.

Commercial landings of suckers, at one ime as high as 2 million pounds per year 1930), have dropped steadily for over 30 ears. Lack of demand or the destruction or locking of preferred spawning grounds in streams, or both, may be responsible for this decline.

The commercial production of bullheads from Lake Erie has always been small and probably never was over 100,000 pounds per year. Again, low demand rather than availability seems to govern the catch.

THE ROLE OF LAKE ERIE'S TRIBUTARIES AND OF LAKE ST. CLAIR IN THE FISHERIES

Tributary streams

In the early and mid-19th century, the tributaries of Lake Erie undoubtedly played a large role in the fisheries of the lake because they were accessible to small vessels and could be fished with crude, homemade gear. Their importance declined, however, as the fisheries of the open lake were developed,

and in modern times the tributaries have contributed almost nothing to the commercial harvest.

The importance of Lake Erie's tributaries to the fishing industry has also diminished in another way. Since the turn of the century, stream-spawning runs of certain commercial species such as walleye, white bass, suckers, burbot, and northern pike have declined sharply or have disappeared in some locales, particularly on the U.S. side of the lake. Today, the tributaries, with the possible exception of the Detroit River, appear to contribute little to the maintenance of existing commercial fish stocks. The damming and pollution of streams and the absence, among the remaining commercially caught fishes, of any species that require streams for spawning have both contributed to this circumstance.

A unit ecological complex consisting of the St. Clair River, Lake St. Clair, the Detroit River, and the western basin of Lake Erie does support a walleye population (or group of subpopulations) that migrates freely among these bodies of water. To this extent, the Detroit River serves as an avenue for the continued interchange of stocks between Lake St. Clair and the western basin. The river is not open to commercial fishing, but it provides a large, active sport fishery for the walleyes.

Two smaller tributaries, the Sandusky River in Ohio and the Thames River (tributary to Lake St. Clair) in Ontario, are used by small subpopulations of the walleye for spawning. The walleye hatches produced in these rivers are small, however, as compared with those produced on spawning reefs in the open waters of the western basin. Spawning runs of smelt enter certain unobstructed and unpolluted Canadian tributaries of the lake, but again, most spawning by this species is on the north shore shoals of the open lake. Small spawning runs of suckers reportedly still enter several tributaries of the eastern basin and similar runs of white bass have been observed in several rivers elsewhere on the south shore. Both suckers and white bass also spawn in the lake.

Lake St. Clair

Lake St. Clair is essentially a shallow expansion of the St. Clair River-Detroit River system that discharges the outflow of Lake Huron into Lake Erie. It has a surface area of 490 square miles, of which about 60 percent is under Canadian jurisdiction. The maximum depth is 21 feet, and the mean depth is only 10 feet. Bottom topography is flat and almost saucerlike. Much of the lake supports a dense growth of aquatic vegetation.

Commercial fishing has been prohibited in the United States (Michigan) waters of the lake since 1909. Contract fishing for noxious species, however, has produced significant quantities of carp and some channel catfish. A substantial sport fishery has also developed for walleyes, muskellunge, and black bass.

Canada has permitted a more or less "limited entry" commercial fishery to operate in their waters of the lake, but fishing grounds are specifically assigned and seasons restricted. During the past 40 years, the Canadian commercial yield has averaged about 800,000 pounds annually. Carp and suckers make up the bulk of the catch but walleyes, yellow perch, and channel catfish are taken in sufficient numbers to support a reasonably profitable fishery.

Recent studies of the walleye coupled with exploratory fishery and limnological investigations of Lake St. Clair have shown that the St. Clair River-Lake St. Clair-Detroit River system and the western basin of Lake Erie must be viewed as a single ecological unit. For example, substantial numbers of walleyes, spawned and hatched on the reefs of the western basin, emigrate northward to the St. Clair River-Lake St. Clair-Detroit River system, where they contribute to the fisheries. Concurrently, many walleyes produced by spawning runs in the Thames River, tributary to Lake St. Clair in Ontario, migrate southward into the western basin of Lake Erie. Although walleyes move actively within this complex of waters presumably for feeding and spawning, relatively few fish appear to wander beyond its northern and eastern boundaries into Lake Huron or the central basin of Lake Erie.

The extent to which other species, less mobile than the walleye, use this area as a common environment has not yet been determined.

THE OUTLOOK

The fishery resources of Lake Erie have undergone substantial changes during the past century and will probably remain unstable far in the future. Although commercial fishing has often contributed to changes in the fish populations (i.e., by overfishing of the high-value species), the long-term trends that have taken place in the fisheries can also be attributed, in part, to an altered aquatic environment. The protected bays and shore areas have become conspicuously enriched as land and water uses have increased. The steadily increasing amounts of agricultural drainage and domestic and industrial wastes discharged into the lake have undoubtedly altered the environment sufficiently to affect most aquatic life.

In the mid-1950's, scientists of the Bureau of Commercial Fisheries and their associates warned that major adverse changes were taking place in the total Lake Erie environment. Their criteria were based on evidence

Photo 15.--One of several research vessels engaged in fishery investigations on Lake Erie today.

of increased fertility, higher water temperatures, heavy algal blooms, dissolved oxygen deficiencies, and a fish species complex that indicated an accelerated aging of the lake. The early warnings of the biologists went largely unheeded. Fortunately, public apathy or indifference to pollution has now given way to widespread concern.

In recent years, critically low oxygen concentrations have developed in the summer over the bottom of much of the western and central basins of the lake. This occurrence is annual in the central basin, and the severity of oxygen depletion and extent of area affected increase steadily. No fish and few invertebrates can live on or near the bottom in hundreds of square miles of oxygen-depleted waters in the summer. This situation, in turn, has brought about a radical change in the bottom fauna and the feeding habits of fish.

Surprisingly, there is no indication that the productivity of Lake Erie has declined. In fact, its biological capacity to produce fish is at a record high. This productivity, however, has been diverted into medium- and low-value species such as yellow perch, white bass, smelt, carp, and sheepshead. Unfortunately, the catches of some of these species are not easily marketed. Consequently, the numbers of fishermen have dwindled, and the fishing industry is, in truth, dying.

Less than 30 years ago the U.S. catch represented about three-fourths of the lakewide landings; today the fraction has decreased to one-fourth and continues to decline. This decrease may be pleasing to some American sportsmen who fail to recognize the potential and importance of the U.S. commercial fishery; yet, it is not only unfortunate, but also unnecessary, that the U.S. fishing industry of Lake Erie does not now produce an equitable share of the basic food resource available to it.

Many sport fishermen regard the commercial fishery as competitive and a nuisance to their own interests. What they do not realize is that a properly regulated commercial fishery can contribute to a healthy sport fishery.

The industry, if it is to continue and grow, will need assistance in a number of ways. For

Photo 16.--Biologist observing a mud sample to be screened and checked for bottom organisms.

example, alternate ways of catching fish must be investigated, new processing techniques developed, equipment modernized, and facilities established that can handle and store large volumes to eliminate periodic seasonal glutting of markets.

Joint consideration must be given to the commercial and sport fisheries, and a sound and uniform fishery management plan established for the lake. An extension of the research programs for assessing the status of the fish populations and their environment is needed.

It is imperative that the responsible public agencies direct their efforts in the management of the fishery with intelligent, long-range plans. Since the fish are free to move from one jurisdiction to another, it is essential that regulations be standardized throughout the lake. Furthermore, these regulations must be administratively flexible to adapt rapidly to changing biological and economic conditions.

The fish populations can be managed to produce a maximum sustained yield with a minimum of fluctuations. The establishment of a limited-entry industry and annual quotas has been suggested by concerned public agencies as management tools. Other management techniques will also be required. Indeed, direct manipulation of fish stocks and the introduction of new species are under consideration by some States.

We recognize that some changes in fish populations will continue from year to year with or without management. The goals of management will be to adjust the harvest to achieve maximum use of abundant stocks, to reduce undesirable or stunted stocks, and to aid the recovery of temporarily depleted populations.

In any event, it should be remembered that waters of Lake Erie are intended to serve many uses. Clean water is imperative for domestic and industrial needs as well as for fishing and recreation. Only the most immediate action to alleviate the present contamination of Lake Erie will offer any hope that the next generation will enjoy the source of food, recreation, and potable water that the lake could still provide.

ACKNOWLEDGMENTS

In addition to many published references, supplemental information for this report was furnished by a number of persons. Among these were representatives of the Ohio Division of Wildlife. The history of fishing gears used in Ohio was adapted from an informal report by Paul Woner; others were Clarence Clark and Jerry Manz, who contributed biological data and comments on the status of certain species. Ed Weigand of Huron and Edward Lay of Sandusky provided several of the photographs illustrating the earlier days of the fishing fleet and their catches. Robert Ferguson of the Ontario Department of Lands and Forests and Ralph Hile of the Bureau of Commercial Fisheries reviewed the manuscript and made many helpful suggestions.

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APPENDIX

The Appendix includes the scientific names and some of the colloquial names given to these ies at one time or another in the commercial fishery. The name most commonly used is ignated by an asterisk. These are listed alphabetically under the common name adopted by American Fisheries Society in its Special Publication No. 2 (1960), "A List of Common & entific Names of Fishes from the United States and Canada."

Common name	Scientific name
American smelt	Osmerus mordax (Mitchill)
Smelt*	
Blue pike*	Stizostedion vitreum glaucum Hubbs
Bullhead*	
Bullheads, marketed as a group include the following species:	
Brown bullhead	Ictalurus nebulosus (LeSueur)
Yellow bullhead	Ictalurus natalis (LeSueur)
Black bullhead	Ictalurus melas (Rafinesque)
Burbot*	Lota lota (Linnaeus)
Eel pout	
Carp*	Cyprinus carpio (Linnaeus)
German carp, European carp; the major recognized forms of this species are the scaled carp, mirror carp, and leather carp.	
Channel catfish*	Ictalurus punctatus (Rafinesque)
Speckled cat, fork-tail cat, catfish	
Cisco or lake herring	Coregonus artedii LeSueur
herring*	
Fresh-water drum	Aplodinotus grunniens Linnaeus
sheepshead,* gray bass, drum	
Goldfish*	Carassius auratus Linnaeus
This species frequently crosses with carp to produce hybrids.	
Lake sturgeon	Acipenser fulvescens Rafinesque
Rock sturgeon, sturgeon*	
Lake trout*	Salvelinus namaycush (Walbaum)
Great Lakes trout, Mackinaw trout	
Lake whitefish	Coregonus clupeaformis (Mitchill)
Common whitefish, whitefish*	
Muskellunge*	Esox masquinongy Mitchill
Musky	
Northern pike*	Esox lucius Linnaeus
Common pike, grass pike	
Redhorse*	
Redhorse suckers, marketed as a group, include the following species:	
Northern redhorse	Moxostoma macrolepidotum (LeSueur)
Silver redhorse	Moxostoma anisurum (Rafinesque)
Golden redhorse	Moxostoma erythrurum (Rafinesque)
Sauger*	Stizostedion canadense (Smith)
Sand pike, gray pike, river pike	
Walleye	Stizostedion vitreum vitreum (Mitchill)
Yellow pike, walleyed pike, pickerel,* doré	
White bass*	Morone chrysops (Rafinesque)
Silver bass, striped bass	
White sucker*	Catostomus commersoni (Lacépède)
Common sucker, finescaled sucker	
Yellow perch	Perca flavescens (Mitchill)
Ringed perch, lake perch, perch*	

Appendix table 1.--Order of yield of the principal commercial species of fish caught in Lake Erie in selected years from 1908 to 1966.

["Cisco" is Lake Erie vernacular name for lake herring; "suckers" include both white and redhorse species; catches of "channel catfish" usually include some bullheads before 1952; see Appendix for clarification of fish names.]

Order of yield	Year							
	[1]1908	[2]1915	1920	1930	1940	1950	1960	1966
1	Cisco	Blue pike	Cisco	Blue pike	Blue pike	Blue pike	Yellow perch	Yellow perch
2	Blue pike	Cisco	Blue pike	Yellow perch	Whitefish	Walleye	Smelt	Smelt
3	Carp	Carp	Carp	Sheepshead	Yellow perch	Yellow perch	Sheepshead	Carp
4	Walleye	Sauger	Sauger	Whitefish	Walleye	Sheepshead	White bass	Sheepshead
5	Northern pike	Lake whitefish	Yellow perch	Carp	Sheepshead	Whitefish	Carp	White bass
6	Sauger	Yellow perch	Whitefish	Walleye	Carp	Carp	Walleye	Walleye
7	Yellow perch	Walleye	Sheepshead	Suckers	Suckers	White bass	Channel catfish	Channel catfish
8	Lake whitefish	Sheepshead	Suckers	Sauger	Cisco	Channel catfish	Suckers	Suckers
9	Suckers	Suckers	Walleye	Cisco	Sauger	Cisco	Goldfish	Goldfish
10	--	--	Channel catfish	White bass	White bass	Suckers	Bullheads	Bullheads

[1] Ranking of yields of all but ciscoes inferred in part from descriptive reports (Canadian landings not reported for majority of species).

[2] Ranking of fourth through ninth species based largely on U.S. records; reports of Canadian landings of saugers, sheepshead, and suckers lacking.

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