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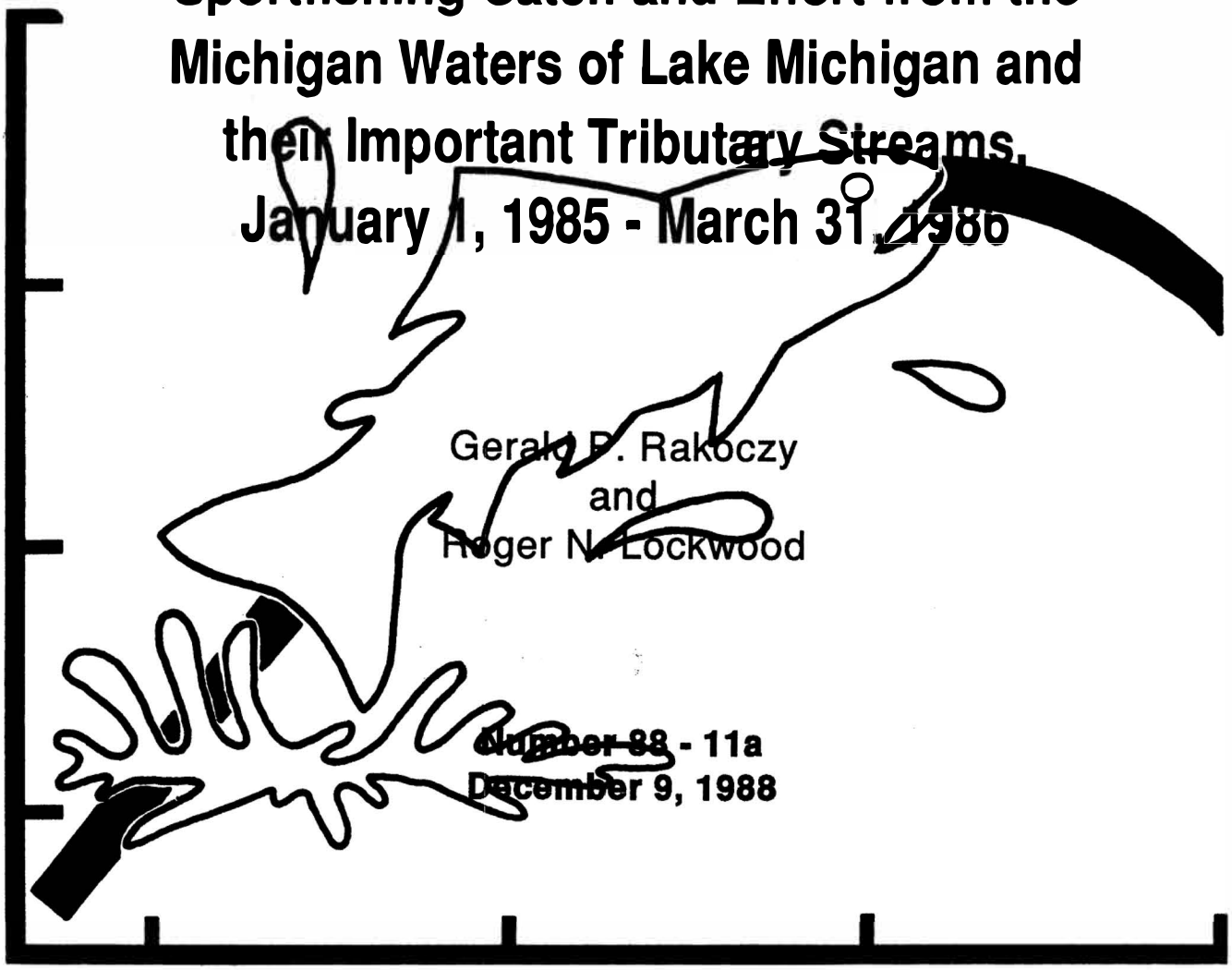
FISHERIES DIVISION

TECHNICAL REPORT

Sportfishing Catch and Effort from the Michigan Waters of Lake Michigan and their Important Tributary Streams, January 1, 1985 - March 31, 1986



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Michigan Department of Natural Resources

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
FISHERIES DIVISION

Fisheries Technical Report No. 88-11a

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SPORTFISHING CATCH AND EFFORT FROM THE MICHIGAN WATERS OF LAKE MICHIGAN AND THEIR IMPORTANT TRIBUTARY STREAMS, JANUARY 1, 1985 - MARCH 31, 1986[1]

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[1]Contribution from Dingell-Johnson Project F-53-R, Michigan

ABSTRACT

Sportfishing catch and effort were sampled for 27 Lake Michigan ports and 10 important river systems during the 1985 open-water season and the winter months of 1985 and 1986. The objective of the creel census was to obtain a monthly record of sport catch, catch rates, fishing effort, and catch composition for Lake Michigan and important anadromous river fisheries.

Approximately 45,000 anglers were sampled at the end of their fishing trips. Catch and effort estimates were calculated by month for all areas sampled. It was estimated that anglers spent 8,422,842 (±319,509) hours fishing the Michigan waters of Lake Michigan and the 10 tributary streams which were censused. Total angler effort by mode of fishing was 81% boat, 12% pier, 5% ice, and 2% shore. St. Joseph-Benton Harbor was the busiest port in terms of angler hours on Lake Michigan. The Manistee River had the greatest amount of angler activity of the 10 streams sampled.

Total harvest was estimated to be over 4.0 million fish. The yellow perch were the most abundant species in the sport catch, totaling an estimated 2,673,415 (±281,594) fish. In addition, sport anglers harvested an estimated 862,633 (±56,520) salmonids from Lake Michigan. The salmonid catch was composed of 59% chinook salmon, 16% lake trout, 13% coho salmon, 6% brown trout, 5% rainbow trout, and less than 1% of other salmonids such as pink salmon, Atlantic salmon, brook trout, and splake.

INTRODUCTION

Michigan's Lake Michigan sport fishery was monitored with an intensive creel census during 1985 and the winter months of 1986. The objective of the program was to obtain a monthly record of sport catch, catch rates, fishing effort, and catch composition for the Great Lake and important anadromous river fisheries.

A fundamental requirement for sound management of the Lake Michigan sport fishery is knowledge of the response of fish stocks to fishing and the contributions of various fish stocks to the fisheries. The success and the future value of the open water and anadromous stream fisheries depends on the long-term consequences of current management. It is essential that management decisions be based on a sound empirical knowledge of the history, current status, and dynamics of the fish communities.

Fishing statistics are needed for stock assessment and to facilitate stock identification. Coupled with fish marking studies, these kinds of data can identify Great Lakes and anadromous fish stocks and determine their spatial distribution, movements, and contribution to various sport fisheries. In future years, data collected from this program could be used to develop, test, and improve decision models which will help to discern management strategies for Lake Michigan fish communities and fisheries.

During the 1985 open-water fishing season, angler catch and effort were sampled at 27 Lake Michigan ports and fishing areas. In addition, 10 important anadromous river fisheries tributary to Lake Michigan were sampled. During the winter months of 1985 and 1986, ice fisheries on two Lake Michigan embayments were also sampled.

Michigan Department of Natural Resources (MDNR) Fisheries Division personnel interviewed approximately 45,000 anglers on Lake Michigan at the end of their fishing trips during 1985 and the winter months of 1986. Most of these anglers were contacted during the April through November open-water season.

STUDY AREA AND METHODS

During the 1985 open-water season, an intensive creel census was conducted at all important ports and sportfishing areas of Lake Michigan from New Buffalo to Harbor Springs in the Lower Peninsula, and from Manistique to Menominee in the Upper Peninsula (Figure 1). During the winter months of 1985 and 1986 ice fisheries were also sampled on Little Bay de Noc and Grand Traverse bays, respectively.

The creel census used in Michigan is based on a stratified design using simple random sampling within strata. Strata included port fished by month by weekday-weekend (holiday) and by mode of fishing. Catch and effort estimates were made for each strata and then

combined to give monthly and seasonal figures. As a general rule, the creel census was designed such that each sampling area was no larger than could be covered in one 8-hour workday. The same sample area was then traversed 5 days per week. Each work schedule was specifically tailored for the area being sampled. Both weekend days and three randomly selected weekdays were sampled each week. In some cases, four 10-hour days per work week were used when permanent personnel were required to drive long distances to and from the sampling area. In these cases, two randomly selected weekdays and both weekend days were sampled each week. The entire angling day from dawn to 1 hour past dusk was covered. This was accomplished by breaking each day into two 8-hour work shifts, then randomly selecting the actual shift to be worked. In the case where an individual was responsible for sampling more than one area, the port or fishing areas were also randomly selected for each day.

Three types of data were collected for each area sampled: angler party interviews for catch rates and length of trip, and angler (or boat) counts for pressure. An angler party was defined as one or more anglers who fished together. Angler parties were interviewed at the end of their fishing trips at various boat launching ramps, marinas, piers, and along the shoreline. Anglers were queried as to their mode of fishing (i.e., boat, shore, pier, open ice, or shanty ice), where they fished, how long they fished, what they fished for, the numbers (by species) of fish they kept, and the number of fishing trips they made or intended to make that day. Additional data were collected on the angler party such as county of residence, and the types of angling methods used (casting, still fishing, trolling, etc.). These data were recorded on an angler interview form by census personnel (Figure 2).

Instantaneous and interval counts were used to sample fishing pressure. Instantaneous counts were used when all boats or anglers in a sample area could be observed from a given point at one time. Interval counts were used when the sample area was too large to be observed from one point. In this case, the number of boats or anglers passing the observation point during a 30-minute period was used to determine the number of fishermen in the entire sampling area. All counts of boat trailers, pier anglers, shore anglers, open-ice anglers, and ice shanties were instantaneous. However, both instantaneous and interval boat counts were made depending on the sampling area. The type and number of boating access points within the sample area determined the type of boat count used. Interval counts were used in cases where boat access to the open lake was limited to harbor areas where all boats exited through defined channels. All fishing effort counts were done from the ground by census workers at randomly selected times. Count data were recorded on a shore and boat count data sheet (Figure 3).

Seasonal workers were trained on-site by permanent fisheries technicians at the beginning of the field season. Count and interview data forms, completed by both the seasonal and permanent personnel, were reviewed every 2 weeks by a designated individual at each district or research station office. Throughout the field season, completed data forms were sent to the

Charlevoix Great Lakes Research Station for computer entry. Data forms were further scrutinized at Charlevoix prior to data entry. The entry software employed range checks on various data for each count and interview record that was keyed.

Catch and effort estimates were made for each port or fishing area by month and species. Standard mathematical formulas for creel census (Ryckman 1981; Smith and Ryckman, in press) were used to calculate all estimates. Two measures of fishing effort were calculated: angler hours, and angler trips. An angler trip is one completed fishing excursion. One or more angler trips could be completed during any 24-hour period.

Scientific and common names of fish species observed during this study are contained in Table 1.

Detailed catch estimates by month, species, and sample area are contained in the appendices, Michigan Department of Natural Resources, Fisheries Technical Report Number 88-11b.

RESULTS

Lake Michigan

Anglers spent an estimated 6,940,980 (±313,090) hours fishing the Michigan waters of Lake Michigan during the April 1 through November 15, 1985 open-water season (Table 2). The number of hours fished converts to an estimated 1,633,431 (±70,394) individual angler trips. Total angling effort by mode of fishing was 85% boat, 12% pier, and 3% shore.

The waters of Lake Michigan from St. Joseph to Muskegon had the greatest concentration of fishing effort. Forty-four percent of the lake-wide total estimated effort (angler hours) occurred in this area. The port of St. Joseph-Benton Harbor had more angler activity than any other port, with an estimated 834,443 (±116,077) angler hours or 178,098 (±22,542) individual fishing trips (Table 3). Ludington, Manistee, Grand Haven, and Muskegon also had substantial levels of sportfishing activity.

The average length of a fishing trip (all modes of fishing) was 4.3 hours. Boat trips were the longest in duration, averaging 4.8 hours. Pier and shore trips averaged 2.6 and 2.4 hours, respectively.

Fishermen caught an estimated 3,435,500 (±284,068) fish comprising 31 species during 1985 (Table 2). The bulk of this catch (79%) came from the boat fishery, while pier and shore anglers harvested 18% and 3% of the total catch, respectively (Tables 4, 5, and 6).

The yellow perch was the most numerous species in the catch, making up 68% of all the fish harvested. An estimated 2,336,819 (±275,819) yellow perch were harvested by all modes of fishing (Table 2). The mean total length and weight of yellow perch harvested by Lake Michigan anglers was 8.55 (±0.06) inches and 0.35 (±0.02) pounds (Table 7). Sixty-three

percent of the lake-wide yellow perch catch came from four southern Lake Michigan ports—New Buffalo, St. Joseph-Benton Harbor, South Haven, and Saugatuck (Table 7). St. Joseph-Benton Harbor had the largest perch catch (664,671 ± 193,119 fish). The bulk of this harvest (60%) came from the boat fishery. Substantial catches of yellow perch (greater than 200,000 fish) also occurred at New Buffalo, South Haven, and Saugatuck (Table 8).

The seasonal lake-wide catch rate for yellow perch in 1985 was 0.337 (±0.043) fish per angler hour. The greatest catch rate for yellow perch (6.296 ± 0.2.723 fish per angler hour) was noted for the Big Bay de Noc sample area (Table 8). Big Bay de Noc was censused only during April and May which coincided with the spring yellow perch fishery. Anglers at the port of New Buffalo experienced the greatest seasonal catch rate (1.011 ± 0.329 fish per hour) for yellow perch of all the ports which were censused throughout the open-water season.

Although yellow perch are important to the Lake Michigan sport fishery, many anglers seek the various species of salmonids. The Lake Michigan salmonid catch, exclusive of lake whitefish, in the study area was estimated at 862,633 (±56,520) fish. The salmonid catch was composed of 59% chinook salmon, 16% lake trout, 13% coho salmon, 6% brown trout, 5% rainbow trout, and less than 1% of other salmonids such as pink salmon, Atlantic salmon, brook trout, and splake. The vast majority of the salmonid harvest (93%) came from the boat fishery (Table 4).

Chinook salmon is the most important salmonid in the Lake Michigan sport fishery in terms of numbers and weight of fish harvested (Rakoczy and Rogers 1987). An estimated 511,318 (±50,108) chinooks were caught by anglers during 1985. Biological data collected from the Lake Michigan sport catch during 1985 indicated the mean total length of a chinook in the catch was 29.77 (±0.29) inches and the mean weight 10.84 (±0.28) pounds (Table 7). Based on these data fishermen harvested in 1985 approximately 5.5 million pounds of chinook from Lake Michigan.

The largest catch of chinook salmon (87,609 ± 21,820 fish) came from the port of Ludington (Table 9). Manistee, Muskegon, White Lake, Grand Haven, and St. Joseph-Benton Harbor had seasonal catches of chinook exceeding 35,000 fish.

The lake-wide chinook catch rate was 0.084 (±0.009) fish per angler hour. The greatest catch rate for chinook salmon (0.220 ± 0.279) was noted for anglers at Leland. Anglers at Muskegon, White Lake, Ludington, Manistee, Portage Lake, and Frankfort-Elberta had estimated catch rates which exceeded the lake-wide mean.

The lake trout was the second most numerous salmonid in the sport catch. An estimated 142,175 (±17,804) were harvested from all the ports sampled. Biological data collected from the sport fishery during 1985 indicated that the mean size of lake trout in the catch was 24.91 (±0.19) inches and 5.77 (±0.16) pounds (Table 7). Therefore, anglers harvested over 800,000 pounds of lake trout from the ports which were sampled. Of all the areas sampled, the largest

estimated lake trout catch (16,473 ± 6,651 fish) occurred at St. Joseph-Benton Harbor (Table 10). White Lake, Ludington, Charlevoix, and Petoskey anglers had lake trout catches exceeding 10,000 fish.

The lake-wide lake trout catch rate in 1985 was 0.021 (±0.003) fish per angler hour. Anglers fishing the Petoskey area had the highest catch rate for lake trout (0.117 ± 0.034 fish per angler hour) of all the areas sampled (Table 10).

Catch rates alone can be a misleading indicator of species abundance. In southern and central Lake Michigan, anglers tend to target for chinook salmon, usually with downriggers. Lures are fished a substantial distance above the bottom. Because salmon are a mid-water species, while lake trout are usually associated with the bottom, a large percentage of the lake trout catch in these areas is taken incidental to salmon fishing. In Grand Traverse Bay and the Charlevoix/Petoskey area, anglers spend a good portion of the season (May and June) seeking lake trout with lures fished at or very near the bottom because salmon normally do not enter the area in large numbers until July. This is the main reason why catch rates for lake trout are higher in some of the northern ports than in the south and central portion of the lake.

Coho salmon was also an important salmonid in the Lake Michigan sport catch. An estimated 111,908 (±15,202) fish were harvested by the sport fishery (Table 2). The mean total length of a coho in the sport catch was 22.43 (±0.34) inches and the mean weight 4.57 (±0.20) pounds (Table 7). Thirty-four percent of the coho catch was taken during August-September in the area from Ludington to Platte Bay. The spring fishery (April-May) in the area from New Buffalo to St. Joseph-Benton Harbor accounted for 16% of the total lake-wide coho catch. Anglers in Platte Bay had the largest catch, estimated at 14,654 (±3,612) fish (Table 11). Substantial catches of coho salmon also occurred at St. Joseph-Benton Harbor, Manistee, New Buffalo, and Muskegon. The lake-wide coho salmon catch rate was 0.016 (±0.002) fish per angler hour. The greatest seasonal catch rate for coho was estimated to be 0.166 (±0.044) fish per hour at Platte Bay.

A total of 48,717 (±7,247) brown trout was estimated to have been caught by Lake Michigan anglers (Table 2). The mean size of brown trout in the catch was 20.80 (±0.22) inches, or 5.31 (±0.17) pounds (Table 7). Forty-six percent of the total catch was taken during April and May and 43% of the seasonal harvest came from the Ludington to Frankfort area. The greatest catch (11,186 ± 3,431 fish) and catch rate (0.018 ± 0.006) for brown trout occurred at Manistee. The lake-wide catch rate for brown trout was 0.007 (±0.001) fish per hour.

The estimated harvest of rainbow trout was 45,868 (±8,970) fish. The mean total length and weight of rainbow in the catch was 25.24 (±0.33) inches and 6.53 (±0.20) pounds, respectively (Table 7). The greatest harvest (8,406 ± 2,001 fish) of rainbow occurred at Manistee. Anglers experienced the greatest catch rate (0.027 ± 0.010 fish per hour) for

rainbow trout in the Frankfort-Elberta area. The lake-wide catch rate for rainbow was 0.007 (±0.001) fish per angler hour.

River fisheries

Eight Lake Michigan tributary streams were sampled during the spring and fall anadromous fish runs. In addition, the St. Joseph and Manistee rivers, and Manistee Lake were sampled throughout the entire season. Anglers spent an estimated 1,130,983 (±53,633) hours fishing the 10 river systems sampled (Table 12). The greatest amount of angler activity occurred on the Manistee River where 290,562 (±28,938) angler hours were spent from April 1 through November 15. The average length of a fishing trip on all the Lake Michigan tributaries sampled was 5.0 hours.

A total of 160,650 (±16,994) chinook salmon, coho salmon, rainbow and brown trout was harvested on these river systems. Chinook salmon was the most abundant salmonid in the catch (102,822 ± 14,529). Anglers on the Manistee River had the largest estimated catch of chinook (25,394 ± 7,528).

Rainbow trout was the second most numerous salmonid in the river catches. The total rainbow harvest from the 10 river systems sampled was estimated to be 41,651 (±7,673) fish. Forty-one percent of the total rainbow harvest came from the Manistee River and Manistee Lake. A substantial catch of rainbow trout (8,843 ± 2,420 fish) was also estimated for the Muskegon River.

Coho salmon and brown trout were important in some river fisheries. The total coho catch was estimated at 11,839 (±4,050) fish of which 46% came from the Manistee River and Manistee Lake. A total of 4,338 (±1,558) brown trout was harvested in the river fisheries. Fishermen on the St. Joseph River had the largest catch, estimated at 1,424 (±852) brown trout.

Winter fisheries

During the winter months of 1985 and 1986 catch and pressure were sampled on Little Bay de Noc and Grand Traverse bays, respectively. Yellow perch was the most abundant species in the catch at both areas. Anglers on Little Bay de Noc spent an estimated 274,745 hours and made 69,354 (±8,529) individual fishing trips during January through March, 1985. An estimated 226,409 (±52,473) yellow perch and 4,890 (±2,565) walleye were harvested. The average length of an ice fishing trip on Little Bay de Noc was 4.0 hours.

During February and March 1986 ice anglers expended an estimated 76,134 (±8,476) hours and made 18,692 (±2,259) fishing trips on East and West Grand Traverse bays. The ice fishery on Grand Traverse bays was mainly composed of two species—yellow perch and lake

whitefish. A total of 104,338 (±25,129) yellow perch and 21,793 (±7,793) lake whitefish were harvested. Eighty-six percent of the yellow perch catch came from West Grand Traverse Bay, while 92% of the lake whitefish occurred in East Grand Traverse Bay. The average length of an ice fishing trip on Grand Traverse bays was 4.1 hours.

SUMMARY

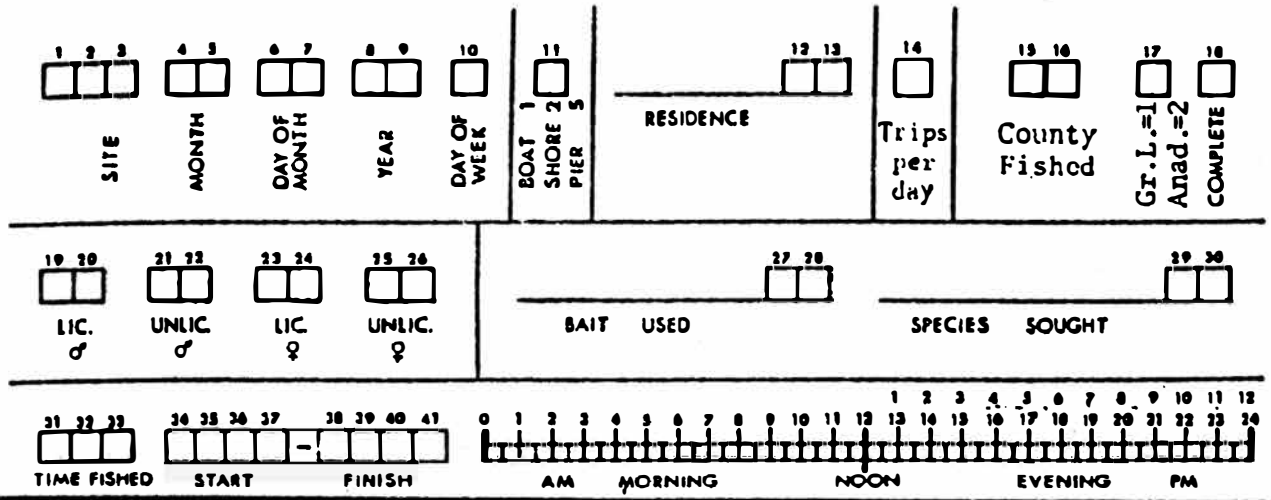
During the study period anglers spent an estimated 8,422,842 (±319,509) hours fishing the Michigan waters of Lake Michigan and 10 tributary streams which were censused. This accounted for an estimated 1,940,347 (±313,394) individual fishing trips. Total angler effort on Lake Michigan by mode of fishing was 81% boat, 12% pier, 5% ice, and 2% shore. St. Joseph-Benton Harbor was the busiest port in terms of angler hours on Lake Michigan.

Total catch was estimated to be over 4.0 million fish. Yellow perch was the most abundant species in the sport catch in most sample areas. The yellow perch catch for all areas censused was estimated at 2,673,415 (±281,594) fish. In addition to yellow perch, sport anglers harvested an estimated 614,140 (±52,172) chinook salmon, 142,492 (±17,806) lake trout, 123,747 (±15,732) coho salmon, 87,826 (±11,809) rainbow trout, and 53,171 (±7,413) brown trout.

ACKNOWLEDGMENTS

The authors wish to thank the staffs of the fisheries management districts who participated in the census program. These field units did the day to day work of angler interviews, fishing pressure counts, and supervision of seasonal workers. Kelley Smith adapted the interview and count entry programs for the micro-computer system. Special thanks to Richard Clark and Jim Ryckman who wrote the computer program for the calculation of the catch and effort estimates. Alan Sutton assisted in tabulating the catch and effort estimates. W. C. Latta edited the manuscript.

Figure 1. Lake Michigan census area.



SPECIES	CODE		# OF FISH		SPECIES	CODE		# OF FISH		SPECIES	CODE		# OF FISH		SPECIES	CODE		# OF FISH	
Rainbow Tr.	0	1			Menominee	1	2			L. M. Bass	2	2			White Sucker	3	3		
Brown Tr.	0	2			Cisco	1	3			Bluegill	2	3			Redhorse Sp.	3	4		
Brook Tr.	0	3			Smelt	1	4			Rockbass	2	4			L. N. Sucker	3	5		
Lake Trout	0	4			N. Pike	1	5			Sunfish Sp.	2	5			Bullhead Sp.	3	6		
Splake	0	5			Musky	1	6			Crappie Sp.	2	6			Channel Cat	3	7		
Coho Salmon	0	7			T. Musky	1	7			White Bass	2	7			Quillback	3	8		
Chinook S.	0	8			Y. Perch	1	8			Drum	2	9			Gar Sp.	3	9		
Atlantic S.	0	9			Walleye	1	9			Carp	3	0			Sturgeon	4	0		
Pink Salmon	1	0			Sauger	2	0			Goldfish	3	1			Burbot	4	1		
L. Whitefish	1	1			S. M. Bass	2	1			Bowfin	3	2			Buffalo Sp.	4	4		

Figure 2. Angler party interview data sheet.

SHORE AND BOAT COUNT DATA

CENSUS CLERK _____ LAKE _____

HOUR	1 01	2 02	3 03	4 04	5 05	6 06	7 07	8 08	9 09	10 10	11 11	12 noon 12	1 13	2 14	3 15	4 16	5 17	6 18	7 19	8 20	9 21	10 22	11 23	12 24

Mon. 1, Tues. 2, Wed. 3, Thur. 4, Fri. 5, Sat. 6, Sun. 7, Holiday 8

1-3	4-6	7-8	9-10	11-12	13	14	15-16	17-19	20-21	22-24	25-26	27-29	30-31	32-34	35-36	37-39	40-41	42-44	45-46	47-49
Lake	Site	Month	Year	Day of Month	Day of Week	Boat - 1 Pier - 5 Shore - 2	HOUR	COUNT	HOUR	COUNT	HOUR	COUNT	HOUR	COUNT	HOUR	COUNT	HOUR	COUNT	HOUR	COUNT

Figure 3. Shore and boat count data sheet.

Table 1. List of scientific and common names of fish observed in study.

Common name	Scientific name
Bowfin	*Amia calva*
Rainbow smelt	*Osmerus mordax*
Northern pike	*Esox lucius*
Brown bullhead	*Ictalurus nebulosus*
Channel catfish	*Ictalurus punctatus*
Burbot	*Lota lota*
Freshwater drum	*Aplodinotus grunniens*
White bass	*Morone chrysops*
Lake herring	*Coregonus artedii*
Lake whitefish	*Coregonus clupeaformis*
Round whitefish	*Prosopium cylindraceum*
Chinook salmon	*Oncorhynchus tshawytscha*
Coho salmon	*Oncorhynchus kisutch*
Pink salmon	*Oncorhynchus gorbuscha*
Rainbow trout	*Oncorhynchus mykiss*
Atlantic salmon	*Salmo salar*
Brown trout	*Salmo trutta*
Brook trout	*Salvelinus fontinalis*
Lake trout	*Salvelinus namaycush*
Splake	*Salvelinus namaycush x S. fontinalis*
White sucker	*Catostomus commersoni*
Redhorse spp.	*Moxostoma* spp.
Rock bass	*Ambloplites rupestris*
Bluegill	*Lepomis macrochirus*
Smallmouth bass	*Micropterus dolomieui*
Largemouth bass	*Micropterus salmoides*
Black crappie	*Pomoxis nigromaculatus*
Yellow perch	*Perca flavescens*
Sauger	*Stizostedion canadense*
Walleye	*Stizostedion vitreum*

Table 2. Estimated catch per hour, number caught, and effort (angler hours, and trips) for Lake Michigan, by all modes of sportfishing, 1985. Two standard errors in parentheses.

Species	Total catch per hour	Month								Season total
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Pink salmon	0.0001 (0.0001)	0 (0)	7 (14)	0 (0)	0 (0)	39 (79)	712 (642)	78 (137)	0 (0)	836 (661)
Coho salmon	0.0161 (0.0023)	9,419 (3,387)	21,072 (10,851)	7,323 (2,699)	8,101 (2,860)	30,264 (7,107)	29,677 (5,525)	5,820 (2,284)	232 (419)	111,908 (15,202)
Chinook salmon	0.0737 (0.0080)	15,758 (4,257)	105,741 (25,063)	30,774 (5,421)	96,449 (17,611)	199,708 (37,658)	54,254 (9,920)	8,456 (2,886)	178 (342)	511,318 (50,108)
Rainbow trout	0.0066 (0.0013)	1,875 (814)	3,556 (1,293)	2,117 (924)	4,477 (1,520)	8,034 (7,337)	5,006 (2,300)	19,982 (3,946)	821 (517)	45,868 (8,970)
Atlantic salmon	0.0002 (0.0002)	0 (0)	249 (504)	55 (99)	115 (186)	25 (52)	898 (1,343)	0 (0)	0 (0)	1,342 (1,451)
Brown trout	0.0070 (0.0011)	6,968 (1,721)	15,265 (5,041)	9,817 (2,994)	7,502 (2,317)	7,365 (3,023)	714 (525)	957 (614)	129 (149)	48,717 (7,247)
Brook trout	<0.0001 (<0.0000)	26 (35)	93 (193)	9 (18)	24 (45)	77 (127)	0 (0)	3 (7)	0 (0)	232 (239)
Lake trout	0.0205 (0.0027)	75 (95)	32,927 (9,407)	36,200 (6,610)	52,341 (12,317)	19,791 (5,696)	419 (423)	422 (672)	0 (0)	142,175 (17,804)
Splake	<0.0001 (<0.0000)	111 (115)	16 (27)	0 (0)	3 (6)	74 (158)	0 (0)	33 (68)	0 (0)	237 (209)
Rainbow smelt	0.0001 (0.0002)	88 (149)	11 (22)	446 (894)	0 (0)	0 (0)	0 (0)	0 (0)	6 (14)	551 (907)
Northern pike	0.0007 (0.0002)	0 (0)	58 (79)	782 (599)	529 (390)	883 (646)	2,037 (1,056)	388 (385)	0 (0)	4,677 (1,483)
White sucker	0.0002 (0.0001)	602 (633)	828 (616)	0 (0)	0 (0)	0 (0)	21 (44)	0 (0)	0 (0)	1,451 (884)
Redhorse spp.	0.0001 (0.0001)	166 (248)	526 (545)	13 (20)	0 (0)	16 (33)	23 (47)	0 (0)	2 (3)	746 (602)
Brown bullhead	0.0001 (0.0002)	59 (98)	46 (71)	10 (15)	317 (665)	0 (0)	0 (0)	0 (0)	0 (0)	432 (676)

Table 2. Continued:

Species	Total catch per hour	Month								Season total
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Channel catfish	0.0018 (0.0020)	48 (52)	1,012 (819)	1,123 (777)	7,119 (13,289)	2,709 (3,859)	217 (308)	11 (24)	0 (0)	12,239 (13,887)
White bass	<0.0001 (<0.0000)	0 (0)	0 (0)	0 (0)	145 (299)	0 (0)	187 (404)	0 (0)	0 (0)	332 (503)
Rock bass	0.0011 (0.0006)	16 (35)	1,624 (1,326)	969 (649)	1,372 (1,996)	1,924 (3,112)	1,191 (1,141)	437 (917)	0 (0)	7,533 (4,242)
Bluegill	0.0019 (0.0019)	0 (0)	4,264 (6,161)	358 (414)	237 (341)	7,654 (11,919)	703 (802)	33 (95)	0 (0)	13,249 (13,452)
Smallmouth bass	0.0026 (0.0015)	29 (61)	1,448 (877)	6,968 (8,968)	3,729 (2,670)	2,081 (2,728)	3,663 (3,312)	265 (434)	0 (0)	18,183 (10,341)
Largemouth bass	0.0003 (0.0002)	0 (0)	103 (194)	19 (34)	167 (223)	532 (583)	889 (1,080)	148 (273)	0 (0)	1,858 (1,292)
Black crappie	0.0003 (0.0004)	691 (1,060)	0 (0)	1,543 (2,615)	14 (23)	30 (46)	0 (0)	0 (0)	0 (0)	2,278 (2,822)
Yellow perch	0.3367 (0.0425)	156,335 (44,633)	57,293 (23,795)	491,876 (120,573)	1,111,091 (214,829)	319,568 (103,297)	82,604 (25,806)	99,656 (34,271)	18,396 (11,947)	2,336,819 (275,502)
Walleye	0.0025 (0.0008)	68 (98)	7,038 (4,593)	2,256 (1,154)	4,334 (2,546)	3,235 (2,022)	512 (376)	145 (149)	0 (0)	17,588 (5,759)
Freshwater drum	0.0046 (0.0024)	26 (53)	2,835 (1,531)	23,817 (16,029)	4,263 (3,404)	925 (853)	157 (227)	0 (0)	0 (0)	32,023 (16,482)
Lake whitefish	0.0129 (0.0038)	4 (8)	677 (1,126)	18,195 (8,450)	45,545 (23,124)	10,097 (6,209)	6,278 (3,878)	9,074 (5,439)	0 (0)	89,870 (26,279)
Round whitefish	0.0027 (0.0007)	434 (244)	337 (360)	822 (1,292)	0 (0)	337 (684)	643 (593)	14,477 (4,221)	1,869 (1,611)	18,919 (4,805)
Burbot	<0.0001 (<0.0000)	12 (25)	76 (115)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	88 (118)
Bullhead spp.	0.0001 (0.0001)	10 (21)	431 (587)	0 (0)	0 (0)	399 (892)	0 (0)	0 (0)	0 (0)	840 (1,068)

Table 2. Continued:

Species	Total catch per hour	Month								Season total
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Crappie spp.	0.0002 (0.0002)	8 (17)	591 (879)	31 (63)	233 (350)	199 (446)	80 (121)	3 (8)	0 (0)	1,145 (1,055)
Sunfish spp.	0.0015 (0.0012)	67 (130)	6,917 (7,217)	1,621 (3,108)	695 (854)	489 (901)	639 (704)	0 (0)	0 (0)	10,428 (7,987)
Bowfin	<0.0001 (<0.0000)	0 (0)	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (3)
Lake herring	0.0001 (0.0002)	0 (0)	0 (0)	0 (0)	0 (0)	306 (627)	187 (404)	0 (0)	0 (0)	493 (746)
Sauger	<0.0001 (<0.0000)	0 (0)	0 (0)	0 (0)	2 (3)	0 (0)	0 (0)	0 (0)	0 (0)	2 (3)
Other	0.0002 (0.0001)	0 (0)	283 (255)	780 (639)	0 (0)	3 (7)	45 (91)	11 (17)	0 (0)	1,122 (694)
Total	0.4950 (0.0466)	192,895 (45,023)	265,324 (39,344)	637,925 (122,715)	1,348,804 (217,650)	616,764 (111,603)	191,756 (28,889)	160,399 (35,400)	21,633 (12,079)	3,435,500 (284,068)
Angler hours		282,784 (36,070)	962,277 (132,737)	922,845 (76,083)	1,626,929 (156,947)	1,886,849 (199,465)	969,682 (91,138)	278,851 (24,186)	10,763 (2,622)	6,940,980 (313,090)
Angler trips		68,565 (7,336)	216,440 (30,954)	228,457 (16,461)	412,456 (42,399)	395,831 (38,424)	222,174 (18,943)	86,218 (6,230)	3,290 (795)	1,633,431 (70,394)

Table 3. Estimated angler effort in hours and trips at selected Lake Michigan ports and fishing areas, 1985. Two standard errors in parentheses.

Port/area	Angler hours	Angler trips
St. Joseph-Benton Harbor	834,443 (116,077)	178,098 (22,542)
Ludington	714,442 (151,419)	153,852 (29,835)
Manistee	629,126 (96,422)	147,958 (19,776)
Grand Haven	590,371 (66,957)	143,375 (13,910)
Muskegon	508,738 (114,646)	124,196 (28,500)

Table 4. Estimated catch per hour, number caught, and effort (angler hours and trips) for the Lake Michigan boat fishery, 1985. Two standard errors in parentheses.

Species	Total catch per hour	Month								Season total
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Pink salmon	0.0001 (0.0001)	0 (0)	7 (14)	0 (0)	0 (0)	39 (79)	200 (438)	72 (137)	0 (0)	318 (466)
Coho salmon	0.0177 (0.0027)	8,879 (3,378)	20,354 (10,849)	6,728 (2,670)	7,645 (2,797)	29,274 (7,088)	26,192 (5,378)	5,188 (2,253)	232 (419)	104,492 (15,115)
Chinook salmon	0.0839 (0.0091)	15,495 (4,251)	104,590 (25,056)	29,832 (5,410)	95,902 (17,608)	194,520 (33,469)	46,698 (9,592)	7,086 (2,655)	176 (342)	494,299 (46,952)
Rainbow trout	0.0044 (0.0009)	1,398 (790)	3,124 (1,275)	1,681 (875)	3,782 (1,463)	6,960 (3,147)	1,865 (898)	6,858 (2,872)	462 (482)	26,130 (4,934)
Atlantic salmon	0.0002 (0.0002)	0 (0)	239 (504)	52 (99)	115 (186)	25 (52)	891 (1,343)	0 (0)	0 (0)	1,322 (1,451)
Brown trout	0.0064 (0.0012)	3,864 (1,223)	11,346 (4,930)	6,929 (2,861)	7,047 (2,303)	6,943 (3,008)	504 (497)	850 (608)	38 (64)	37,521 (6,997)
Brook trout	<0.0001 (<0.0000)	21 (34)	93 (193)	0 (0)	24 (45)	61 (123)	0 (0)	3 (7)	0 (0)	202 (236)
Lake trout	0.0238 (0.0033)	69 (94)	32,722 (9,406)	35,635 (6,599)	51,705 (12,303)	19,606 (5,691)	371 (418)	346 (665)	0 (0)	140,454 (17,788)
Splake	<0.0001 (<0.0000)	97 (114)	16 (27)	0 (0)	3 (6)	74 (158)	0 (0)	33 (68)	0 (0)	223 (208)
Rainbow smelt	<0.0001 (<0.0000)	16 (34)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (14)	22 (37)
Northern pike	0.0007 (0.0002)	0 (0)	58 (79)	576 (498)	510 (388)	863 (646)	1,904 (1,041)	388 (385)	0 (0)	4,299 (1,433)
White sucker	0.0002 (0.0001)	596 (633)	714 (590)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1,310 (865)
Redhorse spp.	0.0001 (0.0001)	109 (219)	526 (545)	5 (10)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	640 (587)
Brown bullhead	0.0001 (0.0002)	59 (98)	46 (71)	6 (13)	317 (665)	0 (0)	0 (0)	0 (0)	0 (0)	428 (676)
Channel catfish	0.0018 (0.0023)	18 (37)	592 (767)	345 (563)	6,842 (13,285)	2,681 (3,859)	217 (308)	0 (0)	0 (0)	10,695 (13,870)

Table 4. Continued:

Species	Total catch per hour	Month								Season total
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
White bass	<0.0001 (<0.0000)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	187 (404)	0 (0)	0 (0)	187 (404)
Rock bass	0.0006 (0.0006)	16 (35)	296 (239)	449 (422)	351 (376)	1,812 (3,109)	258 (440)	437 (917)	0 (0)	3,619 (3,328)
Bluegill	0.0021 (0.0022)	0 (0)	4,185 (6,160)	58 (121)	191 (327)	7,553 (11,918)	573 (786)	33 (95)	0 (0)	12,593 (13,444)
Smallmouth bass	0.0026 (0.0017)	29 (61)	611 (568)	6,299 (8,954)	3,298 (2,639)	1,850 (2,719)	3,175 (3,279)	228 (429)	0 (0)	15,490 (10,286)
Largemouth bass	0.0003 (0.0002)	0 (0)	96 (193)	0 (0)	123 (212)	428 (556)	886 (1,080)	146 (273)	0 (0)	1,679 (1,278)
Black crappie	0.0002 (0.0004)	47 (95)	0 (0)	1,384 (2,602)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1,431 (2,604)
Yellow perch	0.2963 (0.0480)	112,015 (39,961)	33,830 (22,589)	332,361 (117,658)	815,431 (207,357)	265,459 (102,770)	75,634 (25,614)	92,296 (34,141)	18,395 (11,947)	1,745,421 (267,345)
Walleye	0.0028 (0.0010)	35 (73)	6,561 (4,565)	2,225 (1,153)	4,076 (2,513)	3,231 (2,022)	512 (376)	135 (148)	0 (0)	16,775 (5,722)
Freshwater drum	0.0002 (0.0002)	0 (0)	64 (129)	203 (425)	791 (1,153)	244 (319)	25 (52)	0 (0)	0 (0)	1,327 (1,277)
Lake whitefish	0.0153 (0.0045)	0 (0)	677 (1,126)	18,195 (8,450)	45,545 (23,124)	10,097 (6,209)	6,278 (3,878)	9,074 (5,439)	0 (0)	89,866 (26,279)
Round whitefish	0.0009 (0.0004)	0 (0)	312 (357)	822 (1,292)	0 (0)	337 (684)	543 (583)	3,005 (1,783)	0 (0)	5,019 (2,405)
Burbot	<0.0001 (<0.0000)	0 (0)	76 (115)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	76 (115)
Crappie spp.	<0.0001 (<0.0000)	8 (17)	115 (169)	0 (0)	63 (63)	0 (0)	80 (121)	0 (0)	0 (0)	266 (218)
Sunfish spp.	0.0003 (0.0004)	67 (130)	1,349 (2,094)	0 (0)	127 (171)	78 (123)	199 (419)	0 (0)	0 (0)	1,820 (2,150)
Lake herring	0.0001 (0.0002)	0 (0)	0 (0)	0 (0)	0 (0)	306 (627)	187 (404)	0 (0)	0 (0)	493 (746)

Table 4. Continued:

Species	Total catch per hour	Month								Season total
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Other	0.0001 (0.0001)	0 (0)	260 (253)	155 (241)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	415 (349)
Total	0.4615 (0.0526)	142,838 (40,361)	222,859 (37,905)	443,940 (118,721)	1,043,888 (210,239)	552,441 (109,553)	167,379 (28,464)	126,178 (34,941)	19,309 (11,969)	2,718,832 (274,840)
Angler hours		216,531 (35,606)	871,520 (132,602)	758,946 (75,449)	1,339,199 (152,505)	1,728,638 (199,188)	812,485 (90,528)	157,619 (23,345)	5,953 (2,422)	5,890,891 (310,199)
Angler trips		46,088 (6,986)	182,873 (30,839)	163,151 (15,839)	282,219 (31,278)	333,790 (38,117)	167,519 (18,396)	50,555 (5,869)	1,884 (723)	1,228,079 (63,681)

Table 5. Estimated catch per hour, number caught, and effort (angler hours and trips) for the Lake Michigan pier fishery, 1985. Two standard errors in parentheses.

Species	Total catch per hour	Month								Season total
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Pink salmon	<0.0001 (<0.0000)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	9 (18)	6 (8)	0 (0)	15 (20)
Coho salmon	0.0072 (0.0018)	540 (251)	718 (199)	595 (393)	451 (593)	962 (520)	2,428 (1,132)	357 (243)	0 (0)	6,051 (1,490)
Chinook salmon	0.0168 (0.0206)	263 (217)	1,100 (573)	924 (345)	534 (329)	4,576 (17,260)	6,177 (1,310)	598 (290)	2 (4)	14,174 (17,329)
Rainbow trout	0.0184 (0.0088)	251 (144)	372 (210)	425 (294)	695 (414)	1,074 (6,628)	2,669 (2,044)	9,660 (2,467)	302 (107)	15,448 (7,384)
Atlantic salmon	<0.0001 (<0.0000)	0 (0)	10 (20)	3 (6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	13 (21)
Brown trout	0.0107 (0.0020)	2,156 (1,076)	3,304 (941)	2,448 (763)	455 (260)	419 (301)	103 (94)	75 (67)	24 (43)	8,984 (1,673)
Brook trout	<0.0001 (<0.0000)	5 (8)	0 (0)	9 (18)	0 (0)	16 (32)	0 (0)	0 (0)	0 (0)	30 (38)
Lake trout	0.0020 (0.0009)	6 (13)	205 (124)	565 (379)	636 (570)	185 (238)	48 (61)	76 (97)	0 (0)	1,721 (744)
Splake	<0.0001 (<0.0000)	14 (17)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	14 (17)
Rainbow smelt	0.0006 (0.0010)	72 (145)	11 (22)	446 (894)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	529 (906)
Northern pike	0.0001 (0.0001)	0 (0)	0 (0)	0 (0)	0 (0)	20 (30)	37 (47)	0 (0)	0 (0)	57 (56)
White sucker	0.0001 (0.0001)	0 (0)	35 (59)	0 (0)	0 (0)	0 (0)	21 (44)	0 (0)	0 (0)	56 (74)
Redhorse spp.	0.0001 (0.0001)	0 (0)	0 (0)	8 (17)	0 (0)	16 (33)	23 (47)	0 (0)	2 (3)	49 (60)
Channel catfish	0.0010 (0.0007)	28 (37)	235 (246)	302 (344)	202 (308)	28 (56)	0 (0)	11 (24)	0 (0)	806 (528)
Rock bass	0.0025 (0.0026)	0 (0)	42 (82)	49 (73)	1,008 (1,960)	112 (133)	909 (1,051)	0 (0)	0 (0)	2,120 (2,231)

Table 5. Continued:

Species	Total catch per hour	Month								Season total
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Bluegill	0.0004 (0.0003)	0 (0)	59 (82)	29 (58)	46 (95)	101 (123)	130 (160)	0 (0)	0 (0)	365 (245)
Smallmouth bass	0.0016 (0.0009)	0 (0)	151 (285)	173 (326)	299 (373)	181 (195)	488 (469)	37 (66)	0 (0)	1,329 (767)
Largemouth bass	0.0002 (0.0003)	0 (0)	0 (0)	0 (0)	34 (64)	101 (174)	3 (6)	2 (5)	0 (0)	140 (186)
Black crappie	0.0008 (0.0012)	505 (1,015)	0 (0)	159 (252)	14 (23)	30 (46)	0 (0)	0 (0)	0 (0)	708 (1,047)
Yellow perch	0.6316 (0.0797)	1,150 (954)	17,740 (6,560)	152,865 (26,099)	292,474 (56,106)	53,788 (10,403)	6,505 (3,043)	7,096 (2,928)	1 (3)	531,619 (63,238)
Walleye	0.0004 (0.0005)	0 (0)	92 (138)	0 (0)	222 (405)	4 (9)	0 (0)	10 (16)	0 (0)	328 (428)
Freshwater drum	0.0045 (0.0053)	26 (53)	416 (398)	2,480 (4,352)	237 (309)	617 (777)	25 (51)	0 (0)	0 (0)	3,801 (4,450)
Lake whitefish	<0.0001 (<0.0000)	4 (8)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (8)
Round whitefish	0.0163 (0.0050)	434 (244)	25 (50)	0 (0)	0 (0)	0 (0)	100 (105)	11,291 (3,820)	1,869 (1,611)	13,719 (4,155)
Burbot	<0.0001 (<0.0000)	12 (25)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	12 (25)
Crappie	0.0002 (0.0004)	0 (0)	0 (0)	0 (0)	170 (344)	0 (0)	0 (0)	0 (0)	0 (0)	170 (344)
Sunfish spp.	0.0004 (0.0006)	0 (0)	10 (16)	0 (0)	0 (0)	12 (23)	295 (477)	0 (0)	0 (0)	317 (478)
Sauger	<0.0001 (<0.0000)	0 (0)	0 (0)	0 (0)	2 (3)	0 (0)	0 (0)	0 (0)	0 (0)	2 (3)
Other	0.0001 (0.0001)	0 (0)	8 (17)	57 (115)	0 (0)	0 (0)	45 (91)	11 (17)	0 (0)	121 (149)

Table 5. Continued:

Species	Total catch per hour	Month								Season total
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Total	0.7160 (0.0844)	5,466 (1,821)	24,533 (6,685)	161,537 (26,501)	297,479 (56,155)	62,242 (21,241)	20,015 (4,249)	29,230 (5,423)	2,200 (1,615)	602,702 (66,370)
Angler hours		46,049 (4,630)	63,705 (4,842)	117,975 (8,602)	247,306 (30,554)	149,216 (10,322)	128,198 (8,945)	85,919 (4,968)	3,353 (865)	841,721 (35,559)
Angler trips		15,915 (1,938)	22,526 (1,786)	42,134 (3,286)	107,876 (21,680)	57,493 (4,681)	46,393 (4,221)	25,902 (1,688)	1,096 (287)	319,335 (23,031)

Table 6. Estimated catch per hours, number caught, and effort (angler hours and trips) for the Lake Michigan shore fishery, 1985. Two standard errors in parentheses.

Species	Total catch per hour	Month								Season total
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Pink salmon	0.0024 (0.0023)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	503 (469)	0 (0)	0 (0)	503 (469)
Coho salmon	0.0066 (0.0032)	0 (0)	0 (0)	0 (0)	5 (10)	28 (60)	1,057 (573)	275 (282)	0 (0)	1,365 (642)
Chinook salmon	0.0137 (0.0119)	0 (0)	51 (76)	18 (19)	13 (26)	612 (300)	1,379 (2,164)	772 (1,093)	0 (0)	2,845 (2,444)
Rainbow trout	0.0206 (0.0065)	226 (130)	60 (44)	11 (13)	0 (0)	0 (0)	472 (555)	3,464 (1,114)	57 (152)	4,290 (1,261)
Atlantic salmon	<0.0001 (<0.0000)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7 (14)	0 (0)	0 (0)	7 (14)
Brown trout	0.0106 (0.0043)	948 (557)	615 (465)	440 (442)	0 (0)	3 (7)	107 (139)	32 (49)	67 (128)	2,212 (872)
Northern pike	0.0015 (0.0018)	0 (0)	0 (0)	206 (332)	19 (37)	0 (0)	96 (172)	0 (0)	0 (0)	321 (376)
White sucker	0.0004 (0.0008)	6 (9)	79 (166)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	85 (166)
Redhorse spp.	0.0003 (0.0006)	57 (115)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	57 (115)
Brown bullhead	<0.0001 (<0.0000)	0 (0)	0 (0)	4 (7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (7)
Channel catfish	0.0035 (0.0022)	2 (3)	185 (151)	476 (411)	75 (108)	0 (0)	0 (0)	0 (0)	0 (0)	738 (451)
White bass	0.0007 (0.0014)	0 (0)	0 (0)	0 (0)	145 (299)	0 (0)	0 (0)	0 (0)	0 (0)	145 (299)
Rock bass	0.0086 (0.0067)	0 (0)	1,286 (1,302)	471 (487)	13 (29)	0 (0)	24 (51)	0 (0)	0 (0)	1,794 (1,391)
Bluegill	0.0014 (0.0019)	0 (0)	20 (40)	271 (392)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	291 (394)
Smallmouth bass	0.0065 (0.0036)	0 (0)	686 (605)	496 (378)	132 (160)	50 (108)	0 (0)	0 (0)	0 (0)	1,364 (739)

Table 6. Continued:

Species	Total catch per hour	Month								Season total
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Largemouth bass	0.0002 (0.0002)	0 (0)	7 (14)	19 (34)	10 (21)	3 (7)	0 (0)	0 (0)	0 (0)	39 (43)
Black crappie	0.0007 (0.0015)	139 (290)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	139 (290)
Yellow perch	0.2869 (0.1043)	43,170 (19,859)	5,723 (3,597)	6,650 (3,627)	3,186 (2,578)	321 (521)	465 (784)	264 (579)	0 (0)	59,779 (20,696)
Walleye	0.0023 (0.0024)	33 (66)	385 (487)	31 (37)	36 (75)	0 (0)	0 (0)	0 (0)	0 (0)	485 (499)
Freshwater drum	0.1291 (0.0773)	0 (0)	2,355 (1,473)	21,134 (15,421)	3,235 (3,188)	64 (145)	107 (215)	0 (0)	0 (0)	26,895 (15,818)
Round whitefish	0.0009 (0.0010)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	181 (204)	0 (0)	181 (204)
Bullhead spp.	0.0040 (0.0051)	10 (21)	431 (587)	0 (0)	0 (0)	399 (892)	0 (0)	0 (0)	0 (0)	840 (1,068)
Crappie spp.	0.0034 (0.0047)	0 (0)	476 (863)	31 (63)	0 (0)	199 (446)	0 (0)	3 (8)	0 (0)	709 (974)
Sunfish spp.	0.0398 (0.0371)	0 (0)	5,558 (6,907)	1,621 (3,108)	568 (836)	399 (892)	145 (305)	0 (0)	0 (0)	8,291 (7,678)
Bowfin	<0.0001 (<0.0000)	0 (0)	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (3)
Other	0.0028 (0.0028)	0 (0)	15 (31)	568 (581)	0 (0)	3 (7)	0 (0)	0 (0)	0 (0)	586 (582)
Total	0.5469 (0.1450)	44,591 (19,870)	17,932 (8,154)	32,448 (16,186)	7,437 (4,200)	2,081 (1,479)	4,362 (2,519)	4,991 (1,701)	124 (199)	113,966 (27,430)
Angler hours		20,204 (3,446)	27,052 (3,506)	45,924 (4,697)	40,424 (21,000)	8,995 (1,926)	28,999 (5,552)	35,313 (3,915)	1,457 (508)	208,368 (23,181)
Angler trips		6,562 (1,120)	11,041 (1,984)	23,172 (3,048)	22,361 (18,691)	4,548 (1,244)	8,262 (1,614)	9,761 (1,236)	310 (165)	86,017 (19,223)

Table 7. Mean total length, weight, and number sampled of various species of fish harvested by the Lake Michigan sport fishery, 1985. Two standard errors in parentheses.

Species	Mean length	Mean weight	Number sampled
Chinook salmon	29.77 (0.29)	10.84 (0.28)	1,641
Coho salmon	22.43 (0.34)	4.57 (0.20)	421
Lake trout	24.91 (0.19)	5.77 (0.16)	1,080
Rainbow trout	25.24 (0.33)	6.53 (0.20)	972
Brown trout	20.80 (0.22)	5.31 (0.17)	820
Yellow perch	8.55 (0.06)	0.35 (0.02)	1,282

Table 8. Estimated catch and catch rate (fish per angler hour) of yellow perch at selected Lake Michigan ports and fishing areas, 1985. Two standard errors in parentheses.

Port/area	Number of fish	Catch per hour
New Buffalo	273,796 (76,480)	1.011 (0.329)
St. Joseph-Benton Harbor	664,671 (193,119)	0.797 (0.257)
South Haven	292,225 (82,560)	0.753 (0.241)
Saugatuck	240,685 (108,085)	0.600 (0.288)
Holland	105,398 (71,208)	0.392 (0.279)
Grand Haven	110,084 (23,606)	0.186 (0.045)
Ludington	121,230 (51,031)	0.170 (0.080)
Big Bay de Noc[1]	153,036 (46,992)	6.296 (2.723)
Little Bay de Noc	64,609 (27,230)	0.483 (0.217)

[1]Sampled during April and May only.

Table 9. Estimated catch and catch rate (fish per angler) of chinook salmon at selected Lake Michigan ports and fishing areas, 1985. Two standard errors in parentheses.

Port/area	Number of fish	Catch per hour
St. Joseph-Benton Harbor	35,518 (10,707)	0.043 (0.014)
Grand Haven	39,179 (19,409)	0.066 (0.034)
Muskegon	53,859 (22,652)	0.106 (0.051)
White Lake	41,903 (13,382)	0.108 (0.044)
Ludington	87,609 (21,820)	0.123 (0.040)
Manistee	67,915 (15,307)	0.108 (0.030)
Portage Lake	30,853 (15,109)	0.149 (0.085)
Frankfort-Elberta	27,758 (6,376)	0.085 (0.023)
Leland	11,909 (12,451)	0.220 (0.279)
Charlevoix	10,375 (3,999)	0.066 (0.030)

Table 10. Estimated catch and catch rate (fish per angler hour) of lake trout at selected Lake Michigan ports and fishing areas, 1985. Two standard errors in parentheses.

Port/area	Number of fish	Catch per hour
St. Joseph/Benton Harbor	16,473 (6,651)	0.020 (0.008)
Saugatuck	8,555 (3,782)	0.021 (0.010)
Grand Haven	9,661 (3,637)	0.016 (0.006)
Muskegon	8,552 (7,630)	0.017 (0.016)
White Lake	10,517 (4,185)	0.027 (0.013)
Ludington	14,380 (6,190)	0.020 (0.010)
Manistee	7,280 (2,364)	0.012 (0.004)
Frankfort-Elberta	7,884 (1,956)	0.024 (0.007)
West Grand Traverse Bay	6,769 (2,708)	0.024 (0.010)
Charlevoix	15,216 (8,800)	0.097 (0.061)
Petoskey	11,351 (2,988)	0.117 (0.034)

Table 11. Estimated catch and catch rate (fish per angler hour) of coho salmon at selected Lake Michigan ports and fishing areas, 1985. Two standard errors in parentheses.

Port/area	Number of fish	Catch per hour
New Buffalo	11,804 (3,146)	0.0440 (0.014)
St. Joseph-Benton Harbor	13,875 (4,835)	0.017 (0.006)
Muskegon	11,781 (10,424)	0.023 (0.021)
White Lake	6,632 (3,408)	0.017 (0.010)
Ludington	10,138 (3,749)	0.014 (0.006)
Manistee	13,341 (4,241)	0.021 (0.080)
Platte Bay	14,654 (3,612)	0.166 (0.044)

Table 12. Estimated sportfishing catch and effort (angler hours) for salmonids taken at various Lake Michigan tributaries, winter 1986. Two standard errors in parentheses.

River	Chinook salmon	Coho salmon	Rainbow trout	Brown trout	Angler hours
St. Joseph	4,539 (1,753)	258 (211)	2,513 (1,297)	1,424 (852)	203,376 (30,065)
Kalmazoo	1,823 (436)	864 (242)	864 (242)	564 (193)	27,245 (2,254)
Muskegon	17,499 (3,465)	0 (0)	8,843 (2,420)	418 (350)	202,966 (12,271)
Pentwater Lake and River	13 (15)	0 (0)	0 (0)	27 (44)	10,051 (1,906)
Manistee	25,394 (7,528)	2,504 (1,698)	17,209 (5,609)	254 (256)	290,562 (28,938)
Manistee Lake	36,101 (10,111)	2,981 (2,087)	2,953 (2,578)	559 (605)	191,822 (21,360)
Little Manistee	3,132 (1,498)	92 (187)	92 (187)	0 (0)	38,742 (8,536)
Betsie	10,687 (5,383)	3,084 (2,578)	3,117 (2,490)	790 (978)	114,950 (20,673)
Platte	472 (375)	1,176 (1,275)	863 (377)	2 (5)	11,879 (1,590)
Bear	2,483 (2,269)	563 (595)	3,548 (1,738)	81 (100)	28,387 (3,387)
Boyne	679 (631)	317 (635)	1,649 (1,944)	219 (376)	11,012 (2,078)
Total	102,822 (14,529)	11,839 (4,050)	41,654 (7,673)	4,338 (1,558)	1,130,983 (53,633)

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