Sportfishing Catch and Effort from the Michigan Waters of Lakes Michigan, Huron, Erie, and Superior, and their Important Tributary Streams, April 1, 1989 - March 31, 1990

Gerald P. Rakoczy
and
Richard D. Rogers

Number 91 - 10a
July 23, 1991

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
FISHERIES DIVISION

Fisheries Technical Report No. 91-10a
July 23, 1991

SPORTFISHING CATCH AND EFFORT FROM THE MICHIGAN WATERS OF LAKES MICHIGAN, HURON, ERIE, AND SUPERIOR, AND THEIR IMPORTANT TRIBUTARY STREAMS, APRIL 1, 1989 - MARCH 31, 1990[1]

Gerald P. Rakoczy
and
Richard D. Rogers

PRINTED BY AUTHORITY OF Michigan Department of Natural Resources
TOTAL NUMBER OF COPIES: 350 TOTAL COST: $682.62 COST PER COPY $1.95
Michigan Department of Natural Resources DNR

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

Michigan Department of Natural Resources
Fisheries Technical Report No. 91-10a, 1991

Sportfishing Catch and Effort from the Michigan Waters of Lakes Michigan, Huron, Erie, and Superior, and their Important Tributary Streams, April 1, 1989 - March 31, 1990

Gerald P. Rakoczy
and
Richard D. Rogers

Michigan Department of Natural Resources
Charlevoix Fisheries Research Station
97 Grant Street
Charlevoix, Michigan 49720

Abstract.—Sportfishing catch and effort were sampled on lakes Michigan, Huron, Erie, and Superior, and on two important river systems from April 1, 1989 through March 31, 1990. The objective of the creel survey program was to obtain a continuous record of sport catch, catch rates, and catch composition for the Great Lakes and important anadromous river fisheries. Over 50,000 anglers were interviewed 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 8.0 million angler hours in all areas of the Michigan waters of the Great Lakes that were surveyed. Forty-seven percent of the total angler hours were spent on Lake Erie while, 35% and 14% were spent on Lake Michigan and Saginaw Bay, respectively. Total harvest was estimated to be over 6.7 million fish. Yellow perch were the most abundant species in the sport catch in most sample areas, totaling 4.1 million fish. In addition to yellow perch, sport anglers harvested an estimated 1.1 million walleye, 95,000 chinook salmon, 94,000 lake trout, 72,000 coho salmon, 34,000 rainbow trout, and 19,000 brown trout.

Michigan's Great Lakes sport fishery has been monitored with a statewide contact creel survey program since 1983. The objective of the program is to obtain a continuous record of sport catch, catch rates, and catch composition for the Great Lakes and important anadromous river fisheries. In this report, catch of fish is synonymous with harvest of fish or fish removed. No estimates were made of numbers of fish caught and released.

A fundamental requirement for sound management of the Great Lakes fisheries is knowledge of the response of fish stocks to fishing and the contributions of various fish stocks to the fisheries. The success and future value of the Great Lakes 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 help identify discrete spawning populations and determine their spatial distribution, movements, and contribution to various sport fisheries. In future years, data collected from this program may be used to develop, test, and improve decision models which will help discern

management strategies for Great Lakes fish communities and fisheries.

Study Area and Methods

Michigan Department of Natural Resources (MDNR) Fisheries Division personnel interviewed over 50,000 anglers at the end of their fishing trips during the 1989 license year, April 1, 1989 through March 31, 1990. Approximately 48,500 of these anglers were contacted during the April through November open-water season. A total of 1,900 anglers were interviewed during the winter ice-fishing season, January through March, 1990.

During the 1989 open-water season, the survey was conducted at important ports and angling areas on Lake Michigan from New Buffalo to Charlevoix and from Manistique to Menominee (Figure 1). Lake Huron creel surveys were conducted on Saginaw Bay, from Tawas to Port Austin, and at the port of Rogers City (Figure 2). A survey focusing on the boat fishery, was conducted on Lake Erie from Pointe Mouillee to the Michigan-Ohio state line (Figure 3). Two areas were sampled on Lake Superior during the 1989 open-water season, Traverse Bay and Huron Bay (Figure 4). Winter ice fisheries were sampled at two Great Lakes sites, Little Bay de Noc on Lake Michigan, and Keweenaw Bay on Lake Superior (Figures 1 and 4). The total number of fishing areas sampled during the 1989 license year was greatly reduced compared to prior years (1986-88) due to budget constraints.

The creel survey was based on a stratified design using simple random sampling within strata. Strata included port fished, month, weekday-weekend (holiday), and mode of fishing (boat, shore, pier, open ice, or shanty ice). Catch-and-effort estimates were made for each strata and then combined to give monthly and seasonal figures. 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.

Two types of data were collected for each area sampled: angler party interviews to estimate catch rates and angler (or boat) counts to estimate effort. 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 about their mode, location, and time of fishing and were asked to reveal the species of fishes they sought, the numbers and types of fishes they harvested, and the number of fishing trips they made or intended to make that day. Additional data were collected on each angler in the party such as age and sex, zip code or 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 survey personnel (Figure 5).

Instantaneous and interval counts were used to sample fishing effort. 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 45-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.

Most fishing effort counts were done from the ground by survey workers at randomly selected times. Counts made from airplanes (instantaneous) of boats, pier, and shore anglers were used only when ground counts were not feasible, such as areas with many access points or restricted visibility. Air flights were used to make fishing effort counts on Saginaw Bay and Lake Erie. Local flight service companies were contracted to make aerial counts. Four flights were made each week at randomly selected starting times—one each weekend day, and one on each of two randomly selected week days. All effort counts, whether accomplished from the ground or air, were recorded on count data forms by survey clerks or contract pilots (Figure 6).

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 a 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 software used for data entry employed range checks on various data fields for each count or interview record that was keyed. In addition, a module of the creel catch estimate software performed a final check of the data before the catch estimates were made.

Catch and effort estimates were made for each port or fishing area by month and species. Standard mathematical formulas for creel survey (Ryckman 1981; Smith and Ryckman, in preparation) were used to calculate all estimates. Three measures of fishing effort were calculated: angler hours, angler trips, and angler days. An angler trip is one completed fishing excursion. An angler day is composed of one or more fishing excursions during a 24-hour period. Error bounds for all catch and effort estimates in this report are defined as two standard errors of the mean (two times the square root of the variance of an estimate) and approximate true 70-95% confidence limits, depending on sample size. Error bounds for all mean length and weight data are 95% confidence limits.

Statistical significance in the analysis comparing lake-wide or port estimates between years is based on two standard error limits. Information from the previous year is contained in Rakoczy and Rogers (1990a,b). Also, prior to August 1, 1989, the charter boat mode of fishing was included as part of this study. As a result of new legislation in Michigan during 1989, charter boat operators were required to report their clients catch and angling effort monthly to MDNR. Therefore, after that date charter boats were no longer covered by this study. However, in order to make valid year-to-year comparisons, the charter boat data was added to the catch and effort estimates generated by this study. All charter boat data referred to in this report are from Rakoczy and Rogers (in preparation).

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 91-10b.

Results

Lake Michigan

Anglers spent an estimated 2,844,472 (±244,631) hours fishing the Michigan waters of Lake Michigan at the 16 areas sampled during the March 15 through November 15, 1989 open-water season (Table 2). The number of hours fished converts to an estimated 645,163 (±46,973) individual angler trips or 586,082 (±44,328) angler days. Total angling effort by mode of fishing was 84% boat, 13% pier, and 3% shore.

Total angler effort in 1989 at 10 major sample areas combined decreased by only 7% compared to the same period in 1988 (Table 3). Total angler effort has decreased each year since 1986 at these sites. The greatest increases in angling effort compared to 1988 occurred at Frankfort (39%) and Little Bay de

Noc (51%). The greatest decreases in effort compared to 1988 occurred at Grand Haven (47%) and Manistee (35%). The port of Ludington had more angler activity than any other port in 1989, with an estimated 442,578 (±85,069) angler hours.

The average length of a fishing trip (all modes of fishing) was 4.4 hours. Anglers made approximately 1.1 fishing trips per day.

These statistics were virtually unchanged compared to 1988. Boat trips were the longest in duration, averaging 5.0 hours. Pier and shore trips averaged 2.9 and 2.6 hours, respectively.

Fishermen caught an estimated 1,789,018 (±241,054) fish comprising 27 species during 1989 (Table 2). The bulk of this catch (82%) came from the boat fishery, while pier and shore anglers harvested 14% and 4% of the total catch, respectively (Tables 4, 5, and 6).

The yellow perch was the most numerous species in the catch, making up 76% of all the fish harvested. An estimated 1,364,255 (±235,998) yellow perch were harvested by all modes of fishing (Table 2). The average total length of yellow perch kept by Lake Michigan anglers in 1989 was 8.79 (±0.06) inches. During 1989, 15% of all Lake Michigan angler parties interviewed said their target species was yellow perch. The largest perch catch (313,077; ±84,235 fish) of all areas sampled in 1989 occurred at St. Joseph (Table 7.)

Yellow perch catch rates at seven Lake Michigan sample areas combined decreased (22%) in 1989 compared to 1988 (Table 7). Prior to 1989, yellow perch catch rates had increased each year since 1985. The greatest catch rate for perch during 1989 was 1.102 (±0.475) fish per angler hour at Muskegon. The greatest changes in catch rates for yellow perch in 1989 compared to 1988 occurred at St. Joseph (-46%) and in the West Arm of Grand Traverse Bay (+190%) (Table 7).

Although yellow perch are important to the Lake Michigan sport fishery, many anglers (40%) seek the various species of salmonids. The Lake Michigan salmonid catch, exclusive of lake whitefish, in the study area was estimated at 279,360 (±34,604) fish. The vast majority of the salmonid harvest (93%) came from the boat fishery (Table 4). The salmonid catch was composed of 29% lake trout, 28% chinook salmon, 25% coho salmon, 10% rainbow trout, 7% brown trout, and 1% pink salmon, and splake. The species composition of the salmonid catch continued to shift in 1989 compared to previous years. In 1989 marked the first year since catch estimates have been made on Lake Michigan (1985) in which lake trout dominated the sport catch. Prior to 1989, chinook salmon dominated the catch, ranging from 59% of the salmonid harvest in 1985 to 45% in 1988 (Rakoczy and Rogers 1988a,b, 1990a,b). The percent composition of coho salmon in the salmonid catch increased by 14 percentage points in 1989 compared to 1988.

The total salmonid harvest at nine important Lake Michigan fishing areas combined increased slightly (9%) in 1989 compared to 1988 (Table 8). Catch rates for all salmonids combined in 1989 was 0.129 (±0.017) fish per hour compared to 0.105 (±0.012) in 1988. The increase in the salmonid catch and catch rates at these ports was mainly due to increased catch rates of coho salmon and lake trout. Catch rates for coho and lake trout increased by 128% and 29% in 1989 compared to 1988, respectively. Angler effort in 1989 for these areas decreased by 11% compared to 1988. Angler effort has decreased each year since 1985 at these nine ports.

Chinook salmon have been one of the most important salmonids in the Lake Michigan sport fishery in terms of numbers and weight of fish harvested (Rakoczy and Rogers 1987a,b, 1988a,b,c,d and 1990a,b). An estimated 79,222 (±18,284) chinooks were creeled by anglers during 1989 at all sample areas combined (Table 2). Biological data collected from the Lake Michigan sport catch during 1989 indicated that the mean size of a chinook in the sport catch was 27.88 (±0.47) inches or 10.17 (±0.46) pounds. The harvest of chinook in 1989 at nine important salmonid ports decreased by 25% in numbers of fish compared to 1988 (Table 8). The harvest and catch rate for chinook salmon have decreased each year since 1986. Catch rates for chinook at these nine areas combined declined from 0.103 (±0.024) fish per hour in 1986 to 0.034 (±0.008) in 1989. The largest catch of chinook (16,836; ±5,473 fish) came from the

port of Ludington. Catch rates for chinook increased slightly in 1989 compared to 1988 at New Buffalo, St. Joseph, and Frankfort (Table 9). In general, a decrease in chinook catch rates occurred at most other salmonid ports in 1989 compared to 1988.

The lake trout was the most abundant salmonid in the sport catch in 1989. An estimated 80,682 (±13,244) were harvested from all the ports sampled. Data collected from the sport fishery during 1989 indicated that creeled lake trout averaged 25.55 (±0.21) inches in length and weighed 6.51 (±0.19) pounds. Of all the fishing areas sampled, the largest estimated lake trout catch (14,957; ±9,644 fish) occurred at Frankfort. The total catch of lake trout at nine important salmonid fishing areas increased 18% in 1989 compared to 1988 (Table 8). The catch rate for lake trout at the nine ports combined increased from 0.034 (±0.007) fish per hour in 1988 to 0.044 (±0.009) in 1989.

The greatest catch rates for lake trout in 1989 were noted in the Charlevoix 0.165 (±0.060) and West Grand Traverse Bay 0.117 (±0.043) areas (Table 9). These two sample areas also had the best lake trout catch rates in 1988.

Coho salmon was the third most numerous salmonid in the sport catch. The estimated harvest of coho salmon in 1989 was 70,251 (±25,200) fish (Table 2). The average size of coho harvested was 22.69 (±0.42) inches in length and weighed 4.98 (±0.29) pounds. The catch of coho at nine ports combined increased significantly in 1989 by over 100% compared to 1988 (Table 8). Catch rates at these areas combined increased over twofold in 1989 compared to 1988. The catch rate of 0.032 (±0.011) fish per hour for coho in 1989 was the greatest estimated since 1985. The greatest catch (39,598 ± 10,202) of coho occurred at New Buffalo and St. Joseph. Seventy-nine percent of coho harvest at these two ports was taken during April.

An estimated 28,042 (±5,563) rainbow trout were harvested from all Lake Michigan ports sampled during 1989. Over 60% of the harvest was taken during June, July, and August in the offshore boat fishery. This was consistent with the 1988 data. However, in 1987, 68% of the harvest came during September and October from the pier and shore fishery (Keller et al. 1990). Mean size of rainbow in the Lake Michigan sport catch during 1989 was 27.23 (±0.31) inches or 7.74 (±0.23) pounds. The catch, and catch rate for rainbow have increased each year since 1986 at the nine salmonid ports (Table 8). The greatest catch (8,471 ± 4,479) and catch rate (0.024; ±0.018) for rainbow in 1989 occurred at Frankfort.

A total of 18,470 (±4,282) brown trout with an average size of 19.89 (±0.38) inches or 4.26 (±0.29) pounds were estimated to have been caught by Lake Michigan anglers in 1989 (Table 2). The brown trout catch or catch rate has not significantly changed since 1987 (Table 8). The greatest catch (4,205 ± 2,552 fish) of brown trout in 1989 occurred at Manistee. The greatest catch rate (0.030 ± 0.017) for browns occurred in the Menominee area. As has been the case in recent years (Rakoczy and Rogers, 1988c,d, 1990a,b), a large percentage (47%) of the brown trout catch has been taken at the central Lake Michigan ports of Ludington, Manistee, and Frankfort.

Lake Huron

Lake Huron anglers fishing the waters of Saginaw Bay spent an estimated 1,151,830 (±95,472) hours fishing the area from Port Austin to Tawas (Table 10). This represented an estimated 251,602 (±19,410) fishing trips or 240,360 (±18,753) angler days. The average length of a fishing trip was 4.6 hours and anglers made 1.0 trips per day. Angler effort on Saginaw Bay in 1989 decreased 21% compared to the same period (April-September) in 1988 (Table 11). Angler effort on Saginaw Bay has decreased each year since 1986.

Saginaw Bay anglers harvested an estimated 1,315,632 (±187,138) fish representing 25 species in 1989 (Table 10). During the open-water season, 42% of all angler parties interviewed said their target species was yellow perch, 14% were seeking walleye, and 12% responded that they were seeking yellow perch or walleye.

Yellow perch dominated the catch in Saginaw Bay making up 92% of all fish

harvested. An estimated 1,206,255 (±186,292) yellow perch were harvested during April through October. The mean length of yellow perch kept by Saginaw Bay anglers in 1989 was 7.38 (±0.06) inches. The 1989 harvest of yellow perch from the Bay was not significantly different than 1988 (Table 11). Also, the estimated catch rate for yellow perch (0.958 ± 0.160 fish per hour) in 1989 was not significantly different than the previous year. Since 1986, catch rates for yellow perch have ranged from 1.276 (±0.179) to 0.828 (±0.168) fish per hour. The Au Gres area had the greatest yellow perch harvest (686,861 ± 156,589) and catch rate (2.183 ± 0.626) during 1989 of all the Saginaw Bay sites sampled.

Saginaw Bay fishermen also harvested 54,519 (±10,580) walleye in 1989 (Table 10). The mean size of walleye in the sport catch was 21.01 (±0.76) inches and 3.66 (±0.44) pounds. The 1989 walleye harvest decreased 44% compared to 1988 (Table 11). This was caused by both a decline in the walleye catch rate (29%), and a decline in angler effort (21%) on the Bay (Table 11). Walleye catch rates in 1989 on Saginaw Bay, however, were approximately 50% greater than those estimated for 1986-87. The Saganing Creek to Bay City area had the greatest walleye harvest (26,569; ±7,451) and catch rate (0.137; ±0.046) of all the Saginaw Bay sampling sites.

In addition to walleye and yellow perch, Saginaw Bay anglers harvested an estimated 23,354 (±11,354) channel catfish, 7,484 (±3,160) lake trout, 4,838 (±4,298) white bass and, 4,422 (±1,491) chinook salmon. The channel catfish harvest probably is underestimated due to the fact that most fishing for this species occurs throughout the night. Data collection was ended for the day about 1 hour after dark.

Rogers City was the only Lake Huron port sampled outside of the Saginaw Bay area during 1989. The harvest in 1989 at Rogers City was composed mainly of chinook salmon (9,342; ±2,205) and pink salmon (2,708; ±1,276). The harvest and catch rate for chinook salmon at Rogers City in 1989 decline by 41% and 27%, respectively, compared to 1988.

Lake Erie

Approximately 30 miles of Lake Erie shoreline, from Pointe Mouillee to the Michigan-Ohio state line, were surveyed in 1989. Anglers spent an estimated 3,793,963 (±545,688) hours fishing from boats in the survey area (Table 12). A total of 722,251 (±103,885) angler trips or 696,973 (±100,572) angler days were spent in the area. Total angler effort decreased by 20% in 1989 compared to 1988 (Table 13). However, angler effort in 1989 was approximately 60% greater that the level of effort estimated in 1986-87. The average length of a boat fishing trip on Lake Erie was 5.3 hours. The average angler made 1.0 trips per day.

Boat anglers harvested an estimated 3,364,658 (±368,916) fish comprising 21 species (Table 12). Sixty-eight percent of all Lake Erie anglers interviewed responded that they were target fishing for walleye. Walleye made up 32% of the total catch with an estimated harvest of 1,091,642 (±205,068) fish. The mean size of walleye in the catch was 17.75 (±0.34) inches or 2.21 (±0.15) pounds. The walleye harvest in 1989 decrease significantly (47%) compared to 1988 (Table 13). The majority of the 1989 walleye catch (68%) was taken during June and July. This was consistent with the previous year. The catch rate for walleye in 1989 was 0.305 (±0.059) fish per hour compared to 0.458 (±0.096) in 1988 (Table 13).

Lake Erie anglers harvested an estimated 1,441,233 (±242,822) yellow perch during 1989. Sixteen percent of all Lake Erie anglers interviewed indicated that their target species was yellow perch. The mean total length of yellow perch kept by Lake Erie anglers in 1989 was 8.12 (±0.07) inches. The yellow perch harvest during the period April through September was nearly three times greater than for the same period during 1988 (Table 13). This was mainly due to an increase of 250% in the catch rate for yellow perch in 1989 (0.259; ±0.061) compared to 1988 (0.073; ±0.047).

In addition to yellow perch and walleye, an estimated 376,660 (±158,442) white bass, 183,018 (±46,486) white perch and 173,269

(±55,050) channel catfish were harvested by Lake Erie anglers. The white perch harvest was 120% greater in 1989 than 1988. Apparently anglers are becoming more willing to retain white perch for table fare than in the past. As was the case for Saginaw Bay, the channel catfish harvest probably is underestimated due to the fact that most fishing for this species occurs throughout the night.

Lake Superior

The Traverse Bay and Huron Bay boat fisheries were surveyed on Lake Superior. Anglers spent an estimated 20,426 (±3,206) hours fishing in both areas combined. Total angler effort did not differ significantly in 1989 compared to 1988. Over 70% of the harvest in these areas were lake trout. An estimated 5,789 (±1,882) lake trout were harvested during May through September. The 1989 lake trout harvest and catch rate in these areas combined did not significantly change compared to 1988. In addition to lake trout, 1,455 (±1,318) lake whitefish and 298 (±262) coho salmon were harvested in 1989.

River Fisheries

Sections of two Lake Michigan tributary streams, the Grand and Muskegon rivers, were surveyed during 1989. Anglers spent an estimated 52,100 (±7,235) hours fishing the Grand River from the Sixth Street Dam to the Butterworth access site (Table 14). Muskegon River anglers spent an estimated 35,725 (±8,442) hours in the area from Croton Dam to Newaygo.

Rainbow trout was the most numerous species of salmonid in the sport harvest at both locations. A total of 2,640 (±2,074) rainbow were harvested on the Muskegon River and 2,290 (±1,421) were harvested on the Grand River. In addition to rainbow, lesser numbers of chinook salmon, coho salmon, and brown trout were observed in the catch from both rivers.

Winter Ice Fisheries

Ice fisheries were surveyed on Little Bay de Noc, Lake Michigan and Keweenaw Bay, Lake Superior during January through March, 1990. Little Bay de Noc had the most fishing pressure of the two areas with an estimated 195,210 (±18,176) angler hours (Table 15). Angler effort on Little Bay de Noc during the winter of 1990 was not significantly different than 1989. Anglers fishing Little Bay de Noc harvested an estimated 176,068 (±32,411) yellow perch and 9,448 (±2,758) walleye. The 1990 yellow perch and walleye harvests increased by 100% and 56% compared to 1989, respectively. Catch rates for yellow perch increased from 0.476 (±0.149) fish per hour in 1989 to 0.902 (±0.186) in 1990. Walleye catch rates increased from 0.036 (±0.019) in 1989 to 0.057 (±0.017) in 1990.

Keweenaw Bay, which was sampled only during the month of March 1990 due to unsafe ice conditions, had a diverse harvest of salmonids. The harvest consisted of 661 (±413) coho salmon, 332 (±373) chinook salmon, 106 (±212) lake whitefish, and smaller numbers of brown and rainbow trout. Anglers spent an estimated 11,031 (±2,951) hours fishing Keweenaw Bay during the survey period.

Summary

During the 1989 license year, anglers spent an estimated 8,023,078 (±606,362) angler hours in the Michigan waters of the Great Lakes that were surveyed. This accounted for an estimated 1,736,458 (±115,939) individual fishing trips and 1,623,797 (±111,724) angler days. Forty-seven percent of the total angler hours were spent on Lake Erie while, 35% and 14% were spent on Lake Michigan and Saginaw Bay, respectively.

Total catch was estimated to be over 6.7 million fish. Yellow perch were the most abundant species in the sport catch in most sample areas. The yellow perch catch for all areas surveyed was estimated at 4,189,001

(±387,836) fish. Thirty-seven percent of the total yellow perch harvest came from Lake Michigan while, 34% came from Lake Erie.

In addition to yellow perch, sport anglers harvested an estimated 1,194,149 (±205,806) walleye, 95,430 (±18,554) chinook salmon, 94,782 (±13,751) lake trout, 72,435 (±25,209) coho salmon, 34,362 (±6,146) rainbow trout, and 19,522 (±4,312) brown trout. Ninety-one percent of the walleye harvest was taken by Lake Erie anglers. Eighty-seven percent of all salmonids harvested by anglers in the areas surveyed came from Lake Michigan. The salmonid catch in Lake Michigan was composed of 29% lake trout, 28% chinook salmon, 25% coho salmon, 10% rainbow trout, and 7% brown trout. The 1989 marked the first year since catch estimates have been made on Lake Michigan (1985) in which lake trout dominated the sport harvest. Prior to 1989, chinook salmon dominated the catch, ranging from 59% of the salmonid harvest in 1985 to 45% in 1988. The total salmonid harvest at nine important Lake Michigan fishing areas combined increased slightly (9%) in 1989 compared to 1988. The increase in the salmonid catch was mainly due to increased catch rates of coho salmon and lake trout.

Acknowledgments

The authors wish to thank the staffs of the fisheries district and research stations who participated in the survey program. These field units did the day-to-day work of angler interviews, fishing pressure counts, and supervision of seasonal workers. Paul Wei of the Management Information Division wrote the interview and count data entry programs. Evelyn Davis keyed the data. Special thanks to Kelley Smith who wrote the computer programs for the calculation of the catch and effort estimates.

Figure 1.—Lake Michigan survey area.

Figure 2.—Lake Huron survey area.

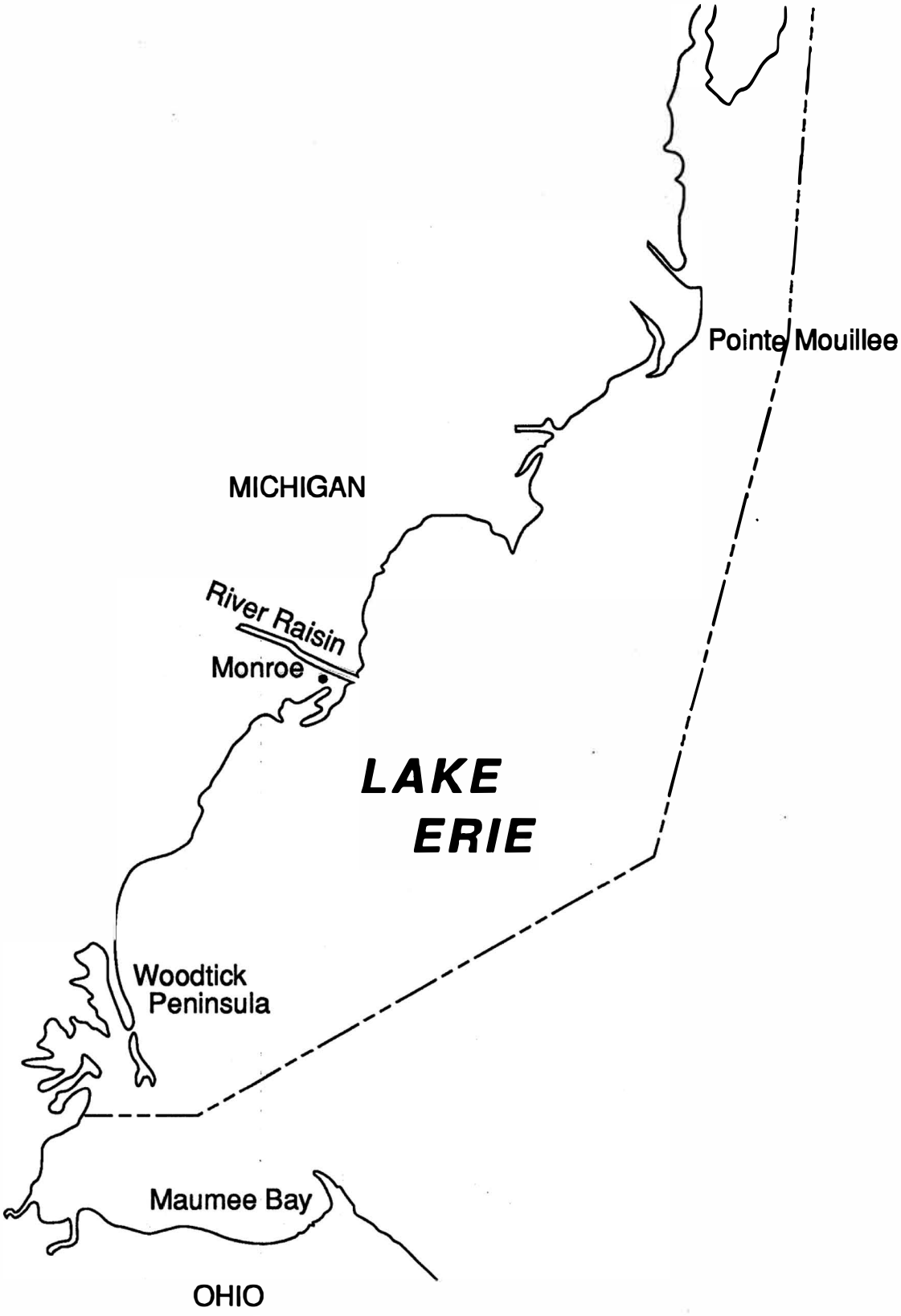


Figure 3.—Lake Erie survey area.

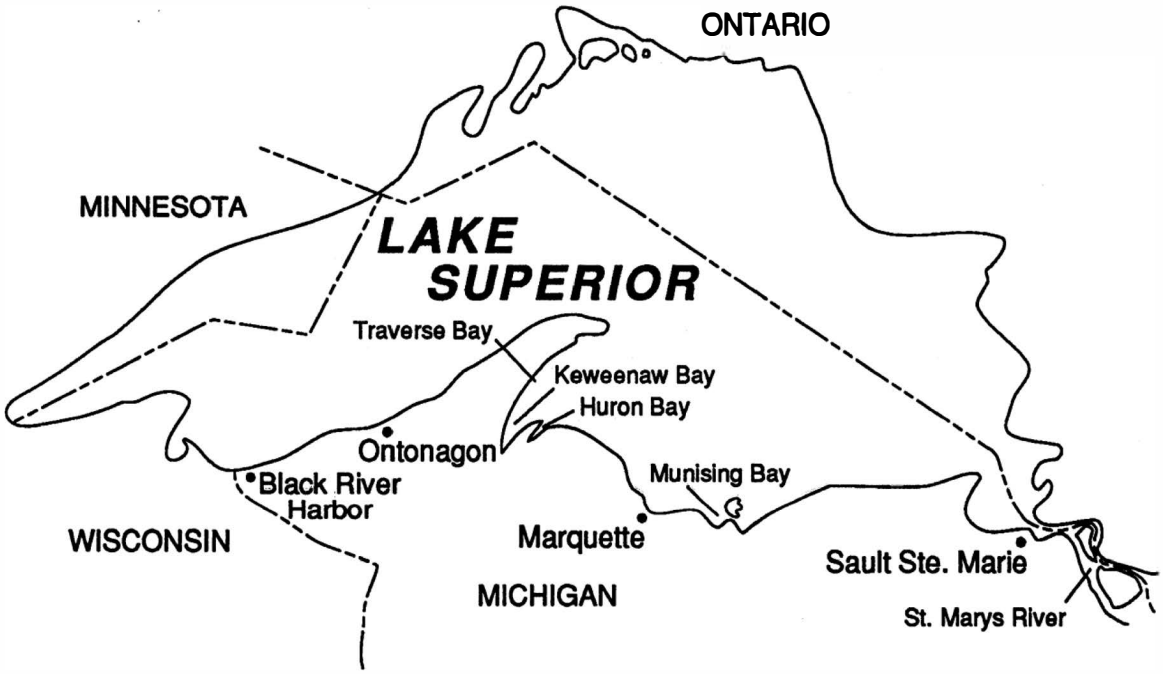
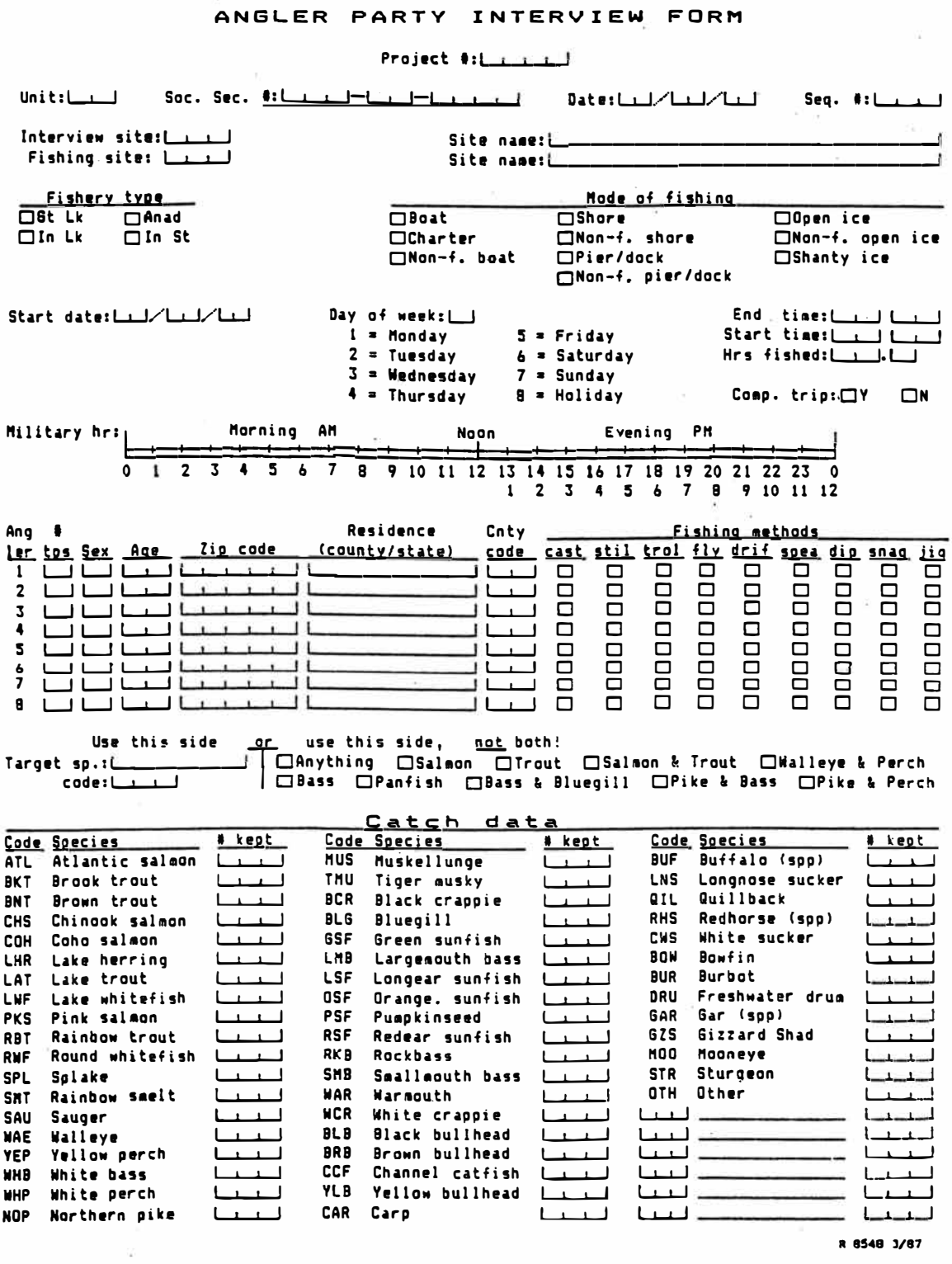


Figure 4.—Lake Superior survey area.



ANGLER PARTY INTERVIEW FORM

Project #:

Unit: Soc. Sec. #: Date: / / Seq. #:

Interview site: Site name:
Fishing site: Site name:

Fishery type
☐St Lk ☐Anad
☐In Lk ☐In St

Mode of fishing
☐Boat ☐Shore ☐Open ice
☐Charter ☐Non-f. shore ☐Non-f. open ice
☐Non-f. boat ☐Pier/dock ☐Shanty ice
☐Non-f. pier/dock

Start date: / / End time:
Day of week: Start time:
1 = Monday 5 = Friday Hrs fished: .
2 = Tuesday 6 = Saturday
3 = Wednesday 7 = Sunday Comp. trip: ☐Y ☐N
4 = Thursday 8 = Holiday

Military hr: Morning AM Noon Evening PM
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
1 2 3 4 5 6 7 8 9 10 11 12

Angler	# tps	Sex	Age	Zip code	Residence (county/state)	Cnty code	Fishing methods: cast	stil	trol	fly	drif	spea	dip	snag	jig
1							☐	☐	☐	☐	☐	☐	☐	☐	☐
2							☐	☐	☐	☐	☐	☐	☐	☐	☐
3							☐	☐	☐	☐	☐	☐	☐	☐	☐
4							☐	☐	☐	☐	☐	☐	☐	☐	☐
5							☐	☐	☐	☐	☐	☐	☐	☐	☐
6							☐	☐	☐	☐	☐	☐	☐	☐	☐
7							☐	☐	☐	☐	☐	☐	☐	☐	☐
8							☐	☐	☐	☐	☐	☐	☐	☐	☐

Use this side or use this side, not both!

Target sp.: code:
☐Anything ☐Salmon ☐Trout ☐Salmon & Trout ☐Walleye & Perch
☐Bass ☐Panfish ☐Bass & Bluegill ☐Pike & Bass ☐Pike & Perch

Catch data

Code	Species	# kept	Code	Species	# kept	Code	Species	# kept
ATL	Atlantic salmon		MUS	Muskellunge		BUF	Buffalo (spp)	
BKT	Brook trout		TMU	Tiger musky		LNS	Longnose sucker	
BNT	Brown trout		BCR	Black crappie		QIL	Quillback	
CHS	Chinook salmon		BLG	Bluegill		RHS	Redhorse (spp)	
COH	Coho salmon		GSF	Green sunfish		CWS	White sucker	
LHR	Lake herring		LMB	Largemouth bass		BOW	Bowfin	
LAT	Lake trout		LSF	Longear sunfish		BUR	Burbot	
LWF	Lake whitefish		OSF	Orange. sunfish		DRU	Freshwater drum	
PKS	Pink salmon		PSF	Pumpkinseed		GAR	Gar (spp)	
RBT	Rainbow trout		RSF	Redear sunfish		GZS	Gizzard Shad	
RWF	Round whitefish		RKB	Rockbass		MOO	Mooneye	
SPL	Splake		SMB	Smallmouth bass		STR	Sturgeon	
SMT	Rainbow smelt		WAR	Warmouth		OTH	Other	
SAU	Sauger		WCR	White crappie				
WAE	Walleye		BLB	Black bullhead				
YEP	Yellow perch		BRB	Brown bullhead				
WHB	White bass		CCF	Channel catfish				
WHP	White perch		YLB	Yellow bullhead				
NOP	Northern pike		CAR	Carp				

R 6548 3/87

Figure 5.—Angler party interview sheet.

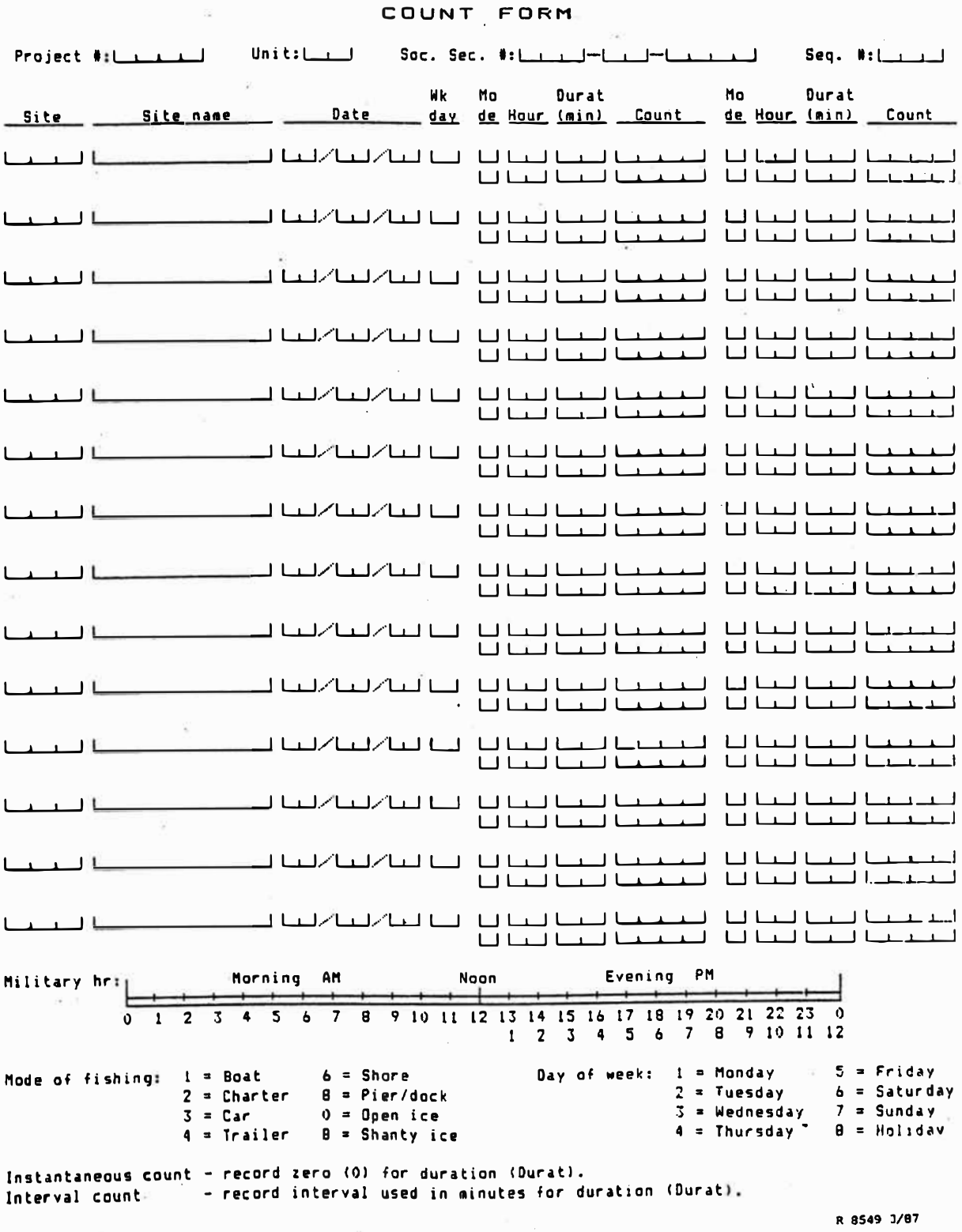


Figure 6.—Shore and boat count data sheet.

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

Common name	Scientific name
Rainbow smelt	*Osmerus mordax*
Northern pike	*Esox lucius*
Muskellunge	*Esox masquinongy*
Black bullhead	*Ameiurus melas*
Yellow bullhead	*Ameiurus natalis*
Brown bullhead	*Ameiurus nebulosus*
Channel catfish	*Ictalurus punctatus*
Burbot	*Lota lota*
White perch	*Morone americana*
White bass	*Morone chrysops*
Freshwater drum	*Aplodinotus grunniens*
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*
Pumpkinseed	*Lepomis gibbosus*
Bluegill	*Lepomis macrochirus*
Longear sunfish	*Lepomis megalotis*
Smallmouth bass	*Micropterus dolomieu*
Largemouth bass	*Micropterus salmoides*
White crappie	*Pomoxis annularis*
Black crappie	*Pomoxis nigromaculatus*
Yellow perch	*Perca flavescens*
Walleye	*Stizostedion vitreum*

Table 2.—Estimated catch per hour, number caught, and effort (angler hours, trips, and days) for Lake Michigan, by all modes of sportfishing, 1989. Two standard errors in parentheses.

Species	Total catch per hour	Month									Season
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Pink salmon	0.0005	0	0	0	0	129	698	650	0	0	1,477
	(0.0006)	(0)	(0)	(0)	(0)	(132)	(1,602)	(571)	(0)	(0)	(1,706)
Coho salmon	0.0247	1,033	31,237	7,580	1,218	1,650	20,870	6,484	121	58	70,251
	(0.0091)	(1,141)	(9,861)	(2,508)	(728)	(838)	(22,738)	(3,451)	(124)	(121)	(25,200)
Chinook salmon	0.0279	31	3,071	10,581	3,106	12,701	38,396	9,951	1,385	0	79,222
	(0.0069)	(44)	(1,572)	(2,946)	(1,905)	(3,669)	(17,176)	(3,243)	(735)	(0)	(18,284)
Rainbow trout	0.0099	31	936	1,613	2,730	10,565	3,845	3,774	3,966	582	28,042
	(0.0021)	(47)	(960)	(630)	(1,938)	(4,127)	(2,242)	(1,426)	(1,302)	(296)	(5,563)
Brown trout	0.0065	250	6,453	5,358	362	2,164	3,306	394	183	0	18,470
	(0.0016)	(164)	(2,736)	(1,678)	(368)	(1,182)	(2,483)	(520)	(187)	(0)	(4,282)
Lake trout	0.0284	0	0	15,192	15,577	25,282	24,377	254	0	0	80,682
	(0.0053)	(0)	(0)	(3,445)	(4,665)	(6,316)	(10,092)	(178)	(0)	(0)	(13,244)
Splake	0.0004	0	1,070	146	0	0	0	0	0	0	1,216
	(0.0002)	(0)	(681)	(205)	(0)	(0)	(0)	(0)	(0)	(0)	(711)
Rainbow smelt	0.0076	0	0	21,507	0	0	0	0	0	0	21,507
	(0.0073)	(0)	(0)	(20,521)	(0)	(0)	(0)	(0)	(0)	(0)	(20,521)
Northern pike	0.0012	0	0	419	238	807	774	612	480	0	3,330
	(0.0005)	(0)	(0)	(438)	(234)	(782)	(792)	(562)	(345)	(0)	(1,386)
White sucker	0.0001	0	32	212	0	0	0	0	0	0	244
	(0.0002)	(0)	(70)	(425)	(0)	(0)	(0)	(0)	(0)	(0)	(431)
Black bullhead	0.0002	0	0	47	174	425	0	40	0	0	686
	(0.0003)	(0)	(0)	(100)	(250)	(883)	(0)	(89)	(0)	(0)	(927)
Brown bullhead	0.0004	0	0	793	0	427	0	0	0	0	1,220
	(0.0005)	(0)	(0)	(1,187)	(0)	(883)	(0)	(0)	(0)	(0)	(1,479)
Channel catfish	0.0004	0	45	123	200	220	363	315	0	0	1,266
	(0.0002)	(0)	(81)	(114)	(179)	(164)	(412)	(403)	(0)	(0)	(641)
White perch	0.0002	0	0	0	0	0	553	0	0	0	553
	(0.0004)	(0)	(0)	(0)	(0)	(0)	(1,190)	(0)	(0)	(0)	(1,190)
Rock bass	0.0021	0	0	1,080	2,482	1,765	475	0	78	0	5,880
	(0.0011)	(0)	(0)	(1,527)	(1,825)	(1,619)	(458)	(0)	(124)	(0)	(2,917)
Pumpkinseed	0.0019	0	0	715	71	613	4,024	112	0	0	5,535
	(0.0027)	(0)	(0)	(771)	(149)	(712)	(7,736)	(232)	(0)	(0)	(7,812)
Bluegill	0.0012	0	0	0	0	384	3,025	0	0	0	3,409
	(0.0016)	(0)	(0)	(0)	(0)	(568)	(4,602)	(0)	(0)	(0)	(4,637)

Table 2.—Continued:

Species	Total catch per hour	Month									Season
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Smallmouth bass	0.0066	0	0	2,916	5,385	3,972	2,709	3,259	488	0	18,729
	(0.0020)	(0)	(0)	(1,459)	(3,113)	(1,948)	(1,987)	(3,150)	(735)	(0)	(5,480)
Largemouth bass	0.0001	0	0	0	0	159	0	0	0	0	159
	(0.0002)	(0)	(0)	(0)	(0)	(262)	(0)	(0)	(0)	(0)	(262)
White crappie	0.0010	0	0	0	2,951	0	0	0	0	0	2,951
	(0.0015)	(0)	(0)	(0)	(4,413)	(0)	(0)	(0)	(0)	(0)	(4,413)
Black crappie	0.0004	0	0	946	0	57	34	0	0	0	1,037
	(0.0007)	(0)	(0)	(1,928)	(0)	(119)	(71)	(0)	(0)	(0)	(1,933)
Yellow perch	0.4796	7	139,325	115,405	152,679	460,755	308,238	162,429	23,369	2,048	1,364,255
	(0.0927)	(14)	(52,674)	(41,850)	(45,039)	(105,370)	(189,404)	(45,321)	(10,350)	(1,716)	(235,998)
Walleye	0.0134	0	0	16,282	2,173	8,557	4,250	5,593	1,151	0	38,006
	(0.0050)	(0)	(0)	(12,415)	(1,375)	(4,121)	(2,031)	(3,614)	(539)	(0)	(13,802)
Freshwater drum	0.0009	0	0	30	2,163	145	119	99	0	0	2,556
	(0.0007)	(0)	(0)	(40)	(1,930)	(168)	(191)	(201)	(0)	(0)	(1,957)
Lake whitefish	0.0049	0	241	2,007	297	6,200	2,682	391	1,988	0	13,806
	(0.0019)	(0)	(508)	(1,777)	(387)	(4,138)	(2,269)	(445)	(756)	(0)	(5,158)
Round whitefish	0.0061	0	46	87	101	12,521	2,209	323	1,993	8	17,288
	(0.0055)	(0)	(93)	(144)	(153)	(14,870)	(4,518)	(443)	(1,025)	(17)	(15,583)
Burbot	0.0001	0	0	68	0	152	0	0	0	0	220
	(0.0002)	(0)	(0)	(113)	(0)	(311)	(0)	(0)	(0)	(0)	(331)
Other	0.0025	0	6	109	6,695	0	45	166	0	0	7,021
	(0.0048)	(0)	(13)	(157)	(13,353)	(0)	(113)	(227)	(0)	(0)	(13,356)
Total	0.6289	1,352	182,462	203,216	198,602	549,650	420,992	194,846	35,202	2,696	1,789,018
	(0.1005)	(1,155)	(53,697)	(48,688)	(47,698)	(106,959)	(192,142)	(45,859)	(10,583)	(1,746)	(241,054)
Angler hours		12,579	197,021	419,481	287,957	733,106	765,207	312,513	104,080	12,528	2,844,472
		(6,770)	(26,870)	(74,295)	(39,525)	(92,691)	(201,045)	(47,680)	(26,492)	(2,968)	(244,631)
Angler trips		2,525	48,508	95,234	71,422	160,259	160,184	77,415	26,025	3,591	645,163
		(949)	(5,963)	(17,987)	(9,050)	(18,203)	(36,223)	(9,845)	(4,819)	(960)	(46,973)
Angler days		2,196	46,009	85,662	64,126	145,589	150,176	67,439	22,037	2,848	586,082
		(907)	(5,841)	(15,269)	(8,440)	(16,359)	(35,576)	(8,749)	(3,905)	(774)	(44,328)

Table 3.—Estimated angler effort (hours) at ten Lake Michigan sample areas, April through October, 1985-89. Two standard errors in parentheses.

Area	Year				
	1985	1986	1987	1988	1989[4]
New Buffalo	270,897	481,717	151,089	268,490	229,668
	(45,486)	(151,319)	(92,752)	(72,843)	(85,620)
St. Joseph	834,003	607,060	369,500	424,635	440,627
	(116,076)	(128,426)	(93,567)	(75,266)	(57,896)
Grand Haven	586,641	700,543	759,713	428,996	225,797
	(66,939)	(152,499)	(145,251)	(121,822)	(37,108)
Muskegon	508,738	319,636	340,095	230,296	164,664
	(114,646)	(53,425)	(73,750)	(58,704)	(35,554)
Ludington	714,442	833,763	614,485	376,995	442,578[5]
	(151,419)	(258,924)	(169,613)	(117,169)	(85,069)
Manistee	629,126	681,144	509,415	435,687	283,544
	(96,422)	(141,842)	(125,973)	(102,153)	(51,078)
Frankfort	322,122	593,406	547,140	262,501	365,263[5]
	(49,044)	(192,736)	(193,979)	(58,305)	(176,322)
Grand Traverse Bay[1]	466,505	335,002	284,478	262,402	260,728
	(26,749)	(24,912)	(22,721)	(17,127)	(20,770)
Charlevoix	155,168	100,014	90,043	62,287[3]	64,042[3]
	(35,350)	(24,447)	(12,480)	(12,761)	(12,003)
Little Bay de Noc[2]	158,157	239,073	154,421	157,723	237,044[5]
	(21,126)	(21,787)	(16,300)	(19,726)	(67,741)
Total	4,645,799	4,891,358	3,820,379	2,922,773	2,713,955
	(264,969)	(437,609)	(356,508)	(240,138)	(243,769)

[1]Includes the East Arm, the West Arm, and the port of Elk Rapids.

[2]Includes the Ford River access site.

[3]May through September.

[4]Includes charter boat data after August 1.

[5]May through October.

Table 4.—Estimated catch per hour, number caught, and effort (angler hours, trips, and days) for the Lake Michigan boat fishery, 1989. Two standard errors in parentheses.

Species	Total catch per hour	Month									Season
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Pink salmon	0.0004	0	0	0	0	129	698	29	0	0	856
	(0.0008)	(0)	(0)	(0)	(0)	(132)	(1,602)	(31)	(0)	(0)	(1,608)
Coho salmon	0.0269	849	26,639	6,871	1,214	1,640	20,497	6,330	76	0	64,116
	(0.0109)	(1,136)	(9,706)	(2,482)	(728)	(838)	(22,736)	(3,448)	(108)	(0)	(25,134)
Chinook salmon	0.0318	12	2,940	10,286	3,078	12,686	37,526	8,905	526	0	75,959
	(0.0083)	(30)	(1,568)	(2,939)	(1,904)	(3,669)	(17,163)	(3,165)	(571)	(0)	(18,251)
Rainbow trout	0.0097	16	146	796	2,617	9,841	3,707	3,430	2,505	0	23,058
	(0.0025)	(41)	(115)	(480)	(1,928)	(4,108)	(2,226)	(1,402)	(1,185)	(0)	(5,400)
Brown trout	0.0061	86	5,066	3,674	278	2,014	3,306	163	19	0	14,606
	(0.0018)	(129)	(2,539)	(1,483)	(347)	(1,142)	(2,483)	(142)	(27)	(0)	(4,034)
Lake trout	0.0335	0	0	14,879	15,461	25,173	24,113	254	0	0	79,880
	(0.0065)	(0)	(0)	(3,439)	(4,661)	(6,314)	(10,085)	(178)	(0)	(0)	(13,235)
Splake	0.0004	0	768	146	0	0	0	0	0	0	914
	(0.0002)	(0)	(506)	(205)	(0)	(0)	(0)	(0)	(0)	(0)	(546)
Northern pike	0.0011	0	0	419	238	760	687	394	177	0	2,675
	(0.0005)	(0)	(0)	(438)	(234)	(776)	(772)	(329)	(177)	(0)	(1,259)
Black bullhead	0.0001	0	0	47	174	0	0	40	0	0	261
	(0.0001)	(0)	(0)	(100)	(250)	(0)	(0)	(89)	(0)	(0)	(284)
Brown bullhead	0.0001	0	0	313	0	0	0	0	0	0	313
	(0.0002)	(0)	(0)	(627)	(0)	(0)	(0)	(0)	(0)	(0)	(627)
Channel catfish	0.0003	0	0	0	106	112	363	184	0	0	765
	(0.0002)	(0)	(0)	(0)	(153)	(104)	(412)	(341)	(0)	(0)	(566)
Rock bass	0.0009	0	0	344	876	710	197	0	25	0	2,152
	(0.0005)	(0)	(0)	(350)	(864)	(726)	(291)	(0)	(60)	(0)	(1,218)
Pumpkinseed	0.0003	0	0	235	71	374	0	0	0	0	680
	(0.0003)	(0)	(0)	(438)	(149)	(519)	(0)	(0)	(0)	(0)	(695)
Bluegill	0.0008	0	0	0	0	0	1,832	0	0	0	1,832
	(0.0017)	(0)	(0)	(0)	(0)	(0)	(3,859)	(0)	(0)	(0)	(3,859)
Smallmouth bass	0.0068	0	0	2,733	4,482	3,420	2,056	3,184	433	0	16,308
	(0.0023)	(0)	(0)	(1,457)	(3,049)	(1,827)	(1,706)	(3,146)	(731)	(0)	(5,301)
White crappie	0.0001	0	0	0	167	0	0	0	0	0	167
	(0.0002)	(0)	(0)	(0)	(352)	(0)	(0)	(0)	(0)	(0)	(352)
Black crappie	0.0004	0	0	946	0	57	34	0	0	0	1,037
	(0.0007)	(0)	(0)	(1,928)	(0)	(119)	(71)	(0)	(0)	(0)	(1,933)

Table 4.—Continued:

Species	Total catch per hour	Month									Season
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Yellow perch	0.4618	0	103,959	99,107	101,263	377,868	279,176	124,999	15,842	0	1,102,214
	(0.1085)	(0)	(50,107)	(40,731)	(43,379)	(103,551)	(188,978)	(41,635)	(9,605)	(0)	(233,051)
Walleye	0.0159	0	0	16,205	2,173	8,557	4,214	5,591	1,151	0	37,891
	(0.0060)	(0)	(0)	(12,414)	(1,375)	(4,121)	(2,029)	(3,614)	(539)	(0)	(13,800)
Freshwater drum	0.0001	0	0	0	136	92	32	0	0	0	260
	(0.0001)	(0)	(0)	(0)	(286)	(138)	(65)	(0)	(0)	(0)	(324)
Lake whitefish	0.0058	0	241	2,007	297	6,200	2,682	391	1,988	0	13,806
	(0.0022)	(0)	(508)	(1,777)	(387)	(4,138)	(2,269)	(445)	(756)	(0)	(5,158)
Round whitefish	0.0066	0	0	56	101	12,521	2,209	323	496	0	15,706
	(0.0066)	(0)	(0)	(128)	(153)	(14,870)	(4,518)	(443)	(464)	(0)	(15,556)
Burbot	0.0001	0	0	68	0	152	0	0	0	0	220
	(0.0002)	(0)	(0)	(113)	(0)	(311)	(0)	(0)	(0)	(0)	(331)
Other	0.0028	0	0	93	6,565	0	0	67	0	0	6,725
	(0.0056)	(0)	(0)	(154)	(13,352)	(0)	(0)	(106)	(0)	(0)	(13,353)
Total	0.6127	963	139,759	159,225	139,297	462,306	383,329	154,284	23,238	0	1,462,401
	(0.1174)	(1,144)	(51,131)	(43,037)	(45,850)	(105,143)	(191,541)	(42,202)	(9,780)	(0)	(237,044)
Angler hours		5,441	137,307	351,631	233,960	617,533	710,382	263,300	67,083	0	2,386,637
		(6,476)	(26,179)	(74,103)	(39,032)	(92,072)	(200,955)	(47,247)	(26,149)	(0)	(243,964)
Angler trips		725	29,986	74,181	49,654	118,071	137,144	57,314	14,353	0	481,428
		(799)	(5,526)	(17,852)	(8,456)	(17,685)	(36,093)	(9,324)	(4,593)	(0)	(46,313)
Angler days		725	29,272	67,109	46,361	109,711	129,441	51,195	12,891	0	446,705
		(799)	(5,432)	(15,137)	(7,993)	(15,885)	(35,466)	(8,282)	(3,707)	(0)	(43,768)

Table 5.—Estimated catch per hour, number caught, and effort (angler hours, trips, and days) for the Lake Michigan pier fishery, 1989. Two standard errors in parentheses.

Species	Total catch per hour	Month									Season
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Coho salmon	0.0159	184	4,384	709	4	10	373	154	45	58	5,921
	(0.0048)	(101)	(1,694)	(357)	(8)	(21)	(320)	(142)	(62)	(121)	(1,774)
Chinook salmon	0.0041	19	131	295	28	15	870	141	15	0	1,514
	(0.0020)	(32)	(118)	(197)	(40)	(31)	(670)	(140)	(21)	(0)	(725)
Rainbow trout	0.0075	15	76	160	113	724	138	5	968	582	2,781
	(0.0021)	(23)	(91)	(259)	(197)	(402)	(267)	(10)	(419)	(296)	(782)
Brown trout	0.0092	164	1,387	1,576	84	150	0	0	69	0	3,430
	(0.0036)	(101)	(1,020)	(760)	(122)	(306)	(0)	(0)	(56)	(0)	(1,319)
Lake trout	0.0021	0	0	302	116	109	264	0	0	0	791
	(0.0013)	(0)	(0)	(200)	(191)	(159)	(375)	(0)	(0)	(0)	(492)
Splake	0.0005	0	178	0	0	0	0	0	0	0	178
	(0.0010)	(0)	(366)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(366)
White sucker	0.0000	0	0	10	0	0	0	0	0	0	10
	(0.0000)	(0)	(0)	(19)	(0)	(0)	(0)	(0)	(0)	(0)	(19)
Channel catfish	0.0013	0	45	123	66	108	0	131	0	0	473
	(0.0008)	(0)	(81)	(114)	(74)	(127)	(0)	(214)	(0)	(0)	(295)
White perch	0.0015	0	0	0	0	0	553	0	0	0	553
	(0.0032)	(0)	(0)	(0)	(0)	(0)	(1,190)	(0)	(0)	(0)	(1,190)
Rock bass	0.0049	0	0	736	509	363	178	0	53	0	1,839
	(0.0049)	(0)	(0)	(1,486)	(953)	(455)	(285)	(0)	(109)	(0)	(1,848)
Pumpkinseed	0.0006	0	0	0	0	239	0	0	0	0	239
	(0.0012)	(0)	(0)	(0)	(0)	(487)	(0)	(0)	(0)	(0)	(487)
Bluegill	0.0042	0	0	0	0	384	1,188	0	0	0	1,572
	(0.0069)	(0)	(0)	(0)	(0)	(568)	(2,508)	(0)	(0)	(0)	(2,572)
Smallmouth bass	0.0024	0	0	0	98	274	531	0	0	0	903
	(0.0030)	(0)	(0)	(0)	(202)	(492)	(1,000)	(0)	(0)	(0)	(1,133)
Largemouth bass	0.0003	0	0	0	0	125	0	0	0	0	125
	(0.0006)	(0)	(0)	(0)	(0)	(252)	(0)	(0)	(0)	(0)	(252)
Yellow perch	0.6094	7	27,680	10,457	48,638	78,610	25,906	27,944	5,123	2,048	226,413
	(0.0937)	(14)	(13,293)	(8,523)	(11,907)	(18,911)	(12,003)	(14,071)	(3,433)	(1,716)	(33,250)
Walleye	0.0001	0	0	0	0	0	36	0	0	0	36
	(0.0003)	(0)	(0)	(0)	(0)	(0)	(90)	(0)	(0)	(0)	(90)
Freshwater drum	0.0059	0	0	30	2,027	53	0	99	0	0	2,209
	(0.0051)	(0)	(0)	(40)	(1,909)	(95)	(0)	(201)	(0)	(0)	(1,922)

Table 5.—Continued:

Species	Total catch per hour	Month									Season
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Round whitefish	0.0035	0	46	0	0	0	0	0	1,252	8	1,306
	(0.0023)	(0)	(93)	(0)	(0)	(0)	(0)	(0)	(847)	(17)	(852)
Other	0.0004	0	6	16	0	0	45	99	0	0	166
	(0.0006)	(0)	(13)	(32)	(0)	(0)	(113)	(201)	(0)	(0)	(233)
Total	0.6742	389	33,933	14,414	51,683	81,164	30,082	28,573	7,525	2,696	250,459
	(0.0955)	(149)	(13,446)	(8,702)	(12,102)	(18,947)	(12,395)	(14,077)	(3,563)	(1,746)	(33,608)
Angler hours		6,962	48,413	50,832	43,716	104,837	45,057	35,286	23,887	12,528	371,518
		(1,969)	(5,446)	(4,653)	(5,581)	(10,378)	(5,636)	(5,957)	(3,763)	(2,968)	(16,860)
Angler trips		1,737	14,539	14,716	16,375	37,843	19,030	14,988	7,165	3,591	129,984
		(508)	(1,909)	(1,473)	(2,539)	(4,024)	(2,805)	(2,878)	(1,278)	(960)	(6,886)
Angler days		1,410	13,621	13,380	13,228	32,103	17,153	12,294	5,838	2,848	111,875
		(426)	(1,873)	(1,390)	(2,078)	(3,599)	(2,554)	(2,567)	(1,089)	(774)	(6,147)

Table 6.—Estimated catch per hour, number caught, and effort (angler hours, trips, and days) for the Lake Michigan shore fishery, 1989. Two standard errors in parentheses.

Species	Total catch per hour	Month									Season
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Pink salmon	0.0072	0	0	0	0	0	0	621	0	0	621
	(0.0066)	(0)	(0)	(0)	(0)	(0)	(0)	(570)	(0)	(0)	(570)
Coho salmon	0.0025	0	214	0	0	0	0	0	0	0	214
	(0.0047)	(0)	(403)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(403)
Chinook salmon	0.0203	0	0	0	0	0	0	905	844	0	1,749
	(0.0098)	(0)	(0)	(0)	(0)	(0)	(0)	(693)	(463)	(0)	(833)
Rainbow trout	0.0255	0	714	657	0	0	0	339	493	0	2,203
	(0.0127)	(0)	(949)	(316)	(0)	(0)	(0)	(257)	(341)	(0)	(1,088)
Brown trout	0.0050	0	0	108	0	0	0	231	95	0	434
	(0.0065)	(0)	(0)	(196)	(0)	(0)	(0)	(500)	(177)	(0)	(565)
Lake trout	0.0001	0	0	11	0	0	0	0	0	0	11
	(0.0002)	(0)	(0)	(25)	(0)	(0)	(0)	(0)	(0)	(0)	(25)
Splake	0.0014	0	124	0	0	0	0	0	0	0	124
	(0.0031)	(0)	(271)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(271)
Rainbow smelt	0.2492	0	0	21,507	0	0	0	0	0	0	21,507
	(0.2385)	(0)	(0)	(20,521)	(0)	(0)	(0)	(0)	(0)	(0)	(20,521)
Northern pike	0.0076	0	0	0	0	47	87	218	303	0	655
	(0.0068)	(0)	(0)	(0)	(0)	(98)	(180)	(456)	(296)	(0)	(581)
White sucker	0.0027	0	32	202	0	0	0	0	0	0	234
	(0.0050)	(0)	(70)	(425)	(0)	(0)	(0)	(0)	(0)	(0)	(431)
Black bullhead	0.0049	0	0	0	0	425	0	0	0	0	425
	(0.0102)	(0)	(0)	(0)	(0)	(883)	(0)	(0)	(0)	(0)	(883)
Brown bullhead	0.0105	0	0	480	0	427	0	0	0	0	907
	(0.0155)	(0)	(0)	(1,008)	(0)	(883)	(0)	(0)	(0)	(0)	(1,340)
Channel catfish	0.0003	0	0	0	28	0	0	0	0	0	28
	(0.0006)	(0)	(0)	(0)	(57)	(0)	(0)	(0)	(0)	(0)	(57)
Rock bass	0.0219	0	0	0	1,097	692	100	0	0	0	1,889
	(0.0221)	(0)	(0)	(0)	(1,295)	(1,374)	(209)	(0)	(0)	(0)	(1,900)
Pumpkinseed	0.0535	0	0	480	0	0	4,024	112	0	0	4,616
	(0.0901)	(0)	(0)	(634)	(0)	(0)	(7,736)	(232)	(0)	(0)	(7,765)
Bluegill	0.0001	0	0	0	0	0	5	0	0	0	5
	(0.0002)	(0)	(0)	(0)	(0)	(0)	(9)	(0)	(0)	(0)	(9)
Smallmouth bass	0.0176	0	0	183	805	278	122	75	55	0	1,518
	(0.0094)	(0)	(0)	(78)	(596)	(465)	(194)	(154)	(82)	(0)	(803)

Table 6.—Continued:

Species	Total catch per hour	Month									Season
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Largemouth bass	0.0004	0	0	0	0	34	0	0	0	0	34
	(0.0008)	(0)	(0)	(0)	(0)	(71)	(0)	(0)	(0)	(0)	(71)
White crappie	0.0323	0	0	0	2,784	0	0	0	0	0	2,784
	(0.0511)	(0)	(0)	(0)	(4,399)	(0)	(0)	(0)	(0)	(0)	(4,399)
Yellow perch	0.4128	0	7,686	5,841	2,778	4,277	3,156	9,486	2,404	0	35,628
	(0.1953)	(0)	(9,334)	(4,442)	(2,245)	(4,723)	(4,134)	(11,068)	(1,758)	(0)	(16,640)
Walleye	0.0009	0	0	77	0	0	0	2	0	0	79
	(0.0014)	(0)	(0)	(124)	(0)	(0)	(0)	(5)	(0)	(0)	(124)
Freshwater drum	0.0010	0	0	0	0	0	87	0	0	0	87
	(0.0021)	(0)	(0)	(0)	(0)	(0)	(180)	(0)	(0)	(0)	(180)
Round whitefish	0.0032	0	0	31	0	0	0	0	245	0	276
	(0.0041)	(0)	(0)	(65)	(0)	(0)	(0)	(0)	(345)	(0)	(351)
Other	0.0015	0	0	0	130	0	0	0	0	0	130
	(0.0023)	(0)	(0)	(0)	(197)	(0)	(0)	(0)	(0)	(0)	(197)
Total	0.8823	0	8.770	29,577	7,622	6,180	7,581	11,989	4,439	0	76,158
	(0.3319)	(0)	(9,395)	(21,038)	(5,144)	(5,098)	(8,780)	(11,131)	(1,915)	(0)	(28,071)
Angler hours		176	11,301	17,018	10,281	10,736	9,768	13,927	13,110	0	86,317
		(112)	(2,642)	(2,630)	(2,756)	(2,590)	(2,148)	(2,358)	(1,965)	(0)	(6,500)
Angler trips		63	3,983	6,337	5,393	4,345	4,010	5,113	4,507	0	33,751
		(58)	(1,176)	(1,634)	(1,986)	(1,544)	(1,237)	(1,302)	(706)	(0)	(3,756)
Angler days		61	3,116	5,173	4,537	3,775	3,582	3,950	3,308	0	27,502
		(56)	(1,048)	(1,439)	(1,739)	(1,523)	(1,149)	(1,175)	(573)	(0)	(3,398)

Table 7.—Estimated yellow perch catch rate (fish per angler hour), number caught, and angler effort (hours) at selected Lake Michigan ports and fishing areas, April through October 1985-89. Two standard errors in parentheses.

	1985		1986		1987		1988		1989	
Area	Catch per hour	Number caught	Catch per hour	Number caught	Catch per hour	Number caught	Catch per hour	Number caught	Catch per hour	Number caught
St. Joseph	0.797	664,671	0.972	590,044	1.213	448,285	1.356	575,937	0.730	313,077
	(0.257)	(193,119)	(0.547)	(307,649)	(0.864)	(298,522)	(0.668)	(266,099)	(0.196)	(84,235)
Grand Haven	0.187	110,083	0.114	79,972	0.281	213,199	0.365	156,496	0.595	121,713
	(0.045)	(23,606)	(0.049)	(29,962)	(0.115)	(77,071)	(0.226)	(85,951)	(0.277)	(52,258)
Muskegon	0.108	54,923	0.167	53,516	0.904	307,326	0.829	190,964	1.102	174,434
	(0.049)	(21,361)	(0.162)	(51,027)	(0.503)	(157,717)	(0.382)	(73,156)	(0.475)	(64,152)
Ludington	0.170	121,230	0.078	64,712	0.374	229,841	0.473	178,483	0.284	115,202
	(0.080)	(51,031)	(0.061)	(46,674)	(0.182)	(92,112)	(0.306)	(101,864)	(0.112)	(38,771)
Manistee	0.035	22,286	0.332	226,199	0.265	134,736	0.684	298,088	0.433	115,093
	(0.030)	(18,626)	(0.206)	(131,847)	(0.136)	(60,864)	(0.502)	(210,724)	(0.232)	(57,456)
West Grand Traverse Bay	0.207	58,453	0.439	76,971	0.654	102,182	0.061	8,771	0.177	24,167
	(0.089)	(24,657)	(0.251)	(43,181)	(0.338)	(51,052)	(0.045)	(6,431)	(0.094)	(12,406)
Little Bay de Noc	0.483	64,609	0.700	139,828	0.463	57,750	0.384	60,504	0.403	95,468
	(0.217)	(27,230)	(0.265)	(50,923)	(0.141)	(16,060)	(0.209)	(32,156)	(0.171)	(30,042)
Total	0.295	1,096,255	0.346	1,231,242	0.516	1,493,319	0.669	1,469,243	0.522	959,154
	(0.057)	(206,419)	(0.098)	(349,527)	(0.127)	(367,400)	(0.167)	(373,369)	(0.077)	(140,823)
Angler Hours		3,713,865		3,556,617		2,892,057		2,197,822		1,837,704
		(253,547)		(361,386)		(288,228)		(220,751)		(144,156)

Table 8.—Estimated catch rate (fish per angler hour), number caught, and angler effort (hours) for various species of salmonids at nine Lake Michigan ports combined (New Buffalo, St. Joseph, Grand Haven, Muskegon, Ludington, Manistee, Frankfort, West Grand Traverse Bay, and Charlevoix), April through October 1985-89. Two standard errors in parentheses.

	1985		1986		1987		1988		1989[2]	
Area	Catch per hour	Number caught	Catch per hour	Number caught	Catch per hour	Number caught	Catch per hour	Number caught	Catch per hour	Number caught
Coho salmon	0.018	75,585	0.027	107,588	0.025	86,876	0.014	36,646	0.032	75,364
	(0.003)	(13,667)	(0.007)	(22,779)	(0.006)	(19,062)	(0.005)	(12,950)	(0.011)	(25,170)
Chinook salmon	0.079	338,855	0.103	404,035	0.074	259,718	0.040	106,287	0.034	80,114
	(0.010)	(42,266)	(0.024)	(93,386)	(0.017)	(58,951)	(0.008)	(21,557)	(0.008)	(18,036)
Rainbow trout	0.007	29,846	0.006	23,296	0.008	26,981	0.011	29,081	0.013	29,854
	(0.002)	(7,932)	(0.003)	(12,655)	(0.002)	(6,028)	(0.003)	(6,999)	(0.002)	(5,736)
Brown trout	0.008	33,488	0.013	50,857	0.006	19,350	0.006	16,336	0.006	14,430
	(0.002)	(6,762)	(0.004)	(15,265)	(0.002)	(6,197)	(0.002)	(5,142)	(0.002)	(4,014)
Lake trout[1]	0.026	87,620	0.036	113,382	0.030	79,929	0.034	67,955	0.044	79,886
	(0.005)	(15,752)	(0.015)	(44,421)	(0.008)	(18,234)	(0.007)	(12,594)	(0.009)	(13,014)
Total	0.138	565,394	0.185	699,198	0.143	472,854	0.105	256,305	0.129	279,648
	(0.012)	(48,270)	(0.030)	(107,732)	(0.020)	(65,160)	(0.012)	(29,435)	(0.017)	(34,310)
Angler Hours		4,303,895		3,938,697		3,534,084		2,633,377		2,355,718
		(263,743)		(435,727)		(356,012)		(239,188)		(234,075)

[1]Lake trout statistics are for May through August.

[2]Includes charter boat data after August 1.

Table 9.—Catch per hour of chinook salmon (April through October) and lake trout (May through August) at nine Lake Michigan ports, 1985-89. Two standard errors in parentheses.

Area	Chinook salmon					Lake trout				
	1985	1986	1987	1988	1989[1]	1985	1986	1987	1988	1989[2]
New Buffalo	0.032	0.023	0.016	0.022	0.025	0.008	0.015	0.030	0.025	0.032
	(0.009)	(0.018)	(0.017)	(0.014)	(0.017)	(0.003)	(0.013)	(0.030)	(0.013)	(0.022)
St. Joseph	0.043	0.049	0.025	0.027	0.032	0.025	0.038	0.039	0.021	0.029
	(0.014)	(0.019)	(0.015)	(0.011)	(0.010)	(0.008)	(0.025)	(0.034)	(0.008)	(0.010)
Grand Haven	0.067	0.098	0.051	0.028	0.022	0.020	0.026	0.040	0.031	0.030
	(0.034)	(0.048)	(0.024)	(0.028)	(0.008)	(0.006)	(0.015)	(0.024)	(0.017)	(0.015)
Muskegon	0.106	0.089	0.082	0.022	0.020	0.021	0.033	0.033	0.017	0.019
	(0.051)	(0.034)	(0.085)	(0.014)	(0.012)	(0.016)	(0.011)	(0.022)	(0.009)	(0.013)
Ludington	0.123	0.155	0.135	0.082	0.048	0.024	0.021	0.027	0.029	0.046
	(0.040)	(0.103)	(0.068)	(0.046)	(0.016)	(0.010)	(0.014)	(0.016)	(0.020)	(0.018)
Manistee	0.108	0.102	0.083	0.048	0.032	0.015	0.011	0.021	0.021	0.027
	(0.029)	(0.039)	(0.030)	(0.020)	(0.013)	(0.004)	(0.006)	(0.007)	(0.009)	(0.016)
Frankfort	0.086	0.109	0.078	0.044	0.046	0.033	0.068	0.032	0.058	0.055
	(0.023)	(0.070)	(0.059)	(0.018)	(0.051)	(0.024)	(0.085)	(0.022)	(0.017)	(0.046)
West Grand Traverse Bay	0.029	0.022	0.028	0.024	0.016	0.036	0.073	0.078	0.078	0.117
	(0.012)	(0.011)	(0.012)	(0.011)	(0.008)	(0.010)	(0.032)	(0.028)	(0.019)	(0.043)
Charlevoix	0.067	0.100	0.103	0.084[1]	0.041[1]	0.114	0.081	0.032	0.142	0.165
	(0.029)	(0.044)	(0.028)	(0.064)	(0.021)	(0.061)	(0.038)	(0.014)	(0.052)	(0.060)

[1]May through September.

[2]Includes charter boat data after August 1.

Table 10.—Estimated catch per hour, number caught, and effort (angler hours, trips, and days) for Saginaw Bay (Port Austin to Tawas), by all modes of sportfishing, 1989. Two standard errors in parentheses.

Species	Total catch per hour	Month							Season
		Apr	May	Jun	Jul	Aug	Sep	Oct	
Pink salmon	0.0002	0	129	57	0	26	0	0	212
	(0.0002)	(0)	(178)	(72)	(0)	(60)	(0)	(0)	(201)
Coho salmon	0.0002	0	78	73	0	0	26	91	268
	(0.0002)	(0)	(89)	(90)	(0)	(0)	(54)	(176)	(223)
Chinook salmon	0.0038	102	1,655	807	775	298	685	100	4,422
	(0.0013)	(105)	(1,098)	(530)	(626)	(297)	(482)	(118)	(1,491)
Rainbow trout	0.0005	35	63	92	25	85	239	71	610
	(0.0004)	(61)	(66)	(113)	(39)	(120)	(483)	(86)	(527)
Atlantic salmon	0.0000	0	5	0	0	0	0	0	5
	(0.0000)	(0)	(12)	(0)	(0)	(0)	(0)	(0)	(12)
Brown trout	0.0003	147	44	33	0	43	18	3	288
	(0.0003)	(260)	(46)	(69)	(0)	(91)	(46)	(6)	(291)
Lake trout	0.0065	0	1,342	1,956	3,907	229	50	0	7,484
	(0.0028)	(0)	(1,069)	(1,221)	(2,701)	(227)	(65)	(0)	(3,160)
Northern pike	0.0002	42	31	99	0	37	40	0	249
	(0.0002)	(66)	(51)	(151)	(0)	(77)	(81)	(0)	(206)
White sucker	0.0000	46	0	0	0	0	0	0	46
	(0.0000)	(88)	(0)	(0)	(0)	(0)	(0)	(0)	(88)
Black bullhead	0.0000	0	0	0	0	0	51	0	51
	(0.0000)	(0)	(0)	(0)	(0)	(0)	(88)	(0)	(88)
Brown bullhead	0.0026	79	99	2,438	245	134	0	2	2,997
	(0.0028)	(100)	(150)	(3,200)	(195)	(201)	(0)	(3)	(3,217)
Channel catfish	0.0203	115	562	13,165	3,244	1,364	4,903	1	23,354
	(0.0100)	(233)	(865)	(7,377)	(1,567)	(1,801)	(8,150)	(2)	(11,285)
White perch	0.0010	0	10	1,015	60	25	0	0	1,110
	(0.0014)	(0)	(18)	(1,540)	(88)	(52)	(0)	(0)	(1,543)
White bass	0.0042	307	3,105	301	793	236	96	0	4,838
	(0.0037)	(426)	(4,186)	(307)	(688)	(417)	(166)	(0)	(4,298)
Rock bass	0.0011	106	134	1,032	0	37	0	4	1,313
	(0.0017)	(187)	(248)	(2,016)	(0)	(59)	(0)	(7)	(2,041)

Table 10.—Continued:

Species	Total catch per hour	Month							Season
		Apr	May	Jun	Jul	Aug	Sep	Oct	
Pumpkinseed	0.0002	0	0	12	90	1	125	6	234
	(0.0002)	(0)	(0)	(23)	(184)	(2)	(175)	(13)	(255)
Bluegill	0.0000	0	0	0	0	6	0	0	6
	(0.0000)	(0)	(0)	(0)	(0)	(16)	(0)	(0)	(16)
Smallmouth bass	0.0005	0	164	41	330	0	0	0	535
	(0.0005)	(0)	(363)	(84)	(329)	(0)	(0)	(0)	(497)
Largemouth bass	0.0009	0	175	201	409	63	148	0	996
	(0.0008)	(0)	(348)	(325)	(625)	(139)	(302)	(0)	(853)
White crappie	0.0001	0	0	0	0	0	78	0	78
	(0.0002)	(0)	(0)	(0)	(0)	(0)	(164)	(0)	(164)
Black crappie	0.0000	0	0	0	0	30	0	0	30
	(0.0000)	(0)	(0)	(0)	(0)	(51)	(0)	(0)	(51)
Yellow perch	1.0473	96,900	13,812	91,899	259,722	234,713	378,172	131,037	1,206,255
	(0.1836)	(34,589)	(10,839)	(41,697)	(70,885)	(81,865)	(130,358)	(54,153)	(186,292)
Walleye	0.0473	380	4,345	1,281	32,806	13,042	2,629	36	54,519
	(0.0100)	(293)	(2,741)	(879)	(7,718)	(5,773)	(3,265)	(70)	(10,580)
Freshwater drum	0.0029	0	462	1,833	683	195	114	0	3,287
	(0.0023)	(0)	(624)	(2,425)	(638)	(205)	(144)	(0)	(2,596)
Burbot	0.0000	0	0	0	0	0	0	46	46
	(0.0000)	(0)	(0)	(0)	(0)	(0)	(0)	(101)	(101)
Other	0.0021	2,107	60	182	50	0	0	0	2,399
	(0.0040)	(4,522)	(96)	(402)	(109)	(0)	(0)	(0)	(4,542)
Total	1.1422	100,366	26,275	116,517	303,139	250,564	387,374	131,397	1,315,632
	(0.1880)	(34,890)	(12,100)	(42,645)	(71,385)	(82,091)	(130,656)	(54,154)	(187,138)
Angler hours		92,202	99,642	221,196	342,765	174,017	187,526	34,482	1,151,830
		(15,094)	(24,514)	(41,440)	(50,891)	(37,828)	(49,335)	(10,677)	(95,472)
Angler trips		27,452	26,714	46,707	64,688	39,972	38,250	7,819	251,602
		(5,277)	(6,078)	(8,606)	(9,310)	(8,113)	(8,891)	(2,518)	(19,410)
Angler days		25,682	24,792	45,121	63,095	38,520	35,801	7,349	240,360
		(5,088)	(5,803)	(8,461)	(9,173)	(7,868)	(8,294)	(2,386)	(18,753)

Table 11.—Estimated yellow perch and walleye catch per hour, number caught, and angler effort (hours) for Saginaw Bay (Port Austin to Tawas) during April-September 1986-89. Two standard errors in parentheses.

Year	Yellow perch		Walleye		Angler hours
	Catch per hour	Number caught	Catch per hour	Number caught	
1986	0.857 (0.151)	1,603,623 (281,629)	0.032 (0.014)	59,203 (25,319)	1,871,136 (145,336)
1987	1.276 (0.179)	2,329,021 (327,449)	0.035 (0.007)	63,461 (12,059)	1,825,524 (116,250)
1988	0.828 (0.168)	1,182,625 (239,915)	0.070 (0.018)	100,129 (25,077)	1,428,189 (155,718)
1989[1]	0.958 (0.160)	1,078,377 (178,247)	0.050 (0.010)	56,301 (10,580)	1,125,229 (94,873)

[1]Includes charter boat data after August 1.

Table 12.—Estimated catch per hour, number caught, and effort (angler hours, trips, and days) for Lake Erie boat fishery, 1989. Two standard errors in parentheses.

Species	Total catch per hour	Month							Season
		Apr	May	Jun	Jul	Aug	Sep	Oct	
Rainbow trout	0.0001	0	0	255	0	0	0	0	255
	(0.0002)	(0)	(0)	(391)	(0)	(0)	(0)	(0)	(391)
Northern pike	0.0004	0	0	0	0	1,351	0	0	1,351
	(0.0008)	(0)	(0)	(0)	(0)	(2,787)	(0)	(0)	(2,787)
Muskellunge	0.0000	0	0	0	0	0	81	0	81
	(0.0000)	(0)	(0)	(0)	(0)	(0)	(166)	(0)	(166)
Redhorse spp.	0.0001	0	0	0	0	380	0	0	380
	(0.0002)	(0)	(0)	(0)	(0)	(784)	(0)	(0)	(784)
Black bullhead	0.0001	0	0	0	0	0	223	0	223
	(0.0002)	(0)	(0)	(0)	(0)	(0)	(457)	(0)	(457)
Yellow bullhead	0.0001	0	0	0	0	100	0	176	276
	(0.0001)	(0)	(0)	(0)	(0)	(210)	(0)	(267)	(340)
Brown bullhead	0.0000	0	0	0	0	0	0	55	55
	(0.0000)	(0)	(0)	(0)	(0)	(0)	(0)	(111)	(111)
Channel catfish	0.0457	4,646	18,141	42,851	30,187	57,687	10,816	8,941	173,269
	(0.0159)	(5,990)	(13,809)	(35,605)	(13,360)	(34,912)	(7,331)	(9,224)	(55,050)
White perch	0.0482	83	2,823	27,195	74,858	44,901	20,962	12,196	183,018
	(0.0141)	(136)	(3,444)	(24,491)	(27,711)	(23,006)	(14,633)	(6,164)	(46,486)
White bass	0.0993	29,694	275,815	42,795	14,311	1,993	4,733	7,319	376,660
	(0.0441)	(18,555)	(155,697)	(19,551)	(6,551)	(2,698)	(4,922)	(7,825)	(158,442)
Rock bass	0.0008	0	234	324	601	1,318	477	179	3,133
	(0.0004)	(0)	(501)	(443)	(563)	(1,301)	(506)	(194)	(1,658)
Pumpkinseed	0.0002	0	0	0	0	424	97	52	573
	(0.0002)	(0)	(0)	(0)	(0)	(629)	(199)	(84)	(665)
Bluegill	0.0038	0	257	765	282	3,206	7,189	2,565	14,264
	(0.0024)	(0)	(545)	(1,605)	(506)	(4,378)	(6,813)	(3,309)	(8,925)
Redear sunfish	0.0000	0	0	21	0	0	0	0	21
	(0.0000)	(0)	(0)	(43)	(0)	(0)	(0)	(0)	(43)
Smallmouth bass	0.0002	0	0	0	402	132	13	78	625
	(0.0002)	(0)	(0)	(0)	(580)	(202)	(26)	(160)	(635)

Table 12.—Continued:

Species	Total catch per hour	Month							Season
		Apr	May	Jun	Jul	Aug	Sep	Oct	
Largemouth bass	0.0001	87	0	49	25	0	229	0	390
	(0.0001)	(187)	(0)	(102)	(50)	(0)	(467)	(0)	(516)
White crappie	0.0003	0	0	0	0	0	0	1,240	1,240
	(0.0004)	(0)	(0)	(0)	(0)	(0)	(0)	(1,835)	(1,835)
Black crappie	0.0001	87	0	0	0	0	222	94	403
	(0.0001)	(187)	(0)	(0)	(0)	(0)	(408)	(191)	(488)
Yellow perch	0.3799	2,717	7,526	49,436	103,400	245,511	486,681	545,962	1,441,233
	(0.0842)	(5,106)	(5,423)	(23,479)	(32,817)	(136,476)	(156,503)	(118,995)	(242,822)
Walleye	0.2877	24,372	290,496	351,426	392,193	30,624	2,466	65	1,091,642
	(0.0681)	(11,079)	(120,416)	(146,991)	(72,722)	(23,062)	(1,872)	(79)	(205,068)
Freshwater drum	0.0113	0	7,219	4,821	8,633	16,114	5,471	717	42,975
	(0.0050)	(0)	(8,830)	(3,297)	(5,125)	(12,772)	(6,298)	(601)	(17,840)
Other	0.0086	0	31,305	59	298	290	295	344	32,591
	(0.0175)	(0)	(66,135)	(125)	(459)	(439)	(466)	(272)	(66,140)
Total	0.8868	61,686	633,816	519,997	625,190	404,031	539,955	579,983	3,364,658
	(0.1604)	(23,002)	(208,389)	(156,273)	(85,919)	(145,279)	(157,721)	(119,829)	(368,916)
Angler hours		136,636	812,816	1,137,551	930,019	345,158	266,186	165,597	3,793,963
		(44,828)	(305,565)	(409,865)	(147,232)	(93,400)	(56,899)	(27,723)	(545,688)
Angler trips		28,229	146,858	212,225	176,743	69,472	55,254	33,470	722,251
		(9,758)	(56,542)	(78,283)	(28,652)	(19,233)	(12,139)	(5,781)	(103,885)
Angler days		27,179	146,858	201,716	166,418	66,935	54,397	33,470	696,973
		(9,577)	(56,542)	(74,661)	(26,970)	(18,628)	(11,995)	(5,781)	(100,572)

Table 13.—Estimated yellow perch and walleye catch per hour, number caught, and angler effort (hours) for the Lake Erie boat fishery during May-September 1986-89. Two standard errors in parentheses.

Year	Yellow perch		Walleye		Angler hours
	Catch per hour	Number caught	Catch per hour	Number caught	
1986	0.308	616,775	0.302	605,666	2,003,342
	(0.088)	(175,555)	(0.055)	(110,365)	(250,754)
1987	0.132	310,342	0.382	901,202	2,357,615
	(0.062)	(146,740)	(0.064)	(151,019)	(305,725)
1988	0.073	318,786	0.458	1,995,530	4,356,500
	(0.047)	(205,749)	(0.096)	(419,052)	(702,517)
1989[1]	0.259	905,040	0.305	1,067,851	3,495,520
	(0.061)	(211,605)	(0.059)	(204,768)	(543,137)

[1]Includes charter boat data after August 1.

Table 14.—Estimated sportfishing catch and effort (angler hours) for salmonids taken from two Lake Michigan tributaries, 1989. Two standard errors in parentheses.

Stream	Species				Angler hours
	Coho salmon	Chinook salmon	Rainbow trout	Brown trout	
Grand River	606	399	2,290	38	52,100
	(579)	(357)	(1,421)	(80)	(7,235)
Muskegon River	0	1,563	2,640	470	35,725
	(0)	(1,644)	(2,074)	(406)	(8,442)

Table 15.—Estimated yellow perch (January-March) and walleye (January-February) catch per hour, number caught, and angler effort for the winter sport fishery on Little Bay de Noc, Lake Michigan, 1986-90. Two standard errors in parentheses.

	Yellow perch		Walleye		
Year	Catch per hour	Number caught	Catch per hour	Number caught	Angler hours
1986	0.824 (0.216)	226,409 (52,473)	0.020 (0.011)	4,890 (2,565)	274,745 (33,342)
1987[1]	—	—	—	—	—
1988	0.491 (0.191)	65,290 (22,140)	0.128 (0.076)	11,798 (6,435)	133,107 (25,403)
1989	0.476 (0.149)	87,083 (25,187)	0.036 (0.019)	6,062 (3,048)	182,963 (21,823)
1990	0.902 (0.186)	176,068 (32,411)	0.057 (0.017)	9,448 (2,758)	195,210 (18,176)

[1]The 1987 data not reliable.

References

Keller, M., K. D. Smith, and R. W. Rybicki. 1990. Review of salmon and trout management in Lake Michigan. Michigan Department of Natural Resources, Fisheries Special Report No. 14, Ann Arbor.

Rakoczy, G. P., and R. D. Rogers. 1987a. Sportfishing catch and effort from the Michigan waters of lakes Michigan, Huron, and Erie, and their important tributary streams, April 1, 1986-March 31, 1987. Michigan Department of Natural Resources, Fisheries Technical Report 87-6a, Ann Arbor.

Rakoczy, G. P., and R. D. Rogers. 1987b. Sportfishing catch and effort from the Michigan waters of lakes Michigan, Huron, and Erie, and their important tributary streams, April 1, 1986-March 31, 1987 (Appendices). Michigan Department of Natural Resources, Fisheries Technical Report 87-6b, Ann Arbor.

Rakoczy, G. P., and R. D. Rogers. 1988a. Sportfishing catch and effort from the Michigan waters of Lake Michigan and their important tributary streams, April 1, 1985-March 31, 1986. Michigan Department of Natural Resources, Fisheries Technical Report 88-11a, Ann Arbor.

Rakoczy, G. P., and R. D. Rogers. 1988b. Sportfishing catch and effort from the Michigan waters of Lake Michigan and their important tributary streams, April 1, 1985-March 31, 1986 (Appendices). Michigan Department of Natural Resources, Fisheries Technical Report 88-11b, Ann Arbor.

Rakoczy, G. P., and R. D. Rogers. 1988c. Sportfishing catch and effort from the Michigan waters of lakes Michigan, Huron, Superior, and Erie, and their important tributary streams, April 1, 1987-March 31, 1988. Michigan Department of Natural Resources, Fisheries Technical Report 88-9a, Ann Arbor.

Rakoczy, G. P., and R. D. Rogers. 1988d. Sportfishing catch and effort from the Michigan waters of lakes Michigan, Huron, Superior, and Erie, and their important tributary streams, April 1, 1987-March 31, 1988 (Appendices). Michigan Department of Natural Resources, Fisheries Technical Report 88-9b, Ann Arbor.

Rakoczy, G. P., and R. D. Rogers. 1990a. Sportfishing catch and effort from the Michigan waters of lakes Michigan, Huron, Erie, and Superior and their important tributary streams, April 1, 1988-March 31, 1989. Michigan Department of Natural Resources, Fisheries Technical Report 90-2a, Ann Arbor.

Rakoczy, G. P., and R. D. Rogers. 1990b. Sportfishing catch and effort from the Michigan waters of Lakes Michigan, Huron, Erie, and Superior and their important tributary streams, April 1, 1988-March 31, 1989 (Appendices). Michigan Department of Natural Resources, Fisheries Technical Report 90-2b, Ann Arbor.

Rakoczy, G. P., and R. D. Rogers. 1991. Charter boat catch and effort from the Michigan waters of the Great Lakes, 1989. Michigan Department of Natural Resources, Ann Arbor. (In preparation.)

Ryckman, J. R. 1981. Creel census methods in general. Appendix VI-A-9 *in* Manual of Fisheries Survey Methods, J. W. Merna et al. Michigan Department of Natural Resources, Fisheries Management Report 9, Ann Arbor.

Smith, K. D., and J. R. Ryckman. 1991. Creel census methodology in Michigan. Michigan Department of Natural Resources, Ann Arbor. (In preparation.)

Report approved by J. C. Schneider
Richard D. Clark, Jr., Editor
Robert C. Haas, Editorial Board Reviewer
Alan D. Sutton, Graphics
Grace M. Zurek, Word Processor