COMMERCIAL FISHERIES REVIEW

February 1963 Washington 25, D. C. Vol. 25, No. 2

A TRAWLING SURVEY OF SOUTHERN LAKE MICHIGAN (AUGUST-NOVEMBER 1960)

By William G. Gordon*

SUMMARY

Otter-trawl explorations in southern Lake Michigan were made in the latter half of 1960 by the U. S. Bureau of Commercial Fisheries. The fishing was carried out with vessels chartered from the Lake Michigan trawl fleet. Objectives of the investigation were to determine: commercial availability of fish to bottom trawls; seasonal distribution of the fish stocks; and the location and extent of areas suitable for fishing with conventional otter trawls.

A total of 134 otter-trawl drags was made at depths ranging from 5 to 45 fathoms around the southern perimeter of the lake from Ludington, Mich., on the east shore to Sturgeon Bay, Wis., on the west shore. Gear damage was light throughout the area. Weather and sea conditions were generally favorable.

Mixed catches of chubs, alewife, and smelt ranged as high as 1,200 pounds per 30-minute drag. Those fish were found most consistently at depths of 15 to 30 fathoms and dominated all catches. Yellow perch and whitefish were taken in limited amounts in drags at depths of less than 35 fathoms. Other fish of commercial importance were not taken in significant amounts.

INTRODUCTION

The traditional gill-net fishery of Lake Michigan has been in economic distress for the past several years. This condition developed as the more valuable species were reduced in number (primarily from sea lamprey depredation). The greatly increased populations of low-value species presently occupying the lake cannot be profitably harvested by gill nets. Progressive members of the fishing industry have sought ways of easing this situation through the development of more economical methods of production.

A limited trawl fishery for chubs, smelt, and alewife began in Wisconsin waters in 1958. It expanded to Indiana waters in 1959 and Michigan waters in 1960. Information regarding the commercial availability of chubs, alewife, smelt, suckers, and other underutilized fish was urgently needed before nearby industrial markets could be interested in developing uses for the fish. The fishing industry requested investigations to determine the seasonal distribution of fish stocks available to otter trawls and the location of suitable trawling bottoms.

The U. S. Bureau of Commercial Fisheries conducted 1-week exploratory cruises in August, September, October, and November of 1960. Systematic operations were conducted in predetermined areas and depths, with major emphasis on determining the depth distribution of the major chub species, alewife, and smelt.

*Fishery Methods and Equipment Specialist, Exploratory Fishing and Gear Research Station, U. S. Bureau of Commercial Fisheries, Ann Arbor, Mich.

DESCRIPTION OF AREA SURVEYED

The 1960 explorations were conducted along approximately 400 miles of the southern Lake Michigan shoreline from Ludington, Mich., to Sturgeon Bay, Wis., at distances of up to 35 miles offshore. For discussion, the area of coverage has been subdivided into east and west sections. A total of 135 trawl stations were established--66 in the eastern section and 69 in the western section (fig. 1). Depths fished ranged from $9\frac{1}{2}$ to 42 fathoms. Most attention was given to the 15- to 40-fathom depth range.

BOTTOM CONDITIONS

EASTERN SECTION: The eastern section includes Lake Michigan east of longitude 87° W. and south of Ludington, Mich. With few exceptions, the bottom is composed of fine sand near shore. The sand grades to clay and soft mud as the depth increases. The gradual slope and regular contours of the lake bottom in most of the section provide excellent trawling bottom. Irregular clay bottom, boulders, and sandy shoals generally occur only at depths of less than 10 fathoms, except north of Michigan City, Ind., where numerous detached shoals create unfavorable trawling conditions out to about 15 fathoms. A limited amount of good trawling bottom exists in depths shallower than 10 fathoms, as widely-scattered and not well-defined patches.

WESTERN SECTION: The western section of Lake Michigan includes the area west of longitude 87° W. and south of Sturgeon Bay, Wis. A band of boulder deposits and bedrock outcrops, extending outward along most of the shoreline to depths of 5 to 15 fathoms, creates unfavorable inshore trawling conditions. The lake bottom beyond those depths consists mostly of sand, clay, or mud. Occasional patches of boulders and gravel impede trawling.

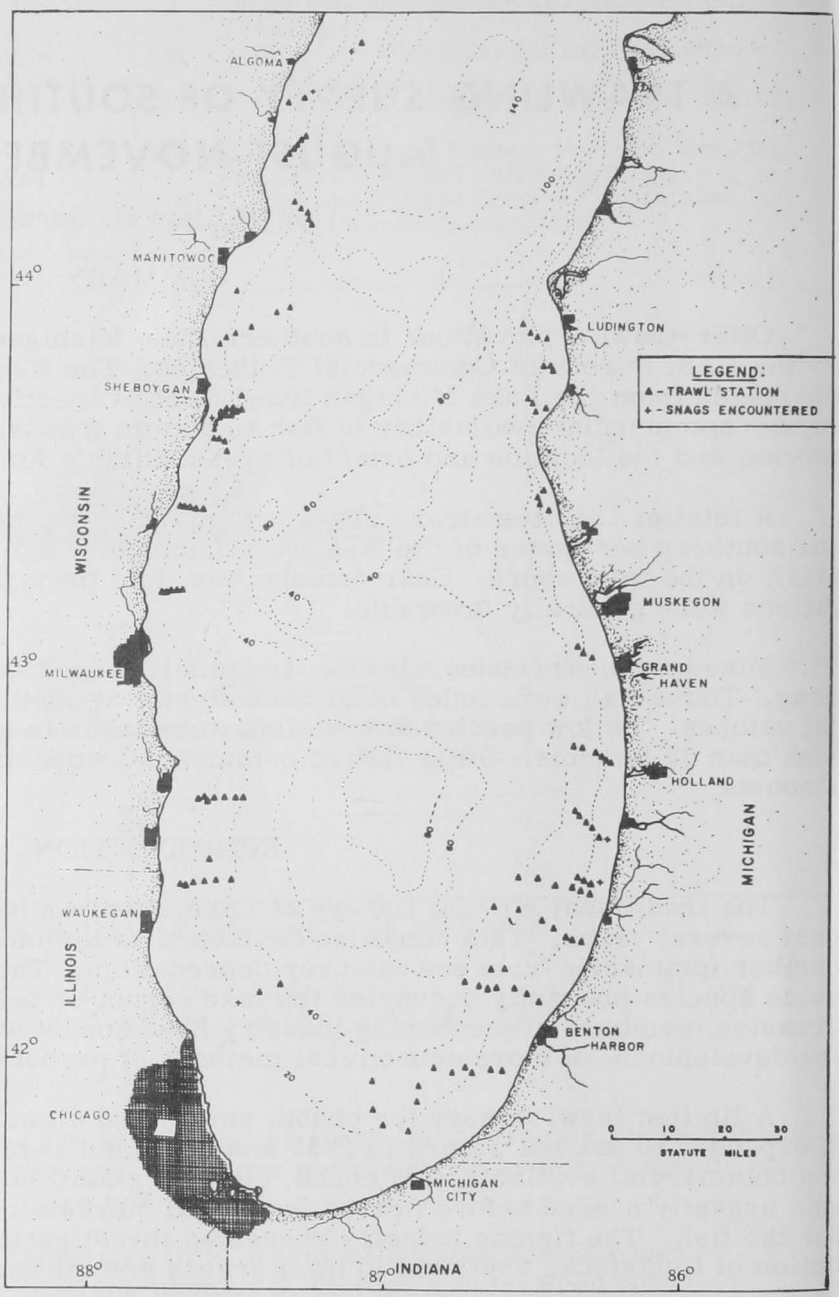

Fig. 1 - Geographic distribution of stations completed by the vessels Art Swaer II, Kevinbren, and Capitol I during 1960.

Although the slope becomes very steep in some places, the contours for the most part are regular, and trawling operations were carried out without difficulties. A number of snags were encountered on the steep slope off Sturgeon Bay, Wis.

South of Waukegan, the lake bottom inside the 15-fathom contour is dominated by rocky reefs and shoals. Little coverage was given to this zone because of the poor bottom and the presence of heavy shipping traffic.

LAKE CURRENTS

Variations in force and direction of currents affect fishing conditions in much of the area studied. The long north-south axis of the lake intensifies the effects of strong southerly or northerly winds, and current velocities may, on occasion, exceed 3 m.p.h. Local wind force and direction and barometric pressure cannot always be correlated with observed current patterns. Since speed, direction, and duration of the currents are variable, a constant check is necessary to maintain desirable trawling speeds.

VESSELS USED

Three commercial trawlers were chartered by the Bureau for the four exploratory fishing cruises: the Art Swaer II (August); Kevinbren (September and November); and Capitol I (October). All are engaged in the recently established Lake Michigan trawl fishery.

M/V "ART SWAER II": The Art Swaer II, home port Pensaukee, Wis., was originally built as a Lake Erie gill-net vessel. The vessel was converted for trawling in 1960 (fig. 2) The all-steel vessel is 60 feet over-all, has a 16-foot beam, is powered by a 150 hp. Diesel

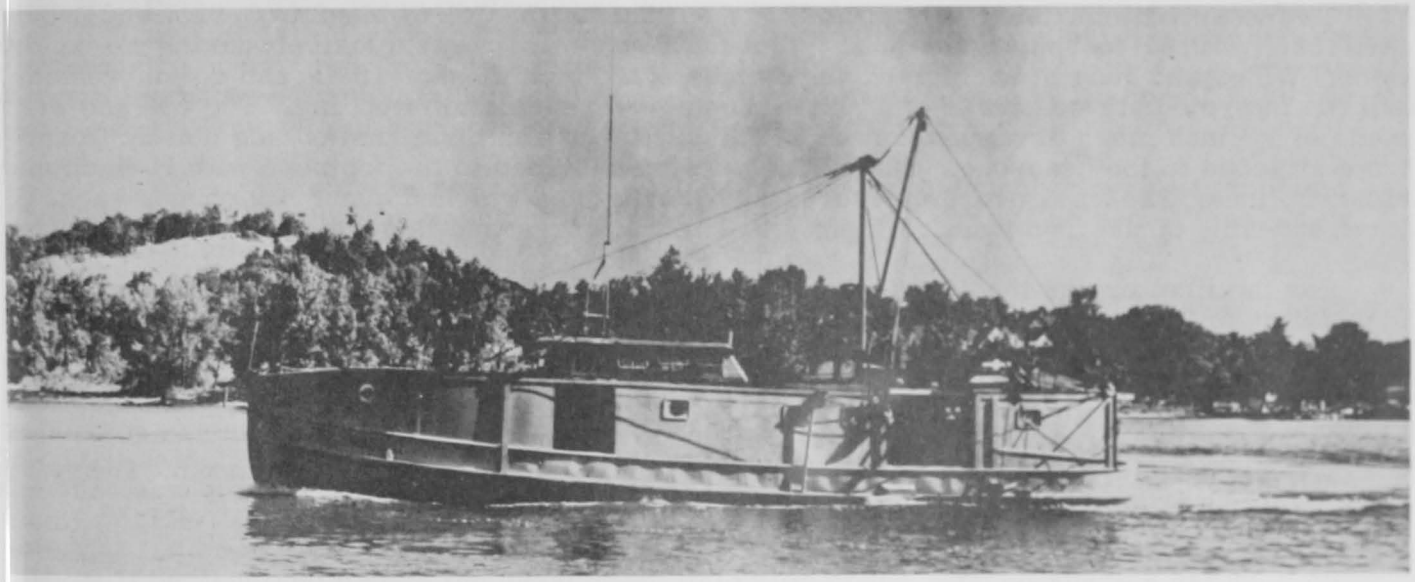

Fig. 2 - M/V Art Swaer II converted gill-net type vessel completed the first cruise of the research program.

engine, and is equipped with depth-sounder, automatic pilot, and radiotelephone. Unlike most converted United States gill-net vessels, the aft deckhouse was not removed. Deck machinery is driven from a main engine power take-off. The net is set out through the stern doorway and towed from two outrigger booms mounted on the mast. The catch is hauled through an enlarged doorway in the port side.

M/V "KEVINBREN": The Kevinbren, home port Milwaukee, Wis., was built in 1949 as a gill-net vessel for the Lake Michigan fishing fleet. It was rigged for trawling early in 1959 (fig. 3). This all-steel vessel has a total length of 57 feet and a beam of 14 feet. It is powered by a 165 hp. Diesel engine. Pilothouse equipment includes a depth-recorder, automatic pilot, and radiotelephone. The aft deckhouse has been removed. The deck machinery is driven by power take-off on the main engine. Arrangement of deck gear is similar to West Coast seiner-trawlers. The net is set and towed from the stern and the catch is hauled aboard over the starboard side.

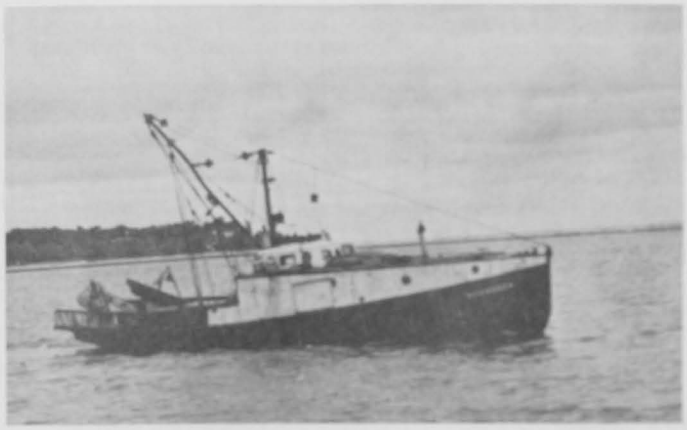

Fig. 3 - M/V Kevinbren, a converted gill-net type vessel used during a part of the explorations.

Fig. 4 - M/V Capitol I, 55-foot, former shrimp vessel chartered for the operations along the southern end of Lake Michigan.

M/V "CAPITOL I:" The Capitol I, home port Saugatuck, Mich., was built in 1959 at Houston, Tex., as a double-rigged shrimp trawler. Brought to Lake Michigan early in 1960, it was converted to a conventional stern trawler by removing the double rig and installing stern davits (fig. 4). The all-steel vessel is 53 feet in length and has a 15-foot beam and a 7-foot draft. It is powered by a 165 hp. Diesel engine. Deck gear is driven by power take-off on the main engine. Electronic equipment includes a depth-recorder, radiotelephone, and automatic pilot. The net is handled over the stern, and the catch is hauled over the starboard side.

GEAR AND METHODS

Two-seam balloon fish trawls similar to those used in the Gulf of Mexico (Gordon and Brouillard 1960), with 50-foot headropes and 60-foot footropes were used exclusively during the explorations. Wings and body of each trawl were made of $2\frac{1}{4}$-inch mesh[1/] 18-thread cotton webbing, and the intermediate was made of $1\frac{1}{2}$-inch mesh 15-thread cotton webbing. The cod end was made of $1\frac{5}{8}$-inch mesh 42-thread cotton webbing. Round aluminum and oblong plastic floats were attached to the headrope. Chain weights were fastened to the footrope with 10-inch manila droplines. The trawl doors measured $2\frac{1}{2}$ by 7 feet and weighed about 120 pounds each. A later widening of the iron runners from 4 to 7 inches increased this weight to about 160 pounds

For the first cruise the doors were fitted with chain-towing bridles; and dandyline gear (consisting of 20-foot extension straps from the wing tips) was attached directly to the back quarter of the door near the top and bottom. In the remaining three cruises, bar brackets were used rather than bridles, and the dandyline gear consisted of two 10-fathom legs connected to the door with conventional V-D (Vigneron-Dahl) gear.

The warp to depth ratio used was 3:1. Towing speed averaged about 3 m.p.h. Drags were 30 minutes long unless bottom obstructions were encountered.

FISHING RESULTS

CHUBS: Various species of deep-water ciscoes (table 1) dominated catches in both sections at depths of 15 to 45 fathoms. Best fishing was in 20 to 30 fathoms. Small chub, mostly "bloater" chub (Leucichthys hoyi) generally composed over 90 percent of the chub catch (fig. 5). The extreme northern and

Table 1 - List of Common and Scientific Names of Fish Caught During Botton Trawling Explorations in Southern Lake Michigan, August-November 1960

Common Name	Scientific Name
Longjaw cisco	Leucichthys alpenae
Herring	Leucichthys artedii
Whitefish	Coregonus clupeaformis
"Bloater" chub	Leucichthys hoyi
Kiyi chub	Leucichthys kiyi
Shortnose cisco	Leucichthys reighardi
Shortjaw cisco	Leucichthys zenithicus
Yellow perch	Perca flavescens
Alewife	Alosa pseudoharengus
Smelt	Osmerus mordax
Burbot	Lota lota
Emerald shiner	Notropis atherinoides
Spottail shiner	Notropis hudsonius
Sea lamprey	Petromyzon marinus
Sculpins	Cottus sp.

1/All mesh sizes in this report are stretched measure.

Fig. 5 - A catch of chubs made during the explorations. This 800-pound catch is typical of those made in productive areas.

southern portions of the area covered were most productive, with chub catches averaging over 500 pounds per 30-minute drag. Chubs suitable for commercial smoking constituted 5 to 20 percent of the chub catch. These chubs ranged in size from 2 to 5 per pound.

ALEWIFE: Catches of alewife ranging from a few individuals to over 200 pounds per 30-minute drag were made in 10 to 30 fathoms. Best catches were obtained along the west shore at 20 to 25 fathoms.

The sporadic occurrence of alewife in the trawl catches indicates the possibility that commercial concentrations of this species may yet be located on other grounds or by mid-water fishing during more intensive explorations.

SMELT: Commercial quantities of smelt were caught at widely scattered points and depths along the west shore; catches along the east shore consisted of 15 pounds or less. Catches from the west section contained as many as 170 pounds of smelt (10 to 20 per pound) per drag in the 15- to 25-fathom depth range.

OTHER FISH: Several other fish of commercial importance were taken in small amounts at various localities and depths. Yellow perch were caught in small numbers in 31 drags inside 35 fathoms. Two drags northeast of Waukegan in 14-20 fathom resulted in catches of 40 and 70 pounds of yellow perch; fishing at the other positions produced perch in amounts not exceeding 10 pounds per drag. Whitefish were caught in amounts of 15 pounds or less per drag at depths less than 20 fathoms at scattered locations along the east shore. Lake herring were taken in amounts of 5 pounds or less in 47 drags at all depths fished.

A few fish, presently of no commercial importance, were caught in small quantities. These included: sculpin in amounts of 2 pounds or less; and spottail shiner (a small minnow), also in amounts of 2 pounds or less.

CONCLUSIONS

Exploratory trawling during the second half of 1960 has demonstrated that commercially important concentrations of underutilized fish are present in most of southern Lake Michigan inside 45 fathoms and that commercial catches can be made with otter-trawl gear in most of the area surveyed. Although obstructions were encountered, the bottom appears relatively clear outside 10 fathoms and for the most part can be considered trawlable. The size of the potential fishery resource, in terms of continuing yield, is unknown. Year-round exploratory work will be required before the seasonal distribution of the various species can be determined and before areas and depths of highest production are delineated. The preliminary study suggests that a considerable amount of gear research will be required to determine the most effective gear for catching the fish.

Since the areas fished are scattered, the survey must be considered preliminary. Possibly heavier concentrations of fish may be located in other seasons and on other grounds, or other fish of greater economic value may be located in other areas, depths, or midwater levels.

APPENDIX

A detailed fishing log showing position, depth, date, catch components, and related data for each drag made by the vessels used is available as an appendix to the reprint of this article. Write for Separate No. 667, which includes the tables (2-5) for the 1960 fishing logs for the Lake Michigan survey: Table 2 - M/V Art Swaer II Cruise 1, August 10-17; Tables 3 - M/V Kevinbren Cruise 2, September 7-13; and 5 - Cruise 4, November 16-21; and Table 4 - M/V Capitol I, Cruise 3, October 11-16.

LITERATURE CITED

GORDON, WILLIAM G. and BROUILLARD, KEITH:
1960. Great Lakes Fishermen Convert Gillnetters to Trawling Vessels. The Fish Boat, vol. 5, no. 8, pp. 35-39.

SELECTED REFERENCES

AYERS, JOHN C.; CHANDLER, DAVID C.; LAUFF, GEORGE H.; POWERS, CHARLES F.; and HENSON, E. BENNETTE
1958. Currents and Water Masses of Lake Michigan. Great Lakes Research Institute, University of Michigan, Publication No. 3, 169 pp.

EMERY, K. O.
1951. Bathymetric Chart of Lake Michigan. Institute of Technology, Engineering Exploratory Station, University of Minnesota; Technology Paper No. 77, 11 pp.

JOHNSON, JAMES H.
1960. Surface Currents in Lake Michigan, 1954 and 1955. U. S. Fish and Wildlife Service, Special Scientific Report--Fisheries No. 338, 120 pp.

MOFFETT, JAMES W.
1956. Recent Changes in the Deep-Water Fish Populations of Lake Michigan. Transactions of the American Fisheries Society, vol. 86, for the year 1956, pp. 394-408.

UNITED STATES ARMY, CORPS OF ENGINEERS
1950. Great Lakes Pilot, U. S. Lake Survey, Lake Michigan, pp. 109-244.