

Wisconsin's 1997 open water sportfishing effort and catch from Lake Michigan and Green Bay.

Bradley T. Eggold

*Wisconsin Department of Natural Resources
Plymouth Field Station
W5750 Woodchuck Lane
P.O. Box 408
Plymouth, Wisconsin 53073*

Abstract - This paper documents the sport fishery in Wisconsin waters of Lake Michigan and Green Bay from March 1, 1997 through December 31, 1997. Fishing effort, catch and catch rates were determined from 1) a stratified random creel survey for launched-boat, pier, shore and stream anglers; 2) a randomized mail survey for moored-boat anglers; and 3) mandatory charter boat reporting system. Anglers spent an estimated 2,868,547 hours fishing on Lake Michigan or Green Bay in 1997 with boat angler effort at 2,105,737 hours or 73% of the total hours. The estimated harvest of 813,057 fish was dominated by yellow perch (235,413) and to a lesser degree coho salmon (138,423), chinook salmon (130,152) and rainbow trout (94,470). The boat fishery, comprised of launched-boat, moored-boat and charter boat anglers dominated the fishery by harvesting an estimated 689,611 fish which was 85.0% of the total fish harvested and was dominated by yellow perch (196,762), coho (128,668) and chinook salmon (117,972) and rainbow trout (80,973). Pier, shore and stream anglers harvested primarily yellow perch, brown and rainbow trout. Overall catch rates were highest for yellow perch at 0.0821 fish/hour and coho salmon at 0.0483 fish/hour.

Before the 1920s, fish biomass and abundance was dominated by lake whitefish (*Coregonus clupeaformis*), lake trout (*Salvelinus namaycush*), bloater chubs (*C. hoyi*), and yellow perch (*Perca flavescens*). During the 1920s to 1950s, the accidental introductions of several exotic species, including the rainbow smelt (*Osmerus mordax*), sea lamprey (*Petromyzon marinus*) and alewife (*Alosa pseudoharengus*), had a major impact on the fish populations in Lake Michigan. These exotic species, along with a deterioration of spawning habitat and increased commercial fishing pressure, were responsible for the decline in the native fish populations (Hansen *et al.* 1990).

In response to the increasing alewife population and declining Lake Michigan fishery, the Wisconsin Department of Natural Resources (WDNR) in 1963 experimentally introduced 9,000 rainbow trout into several Door Co. tributaries with a twofold purpose: 1) to control or limit the abundant alewife population

and 2) to provide a sport fishery. This initial stocking proved to be very successful and expanded to include trouts (*Salmo* spp.), chars (*Salvelinus* spp.) and other pacific salmon (*Oncorhynchus* spp.). The stocking of exotic salmonids provided not only a practical way to control the alewife population but also a valuable sport fishery.

In order to manage the Lake Michigan sport fishery, assessments must be conducted on both the forage and predator fish stocks. Since 1973, the US Fish and Wildlife Service has conducted fall daytime bottom-trawl surveys in Lake Michigan to estimate the abundance of forage fish. These estimates are based on a series of 10 minute trawl tows along the contour of nine depths at each of seven index stations (Eck 1992). Since 1969, the WDNR has monitored the Lake Michigan sport fishery with a statewide contact creel survey. This provides the WDNR with a continuous record of harvest, harvest rates and biological data of the harvest.

This paper reports the results of the annual survey of anglers fishing the Wisconsin waters of Lake Michigan. Data were collected from anglers at ramps, piers, shores and streams, from moored-boat and charter boat anglers. Estimates were then calculated for fishing effort, catch and catch rates for 1997.

Oak Creek	Milwaukee River
Grant Park	Riverfront Ramp
S. Metro Pier	N. City Shoreline

STUDY AREA AND METHODS

Geographical Area

The geographical area of this survey is illustrated in Figure 1. Wisconsin's share of Lake Michigan is second only to Michigan and encompasses 495 miles of shoreline and 25 tributaries. The Wisconsin waters of Lake Michigan include Green Bay and portions of two distinct lake basins (northern and southern). For a complete description see Eggold (1995).

Creel Survey Design

The open water creel survey was conducted using a modified access point design called the Wisconsin Hybrid design. It differs from a true access point design in that creel clerks visit several sites per site group. The fishing season for the creel survey from March 15th to October 31st is stratified by statistical management unit (SMU) (i.e. counties), fishery types (i.e. ramp, pier, shore and stream), statistical survey periods (i.e. months or groups of months) and day type (i.e. weekday, weekend/holiday). Statistical Management Units (SMU) were assigned based primarily on county lines and include units like Kenosha, Racine, Milwaukee, etc. Survey sites within each SMU were placed into site groups. There may be one or several site groups in each SMU based on the time of year and size of each SMU. Site groups were selected randomly on a daily basis without replacement and survey sites within a site group were visited randomly. Surveys were conducted on every weekend day and holiday and on either two or three days during the week, depending on the month. Each workday was comprised of two shifts, an am and pm shift. Combined together, the two shifts covered the entire angling day. The clerk worked one shift per workday. The shifts were equal in duration, did not overlap and were sampled with equal probability. An example is shown below.

EXAMPLE:

Statistical Management Unit MILWAUKEE	
Site Groups MILW. SOUTH MILW. NORTH	
Survey Sites S. Shore Ramps	McKinley Ramps
S. Shore Pier	McKinley Pier

Three types of data were collected for each site sampled: angler, boat trailer or car counts for effort, angler or party interviews for harvest rates and biological information on harvested fish. Instantaneous counts were made by creel clerks at all sites in the survey. The type of count was dependent on the type of fishery. At most ramp sites, boat trailers were counted. At most pier, shore and stream sites, anglers were counted. However, due to poor access points on some tributaries, car counts were used and were corrected by the number of anglers in the car from interview data. The time the count was completed and count per site were recorded on the activity count form.

Angler or angler parties were interviewed at the completion of their fishing trips. Anglers were asked if they were state residents, what time they started their fishing trip, what they fished for and the number of caught and harvested fish. These data were recorded on the angler interview form (Figure 2). If the angler indicated that they had harvested fish, biological information such as species, length, weight, finclip and tag numbers were collected (Figure 3). Standard weight calculations followed that of Hansen (1986).

Fishing effort calculations. Fishing effort estimates (expressed in angler hours) were derived from instantaneous counts of anglers at pier, breakwater, shore and stream sites and from counts of boat trailers at boat ramps and from counts of cars at stream sites. Counts were made at randomly computed times at each site during each visit. We estimated angler effort and its variance within each stratum (SMU, fishery type, month and day type). The variance of angler effort involves variability among days and variability within days. Formulas for two stage surveys were used to calculate variance. For a complete description see Eggold (1995).

Harvest and harvest rate calculations. Harvest estimates were derived from interviews of anglers at all sites. For each interview, the number of fish harvested and the hours fished were determined. The harvest and hours fished were summed over all interviews in a stratum, the ratio of the sum and the variance of the ratio were then calculated. For a complete description see Eggold (1995).

Moored Boat Survey Design

Anglers who moored their boat on Lake Michigan and Green

Bay were surveyed by questionnaire beginning in 1988. The earlier surveys (1982-1985) were based on voluntary information from moored-boat owners who received their survey form from sport fishing clubs. However, in 1988, creel clerks were asked to compile a list of boat registration numbers of moored-boats present on Lake Michigan during a day of bad weather. These numbers were used to develop a list of boat owners from the Wisconsin Department of Natural Resources master file of registered boats. Beginning in 1988, a mail survey was sent to all moored-boat owners to obtain information on 1) whether they moored their boat on Lake Michigan or Green Bay; 2) the port of call; 3) whether the boat was used for fishing during that week; 4) the number of days fished; 5) number of anglers in the fishing party; 6) number of hours fished; and 7) the number of each species caught on each day during the past seven day period.

Fishing effort and harvest calculations. Fishing effort was calculated by harbor and month for each month of the survey. Party size and number of hours fished on each trip were multiplied, summed for each month and harbor, and divided by the number of responses received for the month. This total was multiplied by the boat count and the number of days in the month to obtain estimated angler hours for the entire moored-boat population. Harvest estimates were calculated by harbor and month for each species based on catch per boat. The harvest was summed for each month and harbor, and divided by the number of responses received for the month. This total was multiplied by the boat count and the number of days in the month to obtain estimated harvest for the entire moored-boat population.

Harvest rate calculations. Harvest rate, the number of fish caught per angler hour, was obtained by dividing the monthly reported catch of each species by the total fishing effort for that month for each harbor.

This type of survey is biased because only those interested and successful anglers tend to mail back the survey form. Therefore, the harvest will tend to be an overestimate of the actual number but should be comparable among years and locations. For a more detailed description of the calculations and formulas see Eggold (1993).

Charter Boat Survey Design

At the beginning of each fishing season, a packet of information was sent to each licensee. This packet included notes on important fishing items, a sample of a completed monthly report, grid map of Lake Michigan, list of wardens,

coded-wire tag collection stations, finclip list, sea lamprey information and a supply of monthly report forms.

Each license holder was required by law to report all paid charters. The report was to be mailed by the 10th of each month on the records for the preceding calendar month to the Plymouth Field Station of the WDNR. If a report was late or incorrectly filled out a warning letter was sent. Only one letter was sent per license holder and any subsequent violations were referred directly to a Wisconsin Conservation Warden.

The information obtained from each form included: license number, fishing port, date of fishing trip, grid fished, number of resident and nonresident anglers, number of fished harvested, time each trip started (am, pm, evening), number of lines fished and number of hours fished. This information had to be recorded within half an hour after completing each trip after returning to the dock or shore. The number of lake trout, coho salmon, brown trout, steelhead, chinook salmon and other species caught, tag numbers present and the number of lampreys attached to chinook salmon and lake trout had to be recorded prior to midnight of the day of each trip. The data were received at the Plymouth Field Station, entered and checked for errors.

RESULTS

For purposes of this report both harvest and catch will be used synonymously to mean the number of fish harvested. Fishing effort in Wisconsin waters of Lake Michigan and Green Bay was estimated at 2,868,547 ($\pm 53,164$) hours for 1997 during the open water season from March 1 - December 31 (Table 1). Angler hours decreased slightly from 1996 (2,973,036) and have dropped slightly in each year since 1989 (Figure 4). Green Bay anglers had the most fishing effort at 886,873 ($\pm 35,678$) hours or 31% of all angler hours for 1997. Kewaunee Co. anglers came in second at 327,253 ($\pm 19,421$) hours.

Angler hours were disproportionately spread among the four fishery types. Boat anglers spent 2,105,737 ($\pm 50,483$) hours or 73% of all angler hours fishing on Lake Michigan or Green Bay (Table 5). Stream anglers fished the second most at 399,395 ($\pm 13,594$) hours or 14% of the total (Table 8). Pier and shore anglers fished 137,605 ($\pm 5,944$) and 225,810 ($\pm 7,598$) hours respectively (Tables 6-7).

Fishermen caught an estimated 464,522 ($\pm 9,945$) salmonids during the 1997 season (Table 2). Coho salmon dominated the catch comprising 138,423 ($\pm 6,039$) fish or 30% of the

total. Rainbow trout was the most numerous species caught in 1993-1994 and chinook salmon from 1988-1992 and 1995-1996. However, anglers caught more coho salmon in 1997 than any other salmonid, comprising 30% of the salmonid harvest. This harvest is Wisconsin's all-time high for coho salmon. Chinook salmon harvest numbers decreased to 130,152 (\pm 5,050). Rainbow trout harvest increased from 1996 to 94,470 (\pm 4,436) fish or 20% of the total. Lake trout were the fourth numerous salmonid harvested at 57,954 (\pm 2,371) fish followed by brown trout at 43,224 (\pm 3,411) and brook trout at 299 (\pm 76).

The combined catch rate for salmonids are depicted in Table 2 and Figure 5. The catch rate increased considerably in 1997 to 0.1619 fish/hour and was much higher than previous years. This can be attributed to a decrease in angler hours, increase in the salmonid harvest especially coho salmon and rainbow trout and good fishing conditions during the 1997 fishing season.

Fishermen caught an estimated 235,413 (\pm 16,934) yellow perch in 1997 (Table 3 and Figure 6). Anglers harvest 204,267 (\pm 16,429) yellow perch in Green Bay with a harvest rate of 0.2303 fish/hour. Lake Michigan anglers caught 31,146 (\pm 4,103) yellow perch and had a catch rate of 0.0157 fish/hour (Table 3 and Figure 6). Yellow perch comprised the majority of the catch from all areas combined at 235,413 (\pm 16,934) fish and had an overall catch rate of 0.0821 fish/hour (Table 4). Yellow perch were the most numerous species caught for the boat and pier fishery although the majority (84.0%) were caught by boat fishermen (Table 5). Yellow perch catch rates were highest for the pier fishery at 0.1176 fish/hour followed by the boat fishery at 0.0934 (Table 5). The majority of the harvest took place in the summer months from July to September.

The catch in 1997 was much lower than previous years and considerably less than the 1992-1994 average. In the last several years, management decisions to protect the dwindling yellow perch population have been enacted and include: 1) closure of the Lake Michigan commercial yellow perch season; 2) a drop in the sport bag to 5/day with a June closure on Lake Michigan; and 3) a drop in the Green Bay commercial quota for yellow perch. These procedures not only should protect the remaining yellow perch stocks but also accounted for the decrease in the number of harvested yellow perch in 1997.

The total catch of 13 major species was 813,057 (\pm 22,621) fish for 1997 (Table 4). The majority of the catch came from boat anglers (Table 5) who caught 689,611 (\pm 20,096) fish or 84.8% of the total. The other angler types, pier, shore and

stream accounted for 22,434 (\pm 2,995), 33,543 (\pm 3,167) and 67,469 (\pm 9,424) fish respectively or 2.8%, 4.1% and 8.3% of the total (Tables 6-8).

The coho salmon harvest increased dramatically in 1997 to 138,423 (\pm 6,039) fish which was the most caught since the creel survey began in 1969 (Table 2). Overall coho salmon catch rates were 0.0483. Boat anglers harvested 93% of all coho salmon (128,668) and enjoyed catch rates of 0.0611 fish/hour (Table 5). The remaining harvest was divided among the pier, shore and stream anglers at 1,287, 3,037 and 5,431 fish, respectively (Tables 6-8). Biological data collected on coho salmon showed that the mean weight was 3.1 (\pm 1.5) pounds and the mean length was 20.2 (\pm 2.8) inches with a standard weight of 3.5 pounds (Table 9). All three parameters decreased in 1997.

Anglers caught 130,152 (\pm 5,050) chinook salmon down significantly from 1996 (Table 2). The overall catch rate of 0.0454 was higher than those calculated for steelhead and slightly less than the coho salmon catch rates. Like those two species, the majority of the harvest occurred in the boat fishery with anglers harvesting 117,972 (\pm 4,902) fish or 91% of all chinook salmon caught (Table 5). Boat angler catch rates were 0.0560. Stream anglers harvested 8,112 (\pm 1,138) chinook salmon with catch rates at 0.0203 (Table 8). The average weight and length for chinook salmon were 9.2 (\pm 6.3) pounds and 27.4 (\pm 6.7) inches, while the standard weight was 9.7 pounds (Table 9).

Rainbow trout was the third most abundant salmonid and fourth most abundant species caught in 1997 at 94,470 (\pm 4,436) (Table 2,4). Rainbow trout catch rates were the third highest among all salmonids at 0.0329 fish/hour. The majority of the catch occurred in the boat fishery with 80,973 (\pm 4,298) fish caught (Table 5). Stream anglers caught 11,870 (\pm 1,066) steelhead with catch rates at 0.0297 fish/hour (Table 8). Rainbow trout averaged 6.8 (\pm 2.9) pounds and 26.6 (\pm 4.0) inches with a standard weight of 3.7 pounds (Table 9) remaining constant from the previous years.

Anglers in Wisconsin harvested 57,954 (\pm 2,371) lake trout in Lake Michigan and Green Bay. While the harvest was fairly high, the overall catch rate was lower than all major salmonids except brook and brown trout at 0.0202 fish/hour (Table 4). Like coho and chinook salmon, boat anglers caught most of the lake trout, catching 57,717 (\pm 2,370) fish or 99% of all lake trout. Boat catch rates were slightly higher than the overall catch rate estimated at 0.0274 fish/hour (Table 5). Lake trout size was calculated at 7.3 (\pm 3.8) pounds and 26.6 (\pm 4.0) inches with a standard weight of 5.7 pounds (Table 9).

An estimated 43,224 ($\pm 3,411$) brown trout were harvested in 1997 from all surveyed areas, with an overall catch rate of 0.0151 fish/hour (Table 4). Unlike the other salmonids, which were almost exclusively caught in the boat fishery, brown trout harvest by boat anglers was 29,423 ($\pm 3,228$) fish or only 68% of the total. Pier anglers harvested 2,172 (± 313) brown trout and had catch rates of 0.0158 fish/hour (Table 6). This total was the highest of any species except yellow perch and comprised 34% of the non-yellow perch pier harvest. Likewise, shore anglers caught 9,126 (± 998) brown trout or 52% of the non-yellow perch shore harvest (Table 7). Shore catch rates were 0.0404 fish/hour. Brown trout biological data for 1997 showed that their mean size was 4.9 (± 2.8) pounds, 21.1 (± 4.1) inches and 3.4 pounds standard weight (Table 9).

Smallmouth bass were numerous in the catch, totaling 52,589 ($\pm 5,151$) fish (Table 4). The harvest was highest in June and July. Overall catch rates were 0.0183 fish/hour, much less than those calculated for yellow perch. Again, boat anglers caught the majority of the smallmouth bass, harvesting 50,167 ($\pm 5,116$) fish or 95% of the total (Table 5). Boat catch rates were slightly higher (0.0238) than the overall catch rate. The remainder of the harvest was spread among the three remaining fishery types, having catch rates of 0.0030, 0.0013 and 0.0043 fish/hour respectively (Tables 6-8).

White perch were also numerous in the catch at 23,605 ($\pm 9,031$). Overall catch rates were fairly low at 0.0082 fish/hour (Table 4). The majority of the harvest occurred in the stream fishery at 23,150 ($\pm 9,025$) fish representing 98% of the harvest. Stream catch rates were 0.0580 fish/hour the highest among all the species. The remaining fishery types comprised the remainder of the harvest (455 fish).

Walleyes were the last species harvested in large numbers during the open water fishing season. An estimated 31,049 ($\pm 4,084$) walleyes were caught with the majority caught in spring (Table 4). This represents a substantial increase from 1996 (18,468). Like smallmouth bass, catch rates were lower than most salmonids at 0.0108 fish/hour. The harvest was concentrated exclusively in two fishery types, boat and stream. Boat anglers caught 22,528 ($\pm 3,926$) walleyes (Table 5) while stream anglers caught 7,907 ($\pm 1,092$) walleyes (Table 8). Stream catch rates of 0.0198 fish/hour were better than boat catch rates of 0.0107 fish/hour.

The remaining species, atlantic salmon, brook trout, splake and northern pike comprised only 0.7% of the total harvest and 1% of the non-yellow perch harvest.

Lake Michigan anglers spent an estimated 2,868,547 hours fishing on Lake Michigan or Green Bay with boat angler effort at 2,105,737 hours or 73% of the total hours. The estimated harvest of 813,057 fish was dominated by yellow perch (235,413) and to a lesser degree rainbow trout (94,470), coho (138,423) and chinook salmon (130,152).

The salmonid harvest increased from 440,429 fish in 1996 to 464,422 fish in 1997. Overall catch rates were slightly higher in 1997, due to the extremely successful chinook and coho salmon and rainbow trout fishery exhibited in 1997. The overall catch rate was the highest recorded in the last 8 years.

The yellow perch catch continues to decline with only 235,413 fish harvested, the lowest number recorded the last 6 years. Likewise, catch rates declined to their lowest rate (0.0821) in the past 6 years. Obviously the declining yellow perch population in both Lake Michigan and Green Bay have accounted for the large decreases recorded in this study.

Several factors had major impacts during the 1997 fishing season. Weather patterns during June, July and August were ideal. Large numbers of all species were harvested during this time period. In fact, higher than average catches of coho and chinook salmon occurred in June. A similar pattern formed in 1995 and 1996, with both years showing large catches of fish.

SUMMARY

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Table 1. Estimated angler effort (hours) by area in Wisconsin waters of Lake Michigan and Green Bay, March-December 1990-1997. Standard deviation in brackets.

Area	1990	1991	1992	1993	1994	1995	1996	1997
Kenosha Co.	178,036 [10,685]	184,570 [10,815]	196,298 [10,102]	195,609 [9,665]	189,877 [8,195]	164,111 [9,934]	157,607 [6,705]	188,561 [8,937]
Racine Co.	295,553 [20,111]	332,412 [20,585]	411,704 [21,114]	327,379 [19,740]	315,927 [13,911]	335,535 [18,995]	238,052 [13,846]	302,364 [15,472]
Milwaukee Co.	441,728 [16,495]	465,734 [19,160]	491,750 [19,696]	368,467 [13,736]	404,704 [14,303]	343,545 [12,115]	280,704 [9,625]	283,356 [10,492]
Ozaukee Co.	226,882 [12,032]	175,813 [9,630]	211,667 [11,331]	139,075 [8,437]	206,470 [11,873]	232,899 [16,115]	242,963 [11,915]	229,387 [12,796]
Sheboygan Co.	240,318 [11,690]	191,250 [10,632]	211,947 [11,732]	152,770 [8,747]	244,500 [13,999]	249,426 [16,183]	262,948 [14,697]	216,834 [13,730]
Manitowoc Co.	296,175 [12,231]	260,313 [12,589]	303,214 [15,706]	298,533 [15,475]	266,866 [11,121]	235,990 [9,038]	204,487 [9,673]	227,955 [11,713]
Kewaunee Co.	279,385 [15,959]	328,171 [21,383]	295,724 [13,318]	342,852 [17,627]	338,864 [18,617]	329,637 [16,500]	334,736 [23,955]	327,253 [19,421]
E. Door Co.	406,998 [25,043]	344,292 [16,485]	390,178 [38,245]	310,454 [16,293]	331,851 [19,768]	304,201 [17,298]	278,601 [15,113]	205,964 [16,043]
Green Bay	1,245,291 [39,981]	1,324,911 [40,786]	1,188,588 [38,041]	1,112,877 [39,002]	1,191,252 [34,804]	1,078,522 [32,379]	972,938 [34,570]	886,873 [35,678]
TOTAL	3,610,365 [60,844]	3,607,466 [60,536]	3,701,072 [67,348]	3,248,017 [56,181]	3,490,310 [53,615]	3,273,866 [53,193]	2,973,036 [52,708]	2,868,547 [53,164]

Table 2. Estimated catch and catch rate of salmonids in Wisconsin waters of Lake Michigan and Green Bay, March-December 1990-1997. Standard deviation in brackets.

Species	1990	1991	1992	1993	1994	1995	1996	1997
Coho Salmon	64,085 [3,002]	44,195 [2,435]	70,876 [3,890]	74,304 [4,151]	110,001 [5,857]	65,647 [3,107]	104,715 [4,546]	138,423 [6,039]
Chinook Salmon	111,342 [4,399]	139,081 [5,318]	103,568 [6,571]	87,366 [3,707]	99,754 [4,424]	162,888 [5,953]	183,254 [7,746]	130,152 [5,050]
Rainbow Trout	51,708 [2,996]	67,878 [3,408]	79,525 [6,029]	104,765 [3,998]	114,774 [4,455]	117,508 [4,416]	77,099 [4,192]	94,470 [4,436]
Brown Trout	45,094 [3,605]	59,164 [4,182]	51,554 [2,794]	64,546 [3,735]	52,398 [2,695]	49,654 [2,630]	38,093 [2,160]	43,224 [3,411]
Brook Trout	5,928 [616]	1,661 [397]	4,432 [458]	1,967 [311]	7,482 [797]	1,914 [332]	419 [112]	299 [76]
Lake Trout	75,180 [3,067]	85,842 [3,279]	52,854 [2,504]	60,943 [2,776]	53,989 [2,337]	69,332 [2,797]	36,849 [1,806]	57,954 [2,371]
TOTAL	353,338 [7,753]	397,821 [8,615]	362,809 [10,438]	393,891 [8,290]	438,397 [9,332]	466,943 [8,913]	440,429 [10,304]	464,522 [9,945]
Catch Rate	0.0979	0.1103	0.0980	0.1213	0.1256	0.1426	0.1481	0.1619

Table 3. Estimated catch and catch rate of yellow perch in Wisconsin waters of Lake Michigan and Green Bay, March-December 1992-1997.

Species	1992	1993	1994	1995	1996	1997
Yellow Perch						
Green Bay	1,275,392	775,117	1,091,837	802,668	429,466	204,267
St. Dev.	[83,981]	[67,693]	[69,029]	[57,516]	[34,274]	[16,429]
Catch Rate	1.0730	0.6965	0.9165	0.7442	0.4414	0.2303
Lake Michigan	959,925	545,901	289,905	246,945	95,100	31,146
St. Dev.	[43,456]	[30,016]	[18,389]	[20,677]	[14,985]	[4,103]
Catch Rate	0.3821	0.2557	0.1261	0.1125	0.0475	0.0157
TOTAL	2,235,317	1,321,018	1,381,742	1,049,613	524,566	235,413
	[94,558]	[74,049]	[71,436]	[61,119]	[37,407]	[16,934]
Catch Rate	0.6040	0.4067	0.3959	0.3206	0.1764	0.0821

Table 4. Estimated catch per hour, catch and effort for all survey areas and all fishery types for Wisconsin waters of Lake Michigan and Green Bay in 1997. Standard deviations in brackets.

Species	Total catch per hour	Mar/Apr	May	June	July	August	Sept/Oct	Nov/Dec	Season
Coho salmon	0.0483	796 [341]	26,584 [3,412]	47,658 [2,938]	42,032 [3,817]	10,279 [818]	8,849 [851]	2,225 [347]	138,423 [6,039]
Chinook salmon	0.0454	8 [0]	670 [198]	14,329 [1,409]	61,900 [4,159]	28,612 [1,858]	23,836 [1,651]	797 [72]	130,152 [5,050]
Rainbow trout	0.0329	10,378 [1,014]	1,062 [228]	27,458 [2,511]	45,727 [3,413]	6,177 [637]	2,966 [470]	702 [132]	94,470 [4,436]
Atlantic salmon	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Brown trout	0.0151	16,249 [2,858]	2,364 [433]	2,183 [318]	8,299 [1,047]	6,963 [1,271]	5,760 [640]	1,406 [233]	43,224 [3,411]
Brook trout	0.0001	63 [33]	0 [0]	13 [7]	62 [21]	58 [28]	103 [59]	0 [0]	299 [76]
Lake trout	0.0202	136 [52]	1,687 [329]	13,913 [1,172]	21,806 [1,667]	15,134 [983]	5,176 [628]	102 [0]	57,954 [2,371]
Splake	0.0009	2,206 [832]	166 [147]	0 [0]	229 [162]	67 [67]	0 [0]	0 [0]	2,668 [863]
Northern pike	0.0011	693 [305]	239 [192]	25 [25]	113 [84]	1,178 [480]	963 [354]	0 [0]	3,211 [702]
White perch	0.0082	0 [0]	0 [0]	5,063 [2,721]	3,277 [2,667]	1,472 [687]	13,793 [8,159]	0 [0]	23,605 [9,031]
Smallmouth bass	0.0183	0 [0]	3,025 [1,189]	16,143 [2,577]	25,011 [3,993]	6,081 [1,411]	2,329 [739]	0 [0]	52,589 [5,151]
Yellow perch	0.0821	36,086 [7,530]	5,243 [1,540]	7,099 [1,602]	69,573 [10,099]	57,598 [7,757]	59,814 [7,935]	0 [0]	235,413 [16,934]
walleye	0.0108	1,876 [706]	14,865 [3,447]	5,512 [1,291]	4,459 [1,390]	2,011 [662]	2,326 [518]	0 [0]	31,049 [4,084]
TOTAL	0.2834	68,491 [8,204]	55,905 [5,268]	139,396 [6,056]	282,488 [13,206]	135,630 [8,391]	125,915 [11,617]	5,232 [444]	813,057 [22,621]
Angler hours		315,902 [23,238]	203,241 [16,669]	428,287 [17,124]	876,446 [32,863]	521,726 [19,504]	500,208 [15,833]	22,737 [2,045]	2,868,547 [53,164]

Table 5. Estimated catch per hour, catch and effort for the boat fishery with all survey areas combined for Wisconsin waters of Lake Michigan and Green Bay in 1997. Standard deviations in brackets.

Species	Total catch per hour	Mar/Apr	May	June	July	August	Sept/Oct	Nov/Dec	Season
Coho salmon	0.0611	579 [330]	25,516 [3,404]	46,940 [2,924]	41,564 [3,814]	10,271 [818]	3,651 [505]	147 [0]	128,668 [5,976]
Chinook salmon	0.0560	8 [0]	651 [197]	14,283 [1,409]	61,462 [4,157]	28,443 [1,856]	12,553 [1,130]	572 [0]	117,972 [4,902]
Rainbow trout	0.0385	214 [167]	653 [148]	27,159 [2,508]	45,032 [3,408]	6,161 [637]	1,631 [329]	123 [0]	80,973 [4,298]
Atlantic salmon	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Brown trout	0.0140	9,901 [2,713]	1,833 [418]	1,898 [307]	7,131 [1,018]	6,699 [1,269]	1,806 [374]	155 [0]	29,423 [3,228]
Brook trout	0.0001	3 [0]	0 [0]	6 [0]	18 [0]	36 [21]	48 [44]	0 [0]	111 [49]
Lake trout	0.0274	64 [39]	1,655 [329]	13,853 [1,172]	21,799 [1,667]	15,127 [983]	5,117 [626]	102 [0]	57,717 [2,370]
Splake	0.0011	1,906 [820]	52 [48]	0 [0]	229 [162]	67 [67]	0 [0]	0 [0]	2,254 [840]
Northern pike	0.0012	438 [245]	225 [191]	0 [0]	113 [84]	1,075 [470]	730 [337]	0 [0]	2,581 [622]
White perch	0.0002	0 [0]	0 [0]	0 [0]	85 [85]	314 [314]	56 [56]	0 [0]	455 [335]
Smallmouth bass	0.0238	0 [0]	2,854 [1,188]	15,046 [2,553]	24,761 [3,991]	5,615 [1,387]	1,891 [624]	0 [0]	50,167 [5,116]
Yellow perch	0.0934	23,910 [6,801]	2,358 [1,233]	5,690 [1,591]	56,649 [9,866]	54,261 [7,682]	53,894 [7,754]	0 [0]	196,762 [16,333]
walleye	0.0107	1,503 [675]	13,343 [3,419]	2,908 [1,186]	2,047 [1,114]	1,233 [623]	1,494 [478]	0 [0]	22,528 [3,926]
TOTAL	0.3275	38,526 [7,412]	49,140 [5,157]	127,783 [5,362]	260,890 [12,720]	129,302 [8,292]	82,871 [7,939]	1,099 [0]	689,611 [20,096]
Angler hours		122,508 [20,893]	154,291 [16,290]	370,150 [16,219]	779,247 [32,317]	455,786 [19,173]	220,599 [13,097]	3,156 [0]	2,105,737 [50,483]

Table 6. Estimated catch per hour, catch and effort for the pier fishery with all survey areas combined for Wisconsin waters of Lake Michigan and Green Bay in 1997. Standard deviations in brackets.

Species	Total catch per hour	Mar/Apr	May	June	July	August	Sept/Oct	Nov/Dec	Season
Coho salmon	0.0093	16 [14]	618 [200]	156 [100]	267 [85]	0 [0]	230 [82]	0 [0]	1,287 [253]
Chinook salmon	0.0069	0 [0]	19 [19]	6 [6]	438 [97]	46 [35]	437 [181]	0 [0]	946 [210]
Rainbow trout	0.0029	12 [9]	19 [15]	55 [31]	272 [79]	7 [7]	37 [38]	0 [0]	402 [94]
Atlantic salmon	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Brown trout	0.0158	449 [131]	299 [78]	128 [53]	503 [133]	163 [52]	700 [227]	0 [0]	2,172 [313]
Brook trout	0.0003	8 [6]	0 [0]	0 [0]	32 [20]	0 [0]	0 [0]	0 [0]	40 [21]
Lake trout	0.0011	72 [36]	32 [21]	0 [0]	7 [5]	7 [7]	37 [37]	0 [0]	155 [57]
Splake	0.0022	300 [144]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	300 [144]
Northern pike	0.0011	24 [20]	14 [14]	0 [0]	0 [0]	7 [7]	109 [75]	0 [0]	154 [80]
White perch	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Smallmouth bass	0.0030	0 [0]	0 [0]	411 [28]	0 [0]	7 [7]	0 [0]	0 [0]	418 [29]
Yellow perch	0.1176	4,205 [2,241]	2,293 [854]	1,202 [64]	5,664 [1,356]	2,091 [946]	724 [432]	0 [0]	16,179 [2,945]
walleye	0.0028	47 [45]	322 [220]	0 [0]	0 [0]	12 [12]	0 [0]	0 [0]	381 [225]
TOTAL	0.1630	5,133 [2,250]	3,546 [909]	1,958 [137]	7,183 [1,371]	2,340 [949]	2,274 [535]	0 [0]	22,434 [2,995]
Angler hours		14,997 [2,940]	13,293 [2,218]	16,302 [1,431]	38,087 [3,087]	22,511 [2,168]	32,415 [2,342]	0 [0]	137,605 [5,944]

Table 7. Estimated catch per hour, catch and effort for the shore fishery with all survey areas combined for Wisconsin waters of Lake Michigan and Green Bay in 1997. Standard deviations in brackets.

Species	Total catch per hour	Mar/Apr	May	June	July	August	Sept/Oct	Nov/Dec	Season
Coho salmon	0.0134	201 [85]	450 [136]	562 [265]	201 [120]	8 [5]	1,615 [279]	0 [0]	3,037 [434]
Chinook salmon	0.0138	0 [0]	0 [0]	40 [28]	0 [0]	123 [73]	2,959 [359]	0 [0]	3,122 [367]
Rainbow trout	0.0054	670 [177]	16 [11]	107 [60]	423 [163]	9 [9]	0 [0]	0 [0]	1,225 [249]
Atlantic salmon	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Brown trout	0.0404	5,397 [865]	302 [81]	157 [59]	665 [206]	101 [52]	2,504 [437]	0 [0]	9,126 [998]
Brook trout	0.0006	38 [28]	0 [0]	7 [7]	12 [7]	22 [18]	55 [39]	0 [0]	134 [53]
Lake trout	0.0004	0 [0]	0 [0]	60 [33]	0 [0]	0 [0]	22 [22]	0 [0]	82 [40]
Splake	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Northern pike	0.0004	6 [3]	0 [0]	25 [25]	0 [0]	0 [0]	64 [47]	0 [0]	95 [54]
White perch	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Smallmouth bass	0.0013	0 [0]	0 [0]	138 [130]	0 [0]	102 [112]	58 [58]	0 [0]	298 [182]
Yellow perch	0.0713	6,229 [1,998]	539 [345]	207 [178]	6,870 [1,653]	767 [232]	1,573 [1,287]	0 [0]	16,105 [2,930]
walleye	0.0011	0 [0]	0 [0]	138 [144]	0 [0]	36 [28]	65 [65]	0 [0]	239 [161]
TOTAL	0.1485	12,541 [2,186]	1,307 [380]	1,441 [387]	8,171 [1,678]	1,168 [275]	8,915 [1,437]	0 [0]	33,543 [3,167]
Angler hours		39,634 [3,831]	11,451 [1,054]	11,968 [1,055]	35,638 [2,912]	25,667 [1,922]	101,452 [5,353]	0 [0]	225,810 [7,598]

Table 8. Estimated catch per hour, catch and effort for the stream fishery with all survey areas combined for Wisconsin waters of Lake Michigan and Green Bay in 1996. Standard deviations in brackets.

Species	Total catch per hour	Mar/Apr	May	June	July	August	Sept/Oct	Nov/Dec	Season
Coho salmon	0.0136	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	3,353 [620]	2,078 [347]	5,431 [710]
Chinook salmon	0.0203	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	7,887 [1,135]	225 [72]	8,112 [1,138]
Rainbow trout	0.0297	9,482 [984]	374 [173]	137 [93]	0 [0]	0 [0]	1,298 [333]	579 [132]	11,870 [1,066]
Atlantic salmon	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Brown trout	0.0063	502 [201]	0 [0]	0 [0]	0 [0]	0 [0]	750 [165]	1,251 [233]	2,503 [349]
Brook trout	0.0000	14 [14]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	14 [14]
Lake trout	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Splake	0.0003	0 [0]	114 [139]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	114 [114]
Northern pike	0.0010	225 [181]	0 [0]	0 [0]	0 [0]	0 [0]	60 [60]	0 [0]	381 [215]
White perch	0.0580	0 [0]	0 [0]	5,063 [2,721]	6,939 [2,830]	3,192 [2,666]	13,737 [8,159]	0 [0]	23,150 [9,025]
Smallmouth bass	0.0043	0 [0]	171 [61]	548 [324]	32 [32]	250 [119]	380 [380]	0 [0]	1,706 [576]
Yellow perch	0.0157	1,742 [1,199]	53 [33]	0 [0]	71 [71]	390 [296]	3,623 [999]	0 [0]	6,287 [1,650]
walleye	0.0198	326 [201]	1,200 [373]	2,466 [488]	946 [393]	2,412 [831]	767 [188]	0 [0]	7,901 [1,092]
TOTAL	0.1689	12,291 [1,588]	1,912 [440]	8,214 [2,785]	7,991 [2,858]	6,244 [2,810]	31,855 [8,341]	4,133 [444]	67,469 [9,424]
Angler hours		138,763 [8,952]	24,206 [2,540]	29,867 [5,197]	23,474 [4,194]	17,762 [2,102]	145,742 [6,708]	19,581 [2,045]	399,395 [13,594]

Table 9. Average weight, average length and standard weight of salmonids from Wisconsin's Lake Michigan creel survey, all areas and fishery types combined, 1988-1997. std = standard deviation.

Year	Average weight	± 1 std	Average length	± 1 std	Standard weight
COHO SALMON					
88	4.38927	1.54369	22.4100	2.42620	3.99351
89	4.27399	1.78496	22.5015	2.84274	3.61157
90	4.49193	1.98750	22.6016	3.18498	3.91757
91	4.06888	2.43805	21.6905	3.43957	3.94545
92	4.14931	1.86944	21.9365	3.23596	3.80521
93	3.73333	1.73959	21.2199	2.67736	3.94100
94	3.30836	2.22174	20.1049	3.28443	3.81682
95	3.15977	1.99077	20.3647	3.47945	3.60603
96	4.63768	2.01798	22.5823	3.13583	3.86726
97	3.05433	1.48431	20.2170	2.79178	3.53675
CHINOOK SALMON					
88	11.5957	5.9518	30.0629	6.19946	9.8516
89	9.1850	6.4074	27.4232	6.90950	9.7596
90	9.5136	6.5206	27.6409	7.20534	9.8052
91	8.1385	6.5538	25.7534	6.96827	10.2605
92	10.2518	7.2367	27.9216	7.73204	9.8032
93	10.5038	8.3701	27.4037	8.33738	10.1905
94	10.4453	8.3485	27.0273	8.71924	9.9749
95	9.8882	8.1733	26.3952	8.11261	10.4336
96	8.0482	6.7959	25.7176	7.10989	9.7475
97	9.1569	6.2956	27.3781	6.74607	9.7349
RAINBOW TROUT					
88	6.18994	2.62653	25.4178	4.10865	3.92737
89	6.75515	2.64824	26.6901	3.99997	3.95339
90	6.78511	2.95833	26.2191	4.91875	3.84274
91	6.64343	2.79610	26.3469	4.22405	3.82737
92	7.18517	2.88283	27.0546	4.47526	3.79149
93	6.89070	3.42457	26.2585	4.66549	3.56237
94	6.21323	3.06970	25.5027	4.35808	3.85317
95	6.23276	2.94965	25.4630	4.14715	3.80152
96	6.79034	2.86028	25.8947	4.06373	3.88880
97	6.84737	2.85516	26.6210	4.04426	3.72070
BROWN TROUT					
88	5.50485	2.87826	20.6188	3.94544	4.16698
89	5.49486	2.40390	21.4536	3.25663	4.04284
90	4.96225	2.78125	20.3590	3.76981	4.01236
91	5.11816	2.81203	20.5944	3.39683	4.14541
92	4.39258	2.74944	19.7675	4.06703	3.85596
93	4.82192	2.93521	20.3673	3.98565	3.73331
94	5.57982	3.95542	21.1341	4.70539	3.90347
95	5.27967	3.43907	21.1004	3.92262	3.95885
96	5.53499	3.85055	21.1594	4.26341	3.85055
97	4.89833	2.84844	21.1254	4.05403	3.41882
BROOK TROUT					
88	1.26522	1.11659	13.2891	3.22257	0.97643
89	1.75833	1.52712	15.0167	3.35943	0.92961
90	1.34937	1.49648	13.5329	2.26595	1.02508
91	3.13023	2.88002	17.2930	3.89837	0.73253
92	1.12372	1.28716	12.6987	3.12662	0.86757
93	1.37581	1.36666	13.9435	3.60139	0.87697
94	1.09787	1.21434	12.8191	2.72769	0.89121
95	1.24588	1.03562	12.9365	2.60036	1.03696
LAKE TROUT					
88	8.37042	3.56947	27.5120	3.37376	5.84536
89	8.50272	3.69427	27.8936	3.40782	5.63748
90	8.89295	3.68464	28.1648	3.38979	5.78703
91	9.36891	3.91243	28.5284	3.53048	6.03743
92	9.05581	3.92863	28.6493	3.46747	5.69210
93	7.79163	4.09545	26.8924	3.86344	5.81264
94	7.16244	3.81730	26.3183	4.00574	5.71564
95	8.74280	4.38484	27.3754	3.94920	6.59102
96	7.52374	4.59381	26.3436	4.89904	5.41955
97	7.34694	3.77508	26.5681	3.97078	5.65128

Figure 1. Geographical area of Wisconsin's share of Lake Michigan.

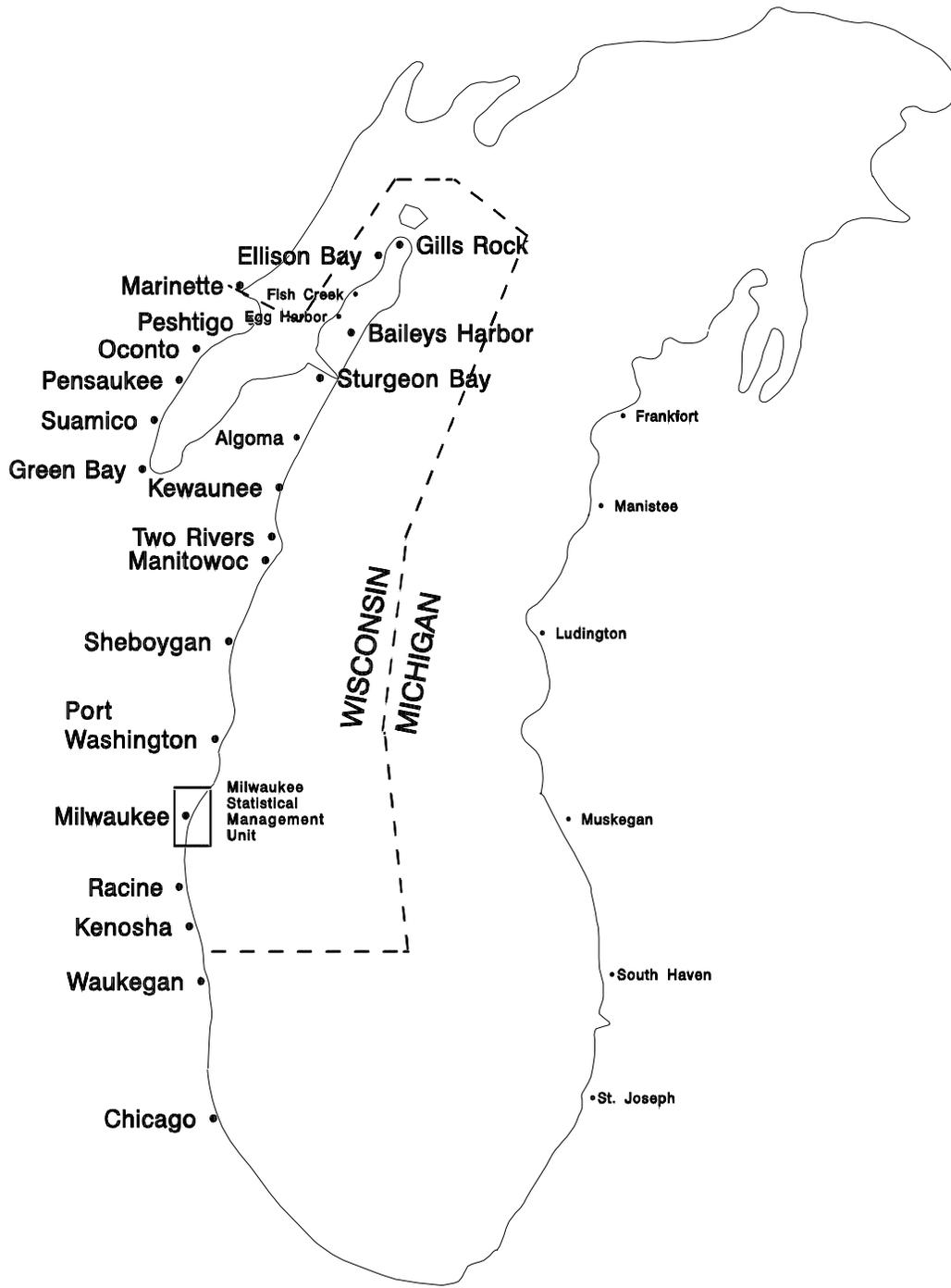


Figure 2. Angler Interview Form.

Figure 3. Catch Record Form.