

Wisconsin's 1995 open water sportfishing effort and catch from Lake Michigan and Green Bay.

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Abstract - This paper documents the sport fishery in Wisconsin waters of Lake Michigan and Green Bay in 1995. Unlike naturally reproducing species such as yellow perch and smallmouth bass the salmonine sport fishery was sustained through the continued stocking of rainbow trout (*Oncorhynchus mykiss*), lake trout (*Salvelinus namaycush*), brook trout (*S. fontinalis*), brown trout (*Salmo trutta*), coho salmon (*O. kisutch*), and chinook salmon (*O. tshawytscha*). Fishing effort, catch and catch rates were determined from 1) a stratified random creel survey for launched-boat, pier, shore and stream anglers; and 2) a randomized mail survey for moored-boat anglers. Anglers spent an estimated 3,070,847 hours fishing on Lake Michigan or Green Bay in 1995 with boat angler effort at 2,226,719 hours or 73% of the total hours. The estimated harvest of 1,504,004 fish was dominated by yellow perch (1,049,613) and to a lesser degree chinook salmon (134,615), rainbow trout (94,443) and coho salmon (53,155). The boat fishery, comprised of launched-boat and moored-boat anglers, dominated the fishery by harvesting an estimated 1,309,067 fish which was 87.0% of the total fish harvested. The harvest by boat fishermen was dominated by yellow perch (937,317), chinook (111,301) and coho salmon (49,906) and rainbow trout (78,761). Pier, shore and stream anglers harvested primarily yellow perch, brown and rainbow trout. Overall catch rates were highest for yellow perch at 0.3418 fish/hour and chinook salmon at 0.0438 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.

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). These surveys indicate that forage composition and biomass have fluctuated widely and that forage may be an important factor in the continued success of the salmonine sport fishery on Lake Michigan (Stewart et al. 1981). The above studies have assessed the status of prey species in Lake Michigan; equally important is an evaluation of predators in Lake Michigan.

Therefore, the WDNR has conducted an annual survey of anglers fishing the Wisconsin waters of Lake Michigan to evaluate the status of the fishery. Data were collected from anglers at ramps, piers, shores and streams and from moored-boat anglers. This report describes the changes in fishing effort, catch and catch rates for 1995.

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).

Green Bay is northernmost and more eutrophic than the lake proper. Due to warmer temperatures during the summer, the majority of the salmonine fishery is limited to the northern section of the bay. Major access points include Marinette, Peshtigo and Oconto on the bay's west shore and Sturgeon Bay, Egg Harbor, Fish Creek and Ellison Bay on the east shore. A significant number of boats and anglers also fish from Green Bay, primarily for yellow perch and walleyes. Major tributaries include the Menominee, Little, Peshtigo, Oconto and Fox Rivers.

The northern basin extends from the tip of Door County to midway between Manitowoc and Sheboygan. The shoreline is generally rocky and irregular in the north and sandier and less broken in the south. The lake bottom slopes steeply to a maximum depth of 923 feet. Major access points include Gills Rock, Baileys Harbor,

Sturgeon Bay, Algoma, Kewaunee, Two Rivers and Manitowoc. Major tributaries include the Ahnapee, Kewaunee, East and West Twin and Manitowoc Rivers.

The southern basin includes all waters from Sheboygan south. The shoreline is unbroken and the lake bottom slopes gradually to a maximum depth of 558 feet. Major access points include Sheboygan, Port Washington, Milwaukee, Racine and Kenosha. Major tributaries include the Sheboygan, Milwaukee and Root Rivers.

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

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.

The goal was to calculate total effort for a stratum (e.g. SMU, fishery type, month and day type) and its variance. **Daily fishing effort** was estimated for any day when instantaneous counts were made. The number of counted anglers (i.e. pier, shore, stream sites) or counted trailers (i.e. ramp sites) at a site was multiplied by the fishing day length. The **daily fishing effort** was averaged by date and then by site, month and day type (weekday, weekend) to obtain the **marginal fishing effort**. The **total marginal fishing effort** was then estimated by multiplying the **marginal fishing effort** by the number of days of that day type during that

month. **Total marginal fishing effort** was then summed by statistical management unit (SMU) (i.e. groups of sites), statistical survey periods (SSP) (i.e. groups of months) and day types. **Total fishing effort** was computed differently for pedestrian and boating anglers. For pedestrian anglers, **total fishing effort** was estimated by multiplying the **total marginal fishing effort** by the proportion of angling hours to non-angling hours. For boating anglers, **total fishing effort** was estimated by multiplying the **total marginal fishing effort** by the average number of anglers per boat and the proportion of angling hours to non-angling hours. The **total fishing effort** was then the total number of angling hours for each SMU, SSP and day type.

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 example, for each species, the estimated harvest was calculated using 3 steps: 1) the harvest rate was estimated for the SMU, SSP and day type by dividing total number of fish counted during interviews by the number of angler hours reported in those interviews; 2) the harvest rate was then multiplied by the **total marginal fishing effort** to get the marginal harvest; 3) the marginal harvest was summed across day types to get total estimated harvest. Harvest rates were then calculated by dividing the total estimated harvest by the total number of angling hours. All calculations were made with a verified computer program.

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 by 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 by 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).

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 3,070,847 (\pm 53,193) hours for 1995 during the open water season from March 1 - December 31 (Table 1). Angler hours decreased slightly from 1994 (3,277,232) but in general have remained relatively constant since 1990 (Figure 4). The Green Bay area had the most fishing effort at

1,070,036 (\pm 32,379) hours or 35% of all angler hours for 1995. Milwaukee Co. had the second highest effort at 327,924 (\pm 12,115) hours. This same pattern was present in previous years.

Angler hours were disproportionately spread among the four fishery types. Boat anglers spent 2,226,719 (\pm 50,264) hours or 73% of all angler hours fishing on Lake Michigan or Green Bay (Table 4). Stream anglers fished the second most at 422,247 (\pm 14,204) hours or 14% of the total (Table 7). Pier and shore anglers fished 230,399 (\pm 7,773) and 191,482 (\pm 6,387) hours respectively (Tables 5-6).

Fishermen caught an estimated 382,045 (\pm 8,913) salmonines during the 1995 season (Table 2). Chinook salmon dominated the catch comprising 134,615 (\pm 5,953) fish or 35% of the total representing the highest harvest since 1989. Rainbow trout followed closely behind at 94,443 (\pm 4,416) fish or 25% of the total. Coho salmon harvest numbers dropped to 53,155 (\pm 3,107). Rainbow trout was the most numerous species caught in 1993-1994. However, chinook salmon as it did from 1988-1992 when it comprised 34% of the salmonine harvest, once again had the highest percentage. Lake trout were the fourth numerous salmonine harvested at 51,000 (\pm 2,797) fish followed by brown trout at 46,927 (\pm 2,630) and brook trout 1,908 (\pm 332).

The combined catch rate for salmonines are depicted in Table 2 and Figure 5. The catch rate increased considerably in 1995 to 0.1244 fish/hour and was much higher than previous years. This can be attributed to a decrease in angler hours, increase in salmonine harvest and improved fishing conditions during the 1995 fishing season.

The total catch of 13 major species was 1,504,004 (\pm 62,121) fish for 1995 (Table 3). The majority of the catch came from boat anglers (Table 4) who caught 1,309,067 (\pm 60,608) fish or 87.0% of the total. The other angler types, pier, shore and stream caught 84,236 (\pm 10,921), 41,048 (\pm 3,029) and 69,653 (\pm 7,561) fish respectively or 5.7%, 2.7% and 4.6% of the total (Tables 5-7).

Yellow perch comprised the majority of the catch from all areas combined at 1,049,613 (\pm 61,120) fish and had an overall catch rate of 0.3418 fish/hour (Table 3).

Yellow perch were also the most numerous species caught for each individual fishery type although the majority (89.3%) were caught by boat fishermen (Table 4). Catch rates were also highest for the boat fishery at 0.4209 fish/hour followed by the pier fishery at 0.2900 (Table 5). The majority of the harvest took place in the summer months from July to August. Both catch and catch rate declined in 1995 from previous years.

Chinook salmon was once again the dominant salmonine species in the harvest during the 1995 fishing season. Anglers caught 134,615 (\pm 5,953) chinook salmon up significantly from 1994 and equal to the numbers caught in 1988 and 1989 (Table 2). The overall catch rate of 0.0438 was higher than those calculated for coho salmon and steelhead. Like those two species, the majority of the harvest occurred in the boat fishery with anglers harvesting 111,301 (\pm 5,704) fish or 83% of all chinook salmon caught (Table 4). Boat angler catch rates were 0.0500. Stream anglers harvested 9,956 (\pm 1,262) chinook salmon with catch rates at 0.0263 (Table 7). The average weight and length for chinook salmon were 9.9 (\pm 8.2) pounds and 26.4 (\pm 8.1) inches, while the standard weight was 10.4 pounds (Table 8).

Rainbow trout was the second most abundant salmonine and third most abundant species caught in 1995 at 94,443 (\pm 4,416) (Table 2-3). Rainbow trout catch rates were the second highest among all salmonines at 0.0308 fish/hour. The majority of the catch occurred in the boat fishery with 78,761 (\pm 4,200) fish caught (Table 4). Stream anglers caught 13,396 (\pm 1,332) steelhead with catch rates higher than the boat fishery at 0.0317 fish/hour (Table 7). Rainbow trout averaged 6.2 (\pm 2.9) pounds and 25.5 (\pm 4.2) inches with a standard weight of 4.3 pounds (Table 8).

The coho salmon harvest decreased dramatically in 1995 to 53,155 (\pm 3,107) fish which was the fewest caught since 1991 (Table 3). Overall coho salmon catch rates were 0.0173 significantly less than steelhead and chinook salmon catch rates. Boat anglers harvested 94% of all coho salmon (49,906) and enjoyed catch rates of 0.0224 fish/hour (Table 4). The remaining harvest was divided among the pier, shore and stream anglers at 1,312, 1,035 and 902 fish (Tables 5-7). Biological data collected on coho salmon showed that the mean weight was 3.2 (\pm 2.0) pounds and the mean length was 20.4 (\pm 3.5) inches with a

standard weight of 3.6 pounds (Table 8).

Anglers in Wisconsin harvested 51,000 (\pm 2,797) lake trout in Lake Michigan and Green Bay. While the harvest was fairly high, the overall catch rate was lower than all major salmonines except brook and brown trout at 0.0166 fish/hour (Table 3). Like coho and chinook salmon, boat anglers caught most of the lake trout, catching 50,838 (\pm 2,797) fish or 99.7% of all lake trout. Boat catch rates were slightly higher than the overall catch rate estimated at 0.0228 fish/hour (Table 4). Lake trout size was calculated at 8.6 (\pm 4.2) pounds and 27.3 (\pm 3.9) inches with a standard weight of 6.6 pounds (Table 8).

An estimated 46,924 (\pm 2,630) brown trout were harvested in 1995 from all surveyed areas, with an overall catch rate of 0.0153 fish/hour (Table 3). Unlike the other salmonines, which were almost exclusively caught in the boat fishery, brown trout harvest by boat anglers was 31,640 (\pm 2,445) fish or only 67% of the total. Pier anglers harvested 4,199 (\pm 507) brown trout and had catch rates of 0.0182 fish/hour (Table 5). This total was the highest of any species except yellow perch and comprised 24% of the non-yellow perch pier harvest. Likewise, shore anglers caught 8,550 (\pm 760) brown trout or 41% of the non-yellow perch shore harvest (Table 6). Shore catch rates were 0.0447 fish/hour. Brown trout biological data for 1995 showed that their mean size was 5.2 (\pm 3.3) pounds, 21.1 (\pm 3.9) inches and 3.9 pounds standard weight (Table 8).

Smallmouth bass were numerous in the catch, totaling 36,064 (\pm 3,749) fish (Table 3). The harvest was highest in July and August. Overall catch rates were 0.0117 fish/hour, much less than those calculated for yellow perch. Again, boat anglers caught the majority of the smallmouth bass, harvesting 29,657 (\pm 3,624) fish or 82% of the total (Table 4). Boat catch rates were slightly higher (0.0133) than the overall catch rate. The remainder of the harvest was spread among the three remaining fishery types, having catch rates of 0.0103, 0.0149 and 0.0028 fish/hour respectively (Tables 4-7).

Walleyes were the last species harvested in large numbers during the open water fishing season. An estimated 17,377 (\pm 2,229) walleyes were caught with the majority caught in spring and fall (Table 3). Like

smallmouth bass, catch rates were lower than most salmonines at 0.0057 fish/hour. The harvest was concentrated exclusively in two fishery types, boat and stream. Boat anglers caught 10,894 (\pm 1,881) walleyes (Table 4) while stream anglers caught 6,389 (\pm 1,193) walleyes (Table 7). Stream catch rates of 0.0151 fish/hour were better than boat catch rates of 0.0050 fish/hour.

The remaining species, atlantic salmon, brook trout, splake, northern pike and white perch comprised only 1.4% of the total harvest and 5% of the non-yellow perch harvest.

SUMMARY

Lake Michigan anglers spent an estimated 3,070,847 hours fishing on Lake Michigan or Green Bay with boat angler effort at 2,226,719 hours or 73% of the total hours. The estimated harvest of 1,504,004 fish was dominated by yellow perch (1,049,613) and to a lesser degree rainbow trout (94,443) and coho (53,155) and chinook salmon (134,615). The salmonine harvest increased from 356,489 fish in 1994 to 382,045 fish in 1995 and like previous years (1986-1992) was dominated by chinook salmon. Overall catch rates were slightly higher in 1995, due to the extremely successful chinook salmon and steelhead fishery exhibited in 1995.

Several factors had major impacts during the 1995 fishing season. The coho salmon bag limit was reduced from 5/day to 3/day to protect a small year class and insure their survival to brood rivers for collections of gametes. This action was partially responsible for the 40% decline in coho salmon harvest in 1995. Secondly, weather patterns during late June, July and early August were ideal. Large numbers of all species were harvested during this time period. The last time this occurred, Wisconsin had its largest salmonine harvest (1987).

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Table 1. Estimated angler effort (hours) by area in Wisconsin waters of Lake Michigan and Green Bay, March-December 1988-1995. Standard deviation in brackets.

Area	1988	1989	1990	1991	1992	1993	1994	1995
Kenosha Co.	284,368 [8,716]	218,761 [12,460]	151,755 [10,685]	158,629 [10,815]	165,950 [10,102]	168,622 [9,665]	159,830 [8,195]	133,258 [9,934]
Racine Co.	324,815 [12,224]	326,536 [23,709]	277,127 [20,111]	314,893 [20,585]	396,809 [21,114]	311,344 [19,740]	297,586 [13,911]	320,551 [18,995]
Milwaukee Co.	723,571 [12,704]	473,739 [20,180]	425,383 [16,495]	451,540 [19,160]	479,859 [19,696]	355,995 [13,736]	390,942 [14,303]	327,924 [12,115]
Ozaukee Co.	361,901 [15,577]	240,980 [20,556]	173,717 [12,032]	133,012 [9,630]	173,848 [11,331]	104,136 [8,437]	171,169 [11,873]	195,071 [16,115]
Sheboygan Co.	275,418 [16,416]	261,673 [22,759]	192,189 [11,690]	150,107 [10,632]	175,114 [11,732]	120,645 [8,747]	214,406 [13,999]	222,112 [16,183]
Manitowoc Co.	376,424 [14,929]	283,346 [14,921]	258,911 [12,231]	231,714 [12,589]	279,780 [15,706]	278,063 [15,475]	249,276 [11,121]	219,980 [9,038]
Kewaunee Co.	394,428 [18,974]	322,705 [19,380]	235,742 [15,959]	285,728 [21,383]	262,050 [13,318]	308,863 [17,627]	301,827 [18,617]	298,337 [16,500]
E. Door Co.	343,363 [18,473]	336,651 [24,669]	370,517 [25,043]	302,863 [16,485]	368,994 [38,245]	283,144 [16,293]	309,660 [19,768]	283,578 [17,298]
Green Bay	1,373,287 [42,929]	1,510,871 [47,909]	1,216,561 [39,992]	1,308,566 [40,786]	1,173,412 [38,041]	1,104,006 [39,002]	1,182,536 [34,803]	1,070,036 [32,379]
TOTAL	4,457,575 [60,548]	3,975,263 [74,613]	3,301,902 [60,852]	3,337,052 [60,536]	3,475,818 [67,348]	3,034,819 [56,181]	3,277,232 [53,615]	3,070,847 [53,193]

Table 2. Estimated catch of salmonines in Wisconsin waters of Lake Michigan and Green Bay, March-December 1988-1995. Standard deviations in brackets.

Species	1988	1989	1990	1991	1992	1993	1994	1995
Coho Salmon	107,758 [5,530]	77,274 [3,588]	45,898 [3,002]	32,509 [2,435]	51,685 [3,890]	56,628 [4,151]	88,735 [5,857]	53,155 [3,107]
Chinook Salmon	135,489 [4,437]	153,390 [7,650]	88,023 [4,339]	108,330 [5,318]	87,108 [6,571]	70,746 [3,707]	81,363 [4,424]	134,615 [5,953]
Rainbow Trout	40,367 [2,052]	66,687 [4,088]	38,774 [2,996]	52,499 [3,408]	65,564 [6,029]	79,874 [3,995]	90,134 [4,455]	94,443 [4,416]
Brown Trout	53,574 [2,615]	49,286 [3,579]	40,669 [3,605]	54,405 [4,182]	46,821 [2,794]	59,511 [3,735]	49,016 [2,695]	46,924 [2,630]
Brook Trout	4,805 [743]	1,171 [246]	5,850 [616]	1,635 [397]	4,377 [458]	1,946 [311]	7,463 [797]	1,908 [332]
Lake Trout	51,764 [2,666]	60,526 [3,414]	48,351 [3,067]	59,949 [3,279]	36,136 [2,504]	43,694 [2,776]	39,778 [2,337]	51,000 [2,797]
TOTAL	393,757 [8,305]	408,334 [11,921]	267,565 [7,720]	309,327 [8,615]	291,691 [10,738]	312,399 [8,288]	356,489 [9,332]	382,045 [8,913]
Catch Rate	0.0088	0.1027	0.081	0.0927	0.0839	0.1029	0.1088	0.1244

Table 3. 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 1995. Standard deviations in brackets.

Species	Total catch per hour	Mar/Apr	May	June	July	August	Sept/Oct	Nov/Dec	Season
Coho salmon	0.0173	1,587 [285]	7,308 [1,084]	11,645 [1,534]	27,069 [2,292]	4,090 [858]	1,208 [228]	248 [68]	53,155 [3,107]
Chinook salmon	0.0438	220 [144]	723 [183]	2,911 [504]	91,466 [5,348]	19,919 [1,856]	19,280 [1,755]	96 [33]	134,615 [5,953]
Rainbow trout	0.0308	12,088 [1,312]	3,779 [625]	17,400 [1,758]	44,903 [2,909]	9,064 [1,909]	6,702 [1,475]	507 [115]	94,443 [4,416]
Atlantic salmon	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Brown trout	0.0153	12,426 [1,299]	2,838 [527]	740 [180]	17,973 [1,533]	5,834 [734]	6,460 [1,417]	653 [147]	46,924 [2,630]
Brook trout	0.0006	611 [166]	161 [116]	162 [85]	475 [176]	59 [37]	417 [172]	23 [14]	1,908 [332]
Lake trout	0.0166	302 [144]	2,362 [454]	12,923 [1,231]	22,542 [1,784]	8,111 [1,250]	4,760 [1,155]	0 [0]	51,000 [2,797]
Splake	0.0003	413 [172]	50 [50]	45 [45]	188 [129]	0 [0]	144 [85]	0 [0]	840 [241]
Northern pike	0.0015	1,136 [365]	977 [540]	207 [195]	317 [210]	560 [280]	1,449 [553]	0 [0]	4,696 [944]
White perch	0.0044	0 [0]	925 [592]	2,921 [40]	1,630 [575]	7,485 [4,820]	480 [199]	0 [0]	13,369 [4,895]
Smallmouth bass	0.0117	0 [0]	2,804 [672]	8,069 [1,843]	8,202 [1,597]	12,068 [2,207]	4,921 [1,669]	0 [0]	36,064 [3,749]
Yellow perch	0.3418	59,153 [9,592]	42,348 [14,033]	71,399 [15,149]	364,456 [37,225]	370,865 [38,341]	141,392 [19,011]	0 [0]	1,049,613 [61,120]
Walleye	0.0057	995 [226]	6,846 [1,494]	1,536 [548]	1,382 [391]	2,057 [859]	4,561 [1,221]	0 [0]	17,377 [2,229]
TOTAL	0.4898	88,931 [9,786]	71,121 [14,225]	129,958 [15,508]	580,603 [37,904]	440,112 [38,845]	191,752 [19,358]	1,527 [202]	1,504,004 [62,121]
Angler hours		323,162 [13,236]	237,533 [13,653]	397,770 [16,351]	1,013,319 [33,828]	572,271 [24,652]	512,666 [21,113]	14,126 [1,625]	3,070,847 [53,193]

Table 4. 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 1995. Standard deviations in brackets.

Species	Total catch per hour	Mar/Apr	May	June	July	August	Sept/Oct	Nov/Dec	Season
Coho salmon	0.0224	941 [168]	7,257 [1,083]	11,645 [1,534]	25,998 [2,278]	3,831 [853]	234 [97]	0 [0]	49,906 [3,079]
Chinook salmon	0.0500	206 [144]	723 [183]	2,911 [504]	83,057 [5,263]	18,891 [1,833]	5,513 [1,079]	0 [0]	111,301 [5,704]
Rainbow trout	0.0354	15 [15]	3,315 [609]	17,380 [1,758]	43,748 [2,902]	8,877 [1,905]	5,426 [1,460]	0 [0]	78,761 [4,200]
Atlantic salmon	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Brown trout	0.0142	6,946 [1,112]	2,119 [498]	497 [157]	15,145 [1,468]	4,409 [682]	2,524 [1,359]	0 [0]	31,640 [2,445]
Brook trout	0.0000	49 [37]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	49 [37]
Lake trout	0.0228	288 [143]	2,362 [454]	12,923 [1,231]	22,487 [1,784]	8,111 [1,250]	4,667 [1,155]	0 [0]	50,838 [2,797]
Splake	0.0003	302 [166]	50 [50]	0 [0]	188 [129]	0 [0]	75 [76]	0 [0]	615 [230]
Northern pike	0.0014	272 [145]	721 [503]	207 [195]	187 [187]	428 [269]	1,253 [546]	0 [0]	3,068 [847]
White perch	0.0023	0 [0]	0 [0]	2,874 [100]	702 [575]	1,082 [679]	363 [194]	0 [0]	5,021 [911]
Smallmouth bass	0.0133	0 [0]	1,382 [499]	6,739 [1,771]	6,695 [1,508]	9,995 [2,165]	4,846 [1,669]	0 [0]	29,657 [3,624]
Yellow perch	0.4209	30,009 [8,179]	23,428 [10,508]	61,359 [15,011]	331,425 [36,929]	358,000 [38,271]	133,096 [18,723]	0 [0]	937,317 [59,847]
Walleye	0.0050	569 [199]	5,227 [1,342]	379 [183]	676 [325]	1,674 [827]	2,369 [936]	0 [0]	10,894 [1,881]
TOTAL	0.5879	39,597 [8,264]	46,584 [10,713]	116,914 [15,355]	530,308 [37,592]	415,298 [38,475]	160,366 [19,001]	0 [0]	1,309,067 [60,608]
Angler hours		94,978 [8,534]	166,037 [12,472]	338,965 [15,733]	863,526 [33,205]	483,120 [23,885]	280,093 [19,429]	0 [0]	2,226,719 [50,264]

Table 5. 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 1995. Standard deviations in brackets.

Species	Total catch per hour	Mar/Apr	May	June	July	August	Sept/Oct	Nov/Dec	Season
Coho salmon	0.0057	153 [153]	42 [39]	0 [0]	931 [249]	177 [77]	9 [9]	0 [0]	1,312 [309]
Chinook salmon	0.0329	14 [14]	0 [0]	0 [0]	6,584 [853]	716 [252]	259 [120]	0 [0]	7,573 [481]
Rainbow trout	0.0043	0 [0]	0 [0]	0 [0]	797 [172]	167 [120]	33 [33]	0 [0]	997 [213]
Atlantic salmon	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Brown trout	0.0182	1,438 [356]	378 [113]	165 [67]	1,112 [236]	689 [186]	417 [149]	0 [0]	4,199 [507]
Brook trout	0.0020	14 [14]	19 [14]	144 [84]	283 [146]	11 [11]	0 [0]	0 [0]	471 [170]
Lake trout	0.0003	14 [14]	0 [0]	0 [0]	55 [27]	0 [0]	0 [0]	0 [0]	69 [31]
Splake	0.0009	98 [42]	0 [0]	45 [45]	0 [0]	0 [0]	60 [37]	0 [0]	203 [72]
Northern pike	0.0005	9 [9]	0 [0]	0 [0]	0 [0]	65 [65]	33 [33]	0 [0]	107 [74]
White perch	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Smallmouth bass	0.0103	0 [0]	235 [181]	835 [423]	614 [411]	670 [252]	29 [29]	0 [0]	2,383 [667]
Yellow perch	0.2900	14,749 [3,120]	17,507 [9,170]	6,162 [2,030]	20,321 [4,065]	7,941 [1,757]	148 [148]	0 [0]	66,828 [10,844]
Walleye	0.0004	23 [14]	42 [42]	0 [0]	0 [0]	29 [29]	0 [0]	0 [0]	94 [54]
TOTAL	0.3656	16,512 [3,144]	18,223 [9,173]	7,351 [2,077]	30,697 [4,194]	10,465 [1,809]	988 [252]	0 [0]	84,236 [10,921]
Angler hours		19,713 [2,356]	22,028 [3,554]	23,357 [1,528]	85,337 [4,872]	47,096 [3,305]	32,868 [2,288]	0 [0]	230,399 [7,773]

Table 6. 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 1995. Standard deviations in brackets.

Species	Total catch per hour	Mar/Apr	May	June	July	August	Sept/Oct	Nov/Dec	Season
Coho salmon	0.0054	493 [164]	9 [9]	0 [0]	140 [73]	82 [50]	311 [63]	0 [0]	1,035 [202]
Chinook salmon	0.0302	0 [0]	0 [0]	0 [0]	1,825 [417]	312 [144]	3,648 [188]	0 [0]	5,785 [710]
Rainbow trout	0.0067	680 [134]	9 [9]	10 [10]	319 [102]	20 [15]	251 [55]	0 [0]	1,289 [190]
Atlantic salmon	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Brown trout	0.0447	3,844 [564]	291 [118]	78 [58]	1,716 [373]	736 [199]	1,885 [250]	0 [0]	8,550 [760]
Brook trout	0.0048	396 [136]	20 [20]	18 [13]	192 [98]	48 [35]	250 [159]	0 [0]	924 [235]
Lake trout	0.0005	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	93 [41]	0 [0]	93 [41]
Splake	0.0001	13 [13]	0 [0]	0 [0]	0 [0]	0 [0]	9 [9]	0 [0]	22 [16]
Northern pike	0.0017	0 [0]	65 [46]	0 [0]	27 [26]	67 [44]	158 [72]	0 [0]	317 [99]
White perch	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Smallmouth bass	0.0149	0 [0]	456 [319]	462 [280]	577 [296]	1,333 [341]	33 [33]	0 [0]	2,861 [621]
Yellow perch	0.1053	0 [0]	85 [5]	3,535 [19]	11,933 [2,301]	4,586 [1,506]	33 [26]	0 [0]	20,172 [2,750]
Walleye	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
TOTAL	0.2143	5,426 [618]	935 [344]	4,103 [287]	16,729 [2,392]	7,184 [1,565]	6,671 [2,217]	0 [0]	41,048 [3,029]
Angler hours		34,099 [2,972]	14,340 [1,421]	12,478 [1,084]	39,965 [2,614]	26,735 [2,415]	63,865 [4,011]	0 [0]	191,482 [6,387]

Table 7. 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 1995. Standard deviations in brackets.

Species	Total catch per hour	Mar/Apr	May	June	July	August	Sept/Oct	Nov/Dec	Season
Coho salmon	0.0021	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	654 [191]	248 [68]	902 [203]
Chinook salmon	0.0236	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	9,860 [1,261]	96 [33]	9,956 [1,262]
Rainbow trout	0.0317	11,393 [1,305]	455 [142]	10 [10]	39 [39]	0 [0]	992 [192]	507 [115]	13,396 [1,332]
Atlantic salmon	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Brown trout	0.0060	198 [67]	50 [50]	0 [0]	0 [0]	0 [0]	1,634 [274]	653 [147]	2,535 [322]
Brook trout	0.0011	152 [86]	122 [113]	0 [0]	0 [0]	0 [0]	167 [65]	23 [14]	464 [157]
Lake trout	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Splake	0.0000	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Northern pike	0.0029	855 [334]	191 [191]	0 [0]	103 [92]	0 [0]	55 [49]	0 [0]	1,204 [399]
White perch	0.0198	0 [0]	925 [592]	47 [40]	928 [0]	6,403 [4,772]	45 [45]	0 [0]	8,348 [4,809]
Smallmouth bass	0.0028	0 [0]	731 [259]	33 [33]	316 [135]	70 [70]	13 [13]	0 [0]	1,163 [303]
Yellow perch	0.0599	14,395 [3,920]	1,328 [1,546]	343 [195]	777 [380]	338 [207]	8,115 [3,293]	0 [0]	25,296 [5,369]
Walleye	0.0151	403 [107]	1,577 [655]	1,157 [517]	706 [218]	354 [231]	2,192 [785]	0 [0]	6,389 [1,193]
TOTAL	0.1650	27,396 [7,447]	5,379 [1,819]	1,590 [555]	2,869 [469]	7,165 [4,783]	23,727 [3,634]	1,527 [202]	69,653 [7,561]
Angler hours		174,372 [9,379]	35,128 [4,023]	22,970 [4,037]	24,491 [3,351]	15,320 [4,525]	135,840 [6,851]	14,126 [1,625]	422,247 [14,204]

Table 8. Average weight, average length and standard weight of salmonids from Wisconsin's Lake Michigan creel survey, all areas and fishery types combined, 1988-1995. std = standard deviation.

Year	Average weight	± 1 std	Average length	± 1 std	Standard weight
COHO SALMON					
88	4.38927	1.54369	22.41000	2.42620	3.99351
89	4.27399	1.78496	22.50150	2.84274	3.61157
90	4.49193	1.98750	22.60160	3.18498	3.91757
91	4.06888	2.43805	21.69050	3.43957	3.94545
92	4.14931	1.86944	21.93650	3.23596	3.80521
93	3.73333	1.73959	21.21990	2.67736	3.94100
94	3.27205	2.12705	20.05710	3.17497	3.86881
95	3.15977	1.99077	20.36470	3.47945	3.60603
CHINOOK SALMON					
88	11.59570	5.95180	30.06290	6.19946	9.85160
89	9.18500	6.40745	27.42320	6.90950	9.75960
90	9.51360	6.52059	27.64090	7.20534	9.80520
91	8.13850	6.55382	25.75340	6.96827	10.26050
92	10.25180	7.23666	27.92160	7.73204	9.80320
93	10.39720	8.22647	27.33640	8.28938	10.09400
94	10.44530	8.34852	27.02730	8.71924	9.97490
95	9.88820	8.17327	26.39520	8.11261	10.43360
RAINBOW TROUT					
88	6.18719	2.62727	25.39920	4.08053	4.41535
89	6.75515	2.64824	26.69010	3.99997	4.41333
90	6.78061	2.95768	26.20220	4.90000	4.29780
91	6.64343	2.79610	26.34690	4.22405	4.28446
92	7.18517	2.88283	27.05460	4.47526	4.25353
93	6.85630	3.35612	26.23280	4.64175	4.06651
94	6.16965	2.97223	25.49290	4.33957	4.27599
95	6.23276	2.94965	25.46300	4.14715	4.26153
BROWN TROUT					
88	5.50485	2.87826	20.61880	3.94544	4.16698
89	5.49486	2.40390	21.45360	3.25663	4.04284
90	4.96225	2.78125	20.35900	3.76981	4.01236
91	5.09668	2.75652	20.59960	3.39654	4.13893
92	4.39258	2.74944	19.76750	4.06703	3.85596
93	4.79869	2.86619	20.37380	3.98419	3.72416
94	5.50476	3.80463	21.08390	4.65721	3.86961
95	5.20670	3.26665	21.05070	3.85832	3.92960
BROOK TROUT					
89	1.37727	0.85017	14.34550	2.58489	0.92961
90	1.14545	0.63049	13.43380	2.04409	1.00090
91	1.64848	0.60885	15.40910	1.66459	0.89511
92	0.94702	0.81395	12.44570	2.72068	0.85408
93	1.08966	0.77362	13.22240	2.36317	0.87697
94	0.85889	0.37051	12.34440	1.50685	0.89121
95	1.19405	0.92428	12.85830	2.51359	1.03080
LAKE TROUT					
88	8.37042	3.56947	27.51200	3.37376	5.84536
89	8.46114	3.60273	27.86290	3.35547	5.63748
90	8.89295	3.68464	28.16480	3.38979	5.78703
91	9.30325	3.80923	28.47950	3.47067	6.03743
92	8.84764	3.51744	28.50940	3.28367	5.69118
93	7.72595	3.96207	26.85570	3.82471	5.80035
94	7.16244	3.81730	26.31830	4.00574	5.71564
95	8.64408	4.23534	27.29390	3.85191	6.57195

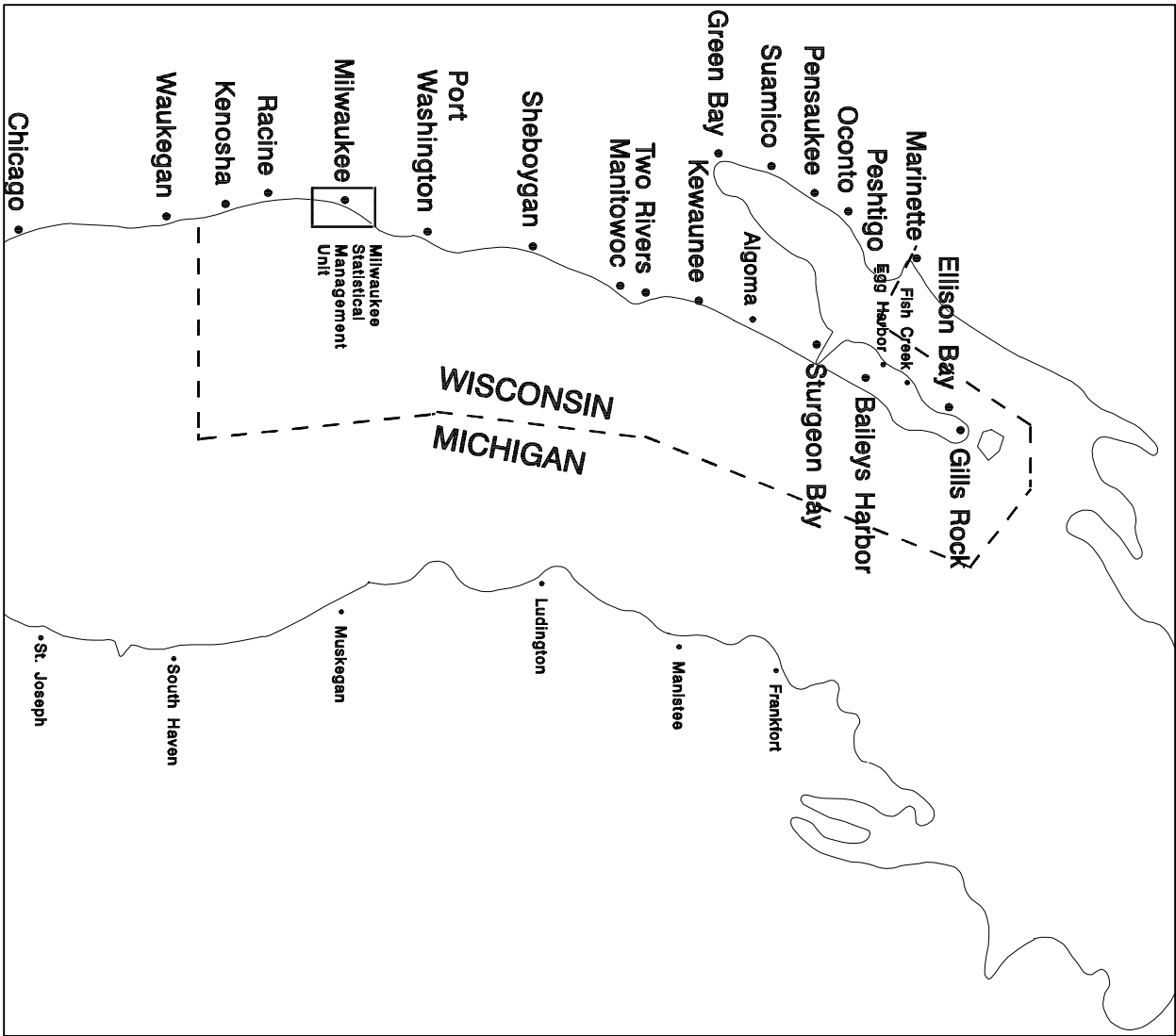


Figure 1. Creel survey locations on Lake Michigan and Green Bay.

ANGLER INTERVIEW FORM

Great Lakes Creel Survey
 Form 3600-073 (Rev 6/12)

Survey Site _____ County _____ Clerk _____

Date 1 2 3 4 5 6 7 8 9 10 11 12
 M M D D Y Y Fishery Type Ramp Pier Shore Stream Ice

1.	PARTY RECORD				BROWN		RAINBOW		LAKE		COHO		CHINOOK		PERCH			
	No. Res	No. Anglers	Trip Status	Interview Time	Time Started Fishing	% Caught	No. Kept	No. Caught	% Time	No. Caught	No. Kept	% Time	No. Caught	No. Kept	% Time	No. Caught	No. Kept	
2.																		
3.																		
4.																		
5.																		
6.																		
7.																		

1.	WALLEYE		OTHER SPECIES			OTHER SPECIES			OTHER SPECIES			
	% Time	No. Caught	No. Kept	% Caught	No. Kept	% Caught	No. Kept	% Caught	No. Kept	% Caught	No. Kept	
2.												
3.												
4.												
5.												
6.												
7.												

Figure 2. Angler Interview Form.

Survey Site							County				Clerk					
Date (MM/DD/YYYY)		County Code (2 digits)		Survey Site Code (3 digits)			Fishery Type									
							<input type="checkbox"/> Ramp 1		<input type="checkbox"/> Pier 2		<input type="checkbox"/> Shore 3		<input type="checkbox"/> Stream 4		<input type="checkbox"/> Ice 5	
Species	Weight (kg)	Length (mm)	Fin Clip	Tag Description			Species	Weight (kg)	Length (mm)	Fin Clip	Tag Description					
				Number	Color	Address					Number	Color	Address			
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Figure 3. Catch Record Form.