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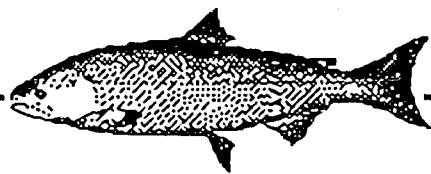
**ILLINOIS  
NATURAL HISTORY  
SURVEY**

A Survey of Sportfishing in the  
Illinois Portion of Lake Michigan  
April 1987 through March 1988

**Aquatic Biology Section**  
Technical Report

William H. Horns

Federal Aid Project  
F-52-R2



Aquatic Biology Technical Report 88/7





Illinois Natural History Survey  
Aquatic Biology Technical Report 88/7

A SURVEY OF SPORTFISHING  
IN THE ILLINOIS PORTION OF LAKE MICHIGAN  
April 1987 through March 1988

William H. Horns  
Aquatic Biology Section, Illinois Natural History Survey

Submitted to  
Division of Fisheries, Illinois Department of Conservation  
in fulfillment of the reporting requirements of  
Federal Aid Project F-52-R2

  
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### ABSTRACT

A survey of sport fishing in the Illinois portion of Lake Michigan was conducted between April 1, 1987, and March 31, 1988. The survey covered all sport fishing, with exception of fishing from chartered boats. It included angling by pedestrians, fishing from boats, smelt fishing, snagging, and ice fishing. The intent of the survey was to provide reliable estimates of sport fishing activity, sport fish harvest, expenditures for sport fishing, and quality of sport fishing. Estimated total fishing effort for all categories of fishing exceeded 1.9 million angler-hours. The estimated total harvest included 1,823,241 yellow perch, 14,972 brown trout, 7,846 rainbow trout, 3,862 lake trout, 43,451 coho salmon, and 28,595 chinook salmon. Estimated expenditures for boats, motors, trailers, fishing gear, and automobile gas exceeded \$7 million. The yield value of the sport fishing harvest was approximately \$3.9 million.

This survey was conducted under a memorandum of understanding between the Illinois Department of Conservation and the Board of Trustees of the University of Illinois. The research was performed by the Illinois Natural History Survey, a division of the Illinois Department of Energy and Natural Resources. The project was supported by funds made available through the Federal Aid in Sport Fish Restoration Act and administered by the Illinois Department of Conservation. The form and content of this report and the interpretations of the data are the responsibility of the University of Illinois and the Illinois Natural History Survey and not the Illinois Department of Conservation.

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## I INTRODUCTION

On 31 March 1988, we completed the third year of a continuing creel survey of sport fishing in the Illinois portion of Lake Michigan. This survey covered all types of sport fishing, with the exception of charter-boat fishing. We were interested in fishing by pedestrians as well as boaters. Our survey also covered smelt fishing, snagging, and ice fishing. The general intent of the project was to provide reliable estimates of sport-fishing activity, sport-fish harvest, expenditures for sport fishing, and quality of sport fishing. Results from the first two years of this series of annual surveys were reported elsewhere (Horns and Gorden 1986, Horns and Gorden 1988). The final annual survey of this series will be concluded on 31 March 1989. The most recent preceding creel survey of this type in Illinois was conducted in 1979 by Bruce Muench (Muench 1981).

### Geographic Setting

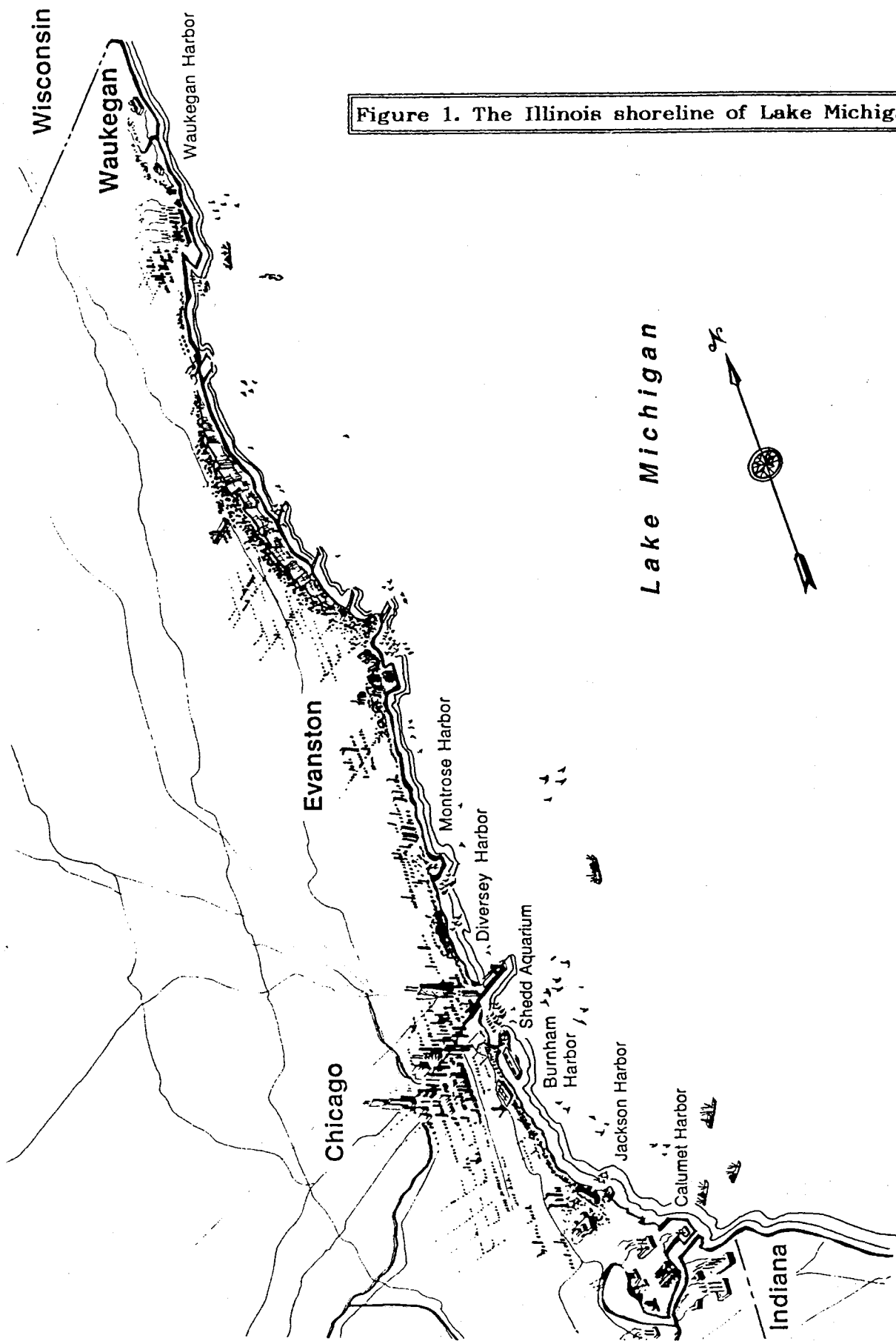
The geographic setting of this survey is illustrated in Figure 1. The area under the jurisdiction of Illinois includes 63 miles of Lake Michigan shoreline. This area is highly developed and heavily industrialized. Chicago covers roughly one-third of the shoreline, and a series of smaller cities cover almost all of the remainder. This section of Lake Michigan lacks significant tributary streams. A geographic feature that influences the distribution and success of sport fishing is the slope of the near-shore lake bottom; the slope becomes progressively steeper as one moves from south to north. This progression means, for example, that boaters from Chicago must go considerably farther from shore to reach good salmon waters than boaters departing from Waukegan.

### Distribution of Fishing

#### *Pedestrians and launched boats*

We defined 27 fishing areas (Table 1). Helicopter flights on seven days in 1987 were used to determine the distribution of fishing. The 27 areas accounted for 95% of the pedestrian anglers observed in the aerial surveys and essentially 100% of the boat trailers parked near launch areas. Boats launched elsewhere (and not included in this survey) included (a) a few boats that were launched from beaches, particularly near the nuclear power plant in Zion, (b) those boats launched from a Fort Sheridan launch ramp that was not accessible to the public, and (c) boats launched from the Calumet Yacht Club (25 to 50 launches per week). In this survey we focused our interviews on eight pedestrian fishing areas and four launch areas. The pedestrian areas (Waukegan Power Plant, Waukegan Harbor, Montrose Harbor, Diversey Harbor, Burnham Harbor, McCormick Place, Jackson Park, and Calumet Park) accounted for 64% of the pedestrian anglers observed during the helicopter flights. The four launch areas (Waukegan Harbor, Diversey Harbor, Burnham Harbor, and Calumet Park) accounted for 70% of the boat trailers observed near launch areas.

Figure 1. The Illinois shoreline of Lake Michigan.



**Table 1. Distribution of pedestrian anglers and boat trailers.**

AREA	PEDESTRIAN ANGLERS (%)	BOAT TRAILERS (%)
1. Illinois Beach State Park	1.1	13.0
2. Waukegan Power Plant discharge and pier	3.6	0.0
3. Waukegan Harbor and breakwalls	11.0	29.0
4. Great Lakes Naval Training Station	3.5	1.6
5. Forest Park	0.2	1.4
6. Central Park	0.8	3.0
7. Winnetka (Lloyd and Tower Parks)	1.7	1.7
8. Wilmette Harbor	2.0	0.0
9. Northwestern Univ. and Dawes Park	2.4	5.3
10. Farwell Avenue pier	1.5	0.0
11. Hollywood Avenue pier	1.3	0.0
12. Foster Avenue pier	0.9	0.0
13. Wilson Avenue ramp	0.0	2.0
14. Montrose Harbor and breakwalls	29.6	0.0
15. Belmont Harbor	3.6	0.0
16. Diversey Harbor and breakwalls	3.6	13.4
17. North Avenue pier	1.8	0.0
18. Navy Pier	1.8	0.0
19. Monroe Street breakwalls	2.3	0.0
20. Burnham Harbor and vicinity	7.0	15.4
21. McCormick Place seawall	1.6	0.0
22. 31st Street pier	1.3	0.0
23. 50th Street access area	0.4	0.0
24. 59th Street Harbor	1.2	0.0
25. Jackson Park Harbor and breakwall	4.6	0.7
26. Rainbow Park	0.8	0.9
27. Calumet Park	2.9	12.6
28. other areas	7.5	0.0
TOTAL	100.0	100.0

*Moored boats*

The principal boat mooring areas are Waukegan Harbor, Great Lakes Naval Training Station, Wilmette Harbor, and the Chicago Park District harbors. In this survey we used the numbers of power boats kept at moorings as an index of fishing activity from moored non-charter power boats. Table 2 summarizes the distribution of moored power boats. Although some fishing occurs from sail boats, we assumed that it was a negligible portion of all fishing. The only private lift service that we included in the survey was that of Larsen Marine (referred to as I/O service in Table 2), which operates in Waukegan Harbor.

<b>MOORING AREA</b>	<b>NUMBER OF POWER BOATS</b>
<b>Waukegan Harbor</b>	<b>590</b>
Public Moorings	476
Larsen Marine I/O service	114
<b>Great Lakes Naval Training Station</b>	<b>105</b>
<b>Wilmette Harbor</b>	<b>87</b>
<b>Chicago Park District</b>	<b>1808</b>
Diversey	659
Burnham	488
other harbor moorings	661

*Ice fishing*

Ice fishing was confined to the following areas: Montrose Harbor, Belmont Harbor (the extreme northwest corner), Diversey Harbor (especially Lincoln Park lagoon), Burnham Harbor, and Jackson Harbor (primarily the inner harbor).

*Snagging*

Legal snagging in 1987 was confined to five areas: Jackson Park inner and outer harbors, Lincoln Park lagoon, Winnetka Power Plant discharge area, Waukegan Harbor, and the Waukegan Power Plant discharge area. The snagging season ran from 1 October through 31 December. We did not attempt to assess the extent of illegal snagging.

*Smelt fishing*

The geographic distribution of smelt fishermen was probably similar to that of conventional pedestrian anglers. Most smelt fishermen in Illinois used small gill nets and preferred structures such as breakwalls and piers similar to those used by conventional anglers. Our smelt fishing interviews were conducted at Montrose Harbor and Waukegan Harbor.

## II METHODS

For purposes of this survey, we considered the following groups separately: (1) summer (1 April through 3 October) pedestrian and launched-boat anglers. These anglers could be studied directly through personal interviews and direct head counts. (2) Anglers using moored boats. Although we experimented with direct mailings and with personal contact to gain information from this group, the data presented here are based entirely on extrapolations from estimates for anglers using launched boats. (3) Winter (4 October through 31 March) fishermen, including snaggers, ice fishermen, and conventional anglers. Here we obtained information directly through interviews and head counts. (4) Smelt fishermen were interviewed and counted in a survey that focused on Waukegan and Montrose Harbors.

### Summer Pedestrians and Launched-boat Anglers

The major work of this survey was the assessment of catch, effort, and expenditures by summer pedestrian and launched-boat anglers. Estimates were made for selected *primary fishing areas*, and those estimates were extrapolated to less heavily fished areas. For each primary fishing area, we used a stratified random sampling design similar to that suggested by Malvestuto (1983), in which the fishing day was the primary sampling unit. Daily estimates of variables of interest (total catch by species, expenditures by category, etc.) for each primary site were combined to form seasonal estimates using the formula for stratified random samples given by Cochran (1977).

#### *Use of primary fishing areas*

The primary fishing areas for pedestrian anglers were Waukegan Power Plant, Waukegan Harbor, Montrose Harbor, Diversey Harbor, Burnham Harbor, McCormick Place, Jackson Park, and Calumet Park. The primary fishing areas for launched boats were Waukegan Harbor, Diversey Harbor, Burnham Harbor, and Calumet Park. For each day of work, a creel clerk was assigned to visit three areas, two pedestrian areas and one launch area, in a prescribed order. The three areas were always one of four groups: (1) Waukegan Harbor (pedestrians), Waukegan Power Plant (pedestrians), Waukegan Harbor (launched boats); (2) Montrose Harbor (pedestrians), Diversey Harbor (pedestrians), Diversey Harbor (launched boats); (3) Burnham Harbor (pedestrians), McCormick Place (pedestrians), Burnham Harbor (launched boats); and (4) Jackson Park (pedestrians), Calumet Park (pedestrians), Calumet Park (launch ramps). The primary fishing areas accounted for 64% of pedestrian fishing and 70% of fishing from launched boats (Table 1). Estimates obtained for the primary fishing areas were extrapolated to all other areas based on the distributions of pedestrian anglers and boat trailers.

#### *Selection of dates in a stratified random sample*

The summer fishing season (1 April through 3 October 1987) was stratified by time period and type of day. Each date fell within one time period and was either a working day or a nonworking day (weekends and holidays). The following 16 strata were formed:

- |                              |                                 |
|------------------------------|---------------------------------|
| 1. working days 4/1 - 4/18   | 2. nonworking days 4/1 - 4/18   |
| 3. working days 4/19 - 5/9   | 4. nonworking days 4/19 - 5/9   |
| 5. working days 5/10 - 5/30  | 6. nonworking days 5/10 - 5/30  |
| 7. working days 5/31 - 6/20  | 8. nonworking days 5/31 - 6/20  |
| 9. working days 6/21 - 7/11  | 10. nonworking days 6/21 - 7/11 |
| 11. working days 7/12 - 8/1  | 12. nonworking days 7/12 - 8/1  |
| 13. working days 8/2 - 8/22  | 14. nonworking days 8/2 - 8/22  |
| 15. working days 8/23 - 9/12 | 16. nonworking days 8/23 - 9/12 |
| 17. working days 9/13 - 10/3 | 18. nonworking days 9/13 - 10/3 |

Within each stratum dates were selected at random. This sampling process was conducted separately for each of the four groups of three areas. Three dates were selected from each stratum except 1 and 2; in those strata, which were a few days shorter than the others, fewer than three dates were selected for all but the most northerly group of areas. The areas in each group of areas were all visited on the dates selected for that group.

#### *Data collection*

Data collection at pedestrian fishing areas consisted of counting all pedestrian anglers at the start and finish of a two-hour interview period and interviewing with a representative sample of anglers during the two hours. For four of the primary pedestrian areas (Waukegan Harbor, Montrose Harbor, Burnham Harbor, and Jackson Park) the interview period was always 6:00 a.m. to 8:00 a.m.; for the other four (Waukegan Power Plant, Diversey Harbor, McCormick Place, and Calumet Park) the interview period was always 8:30 a.m. to 10:30 a.m. Each interview was designed for one angling party (i.e., one or more anglers fishing together) rather than for one individual angler. At launch ramps the number of angling boats returning to the ramp between 11:00 a.m. and 1:00 p.m. were counted and a representative sample of all returning fishing parties were interviewed.

The interviewers (referred to as creel clerks) gathered information related to effort (number of angler-hours, number of angler-trips), expenditures for the present fishing trip (by category: major = boat, motor, or trailer; minor = fishing gear; other = auto gas @ 10 cents per mile), species sought, and catch (by species). They also weighed and measured fish in possession of the anglers and noted clipped fins. The data form and instructions to creel clerks are reproduced in Appendix A.

#### *Variables measured for each date*

The data collected in the interviews on one date at one area were reduced to a set of variables describing daily fishing activity: (1) *Catch per angler-hour* was determined for each species and was the number of fish caught by all parties interviewed divided by the number of hours of fishing by individuals in those parties. (2) *Expenditures per angler-trip* was determined in each of three categories (major, minor, and other) and equalled total expenditures divided by the number of anglers interviewed. (3) *Angler-hours* (i.e., total time spent fishing by all anglers) and (4) *angler-trips* (i.e., total number of anglers who fished) were determined differently for

pedestrians and boaters. For pedestrians, angler-hours was the average number of anglers (at start and finish of interviews) multiplied by the number of hours in the day (from 0.5 hour before sunrise to 0.5 hour after sunset), and angler-trips was angler-hours divided by the average duration of a pedestrian fishing trip (4.32 hours for all interviews with conventional pedestrian anglers during this 1987-1988 survey). For boaters, we estimated the number of fishing boats launched for the day by multiplying the number of fishing boats landing during the two-hour interview period by the estimated average ratio of the number of all boats returning in a day to the number returning between 11:00 a.m. and 1:00 p.m. That ratio was estimated to be 2.94 by monitoring all boat traffic at one of three launch ramps on 25 days in 1985, 1986, and 1987. Angler-trips was then estimated as the total number of boats launched for the day multiplied by the average number of anglers per boat (2.77 anglers for all interviews in 1987). Angler-hours was taken as angler-trips multiplied by the yearly average number of hours per angling trip by boaters (5.25 hours for all interviews in 1987). (5) *Catch* was determined for each species as catch per angler-hour multiplied by angler-hours, and (6) *expenditures* was determined for each category as expenditures per angler-trip multiplied by angler-trips.

#### *Expansion of daily estimates*

The formula given by Cochran (1977) for stratified random samples was employed to expand the daily estimates to form seasonal area-specific estimates of effort, catch, and expenditures.

Seasonal averages of catch per angler-hour were obtained for each primary fishing area by taking unweighted averages of daily values. In these calculations, seasonal averages for yellow perch included only data from anglers who were fishing for perch, and seasonal averages for salmonids included only data from anglers who were fishing for salmonids.

#### *Extrapolation to other areas*

Extrapolations of seasonal estimates for primary fishing areas to other areas were based on the distributions of pedestrian anglers and boat trailers (Table 1). The distribution of boat trailers was assumed to reflect the distribution of launched-boat anglers. In the extrapolations, catch, effort, and expenditures at areas not visited were estimated by extension of results for the nearest primary fishing areas. Thus, for pedestrian anglers, results for Waukegan Harbor were extended to all other areas (except Waukegan Power Plant) north of and including Wilmette Harbor; results for Montrose Harbor were extended to all remaining areas north of Diversey Harbor; results for Diversey Harbor were extended to all remaining areas north of the Monroe Street breakwalls; results for Burnham Harbor were extended to all remaining areas north of McCormick Place; results for McCormick were extended to all remaining areas north of 31st Street; results from Jackson Park were extended to all remaining areas north of Rainbow Park; and results from Calumet Park were extended to all remaining areas south of (and including) Rainbow Park. For launched boats, results for Waukegan Harbor were extended to all launch



ramps north of Wilmette; results for Diversey were extended to Dawes Park and the Wilson Avenue ramps; and results for Calumet Park were extended to ramps at 59th Street Harbor, Jackson Park, and Rainbow Park.

### Moored Boats

To estimate effort, catch, and expenditures by anglers using moored boats, we extrapolated estimates for launched boats. First, we estimated the ratio of moored fishing boats to launched fishing boats for Waukegan Harbor, Diversey Harbor, and Burnham Harbor. On several dates during the summers of 1986 and 1987 we counted the number of fishing boats returning to moorings and to Larsen Marine I/O service at Waukegan Harbor while simultaneously counting the number of fishing boats returning to the launch ramp. Charter boats were excluded from the counts. The ratio of moored to launched boats at Waukegan was 0.83. In a similar series of counts at Diversey Harbor the ratio was 1.54. For Burnham Harbor, where we monitored boats only in 1987, the ratio was 0.34. Using these figures, seasonal estimates of effort, catch, and expenditures by anglers using launched boats at Waukegan, Diversey, and Burnham harbors were extrapolated to moored boats. Thus, for example, the moored boat catch at Waukegan Harbor for a given time period was estimated to be the launched boat catch for that time period multiplied by 0.83. Values so derived for Waukegan, Diversey, and Burnham harbors were then extrapolated to other moored boats based on the distribution of moored power boats (Table 2). Estimates for Waukegan Harbor were extrapolated to boats moored in Wilmette Harbor and Great Lakes Naval Training Station, and the combined estimates for Diversey Harbor and Burnham Harbor were extrapolated to all other boats moored in Chicago.

### Winter Fishing

Winter fishing comprised snagging, ice fishing, and conventional angling (mostly occurring at power plant discharge areas). During the winter months (October through March) the following nine areas were visited weekly for counts of each type of fisherman and for interviews:

Waukegan Power Plant	Waukegan Harbor
Winnetka Power Plant	Montrose Harbor
Belmont Harbor	Diversey Harbor
Navy Pier	Burnham Harbor
Jackson Park	

This list includes all legal snagging areas, all ice-fishing areas, and all other areas fished by conventional anglers to any significant extent during winter. Creel clerks used the form and procedures outlined in Appendix A.

From 1 October 1987 through 31 March 1988, all areas were scheduled for weekly visits on a Saturday or a Sunday. All areas were visited during daylight hours. The times of counts and interviews were uncontrolled and depended on the pace at which creel clerks were able to complete their work. Daily estimates for catch, expenditures, and effort for each area were derived as described above for the summer survey except that different values for average fishing-trip length were used for snaggers and ice fishermen. Those averages (derived from this series of interviews) were 4.49 hours for snaggers

and 4.99 hours for ice fishermen. The daily estimates were treated as a random sample from all weekend days and holidays during the snagging season, and seasonal weekend-holiday totals were estimated accordingly. Work-day totals were estimated by extrapolation; the summer ratio of average work-day pedestrian fishing activity (estimated man-hours of fishing) to average weekend-holiday pedestrian fishing activity was used as the basis for the extrapolation.

### Smelt Fishing

Our data collection focused on two fishing areas, Montrose Harbor and Waukegan Harbor. Together those areas probably account for about the same fraction of Illinois' total smelt fishing in Illinois as of total conventional pedestrian angling (41%, see Table 1). Dates during the smelt season (1 April through 15 May) were selected randomly, and two clerks were assigned to cover the two sites simultaneously. Data collection was similar to that described above for conventional pedestrian anglers, except that initial counts of smelt fishermen were made at 10:00 p.m. (9:00 p.m. prior to the start of Daylight Savings Time on 5 April) and interviews were conducted after that. Creel clerks used the form and procedures used in other interviews, with two differences: the smelt in possession of fishermen were not weighed or measured and "major expenditures" here meant expenditures for food and drink, not for boats, motors, and trailers, as elsewhere.

Daily estimates of effort (angler-hours) were derived by multiplying the number of fishermen by 4.0 hours (approximately the average trip length). Daily catch estimates were derived by multiplying angler-hours by catch per angler-hour for the day in question.

Data collection was terminated for the season when one of the clerks fell and broke his leg on 16 April while conducting the survey.

### Yield Values

Here the term *yield value* means the hypothetical market price of the sport fish harvest. We attempted to estimate what it would cost to purchase in retail markets the fish caught by sport fishermen if sale of sport-caught fish were legal. For salmonids, we used approximate market prices of whole fish, headed and gutted. For yellow perch we used market prices of fillets. In these estimates we multiplied estimated catch for each species by the average weight of individual fish weighed in our survey. That estimated harvested round weight was then multiplied by a factor to estimate the harvested market weight. For salmonids, the factor was 0.75 because approximately 25% of the weight of a salmonid is in the head and viscera. For yellow perch the factor was 0.40 because approximately 60% of the fish is wasted in the filleting process. Total harvested marketable weight was then multiplied by approximate market prices (Table 9).

### Missing Data

On some dates creel clerks were unable to complete their assigned interviews. When data were missing from some but not all of the assigned

dates in a stratum, estimates for the stratum were based on data from the completed dates. No special formula was used, but the sample size was smaller than for strata where all interviews were completed.

### III RESULTS

All estimates derived in this survey are given here without qualification; for simplicity of expression, we do not repeat the word "approximately" with each estimated value. The reader should be aware, however, that these estimates are affected by measurement error, random sampling error, and bias. These problems of imprecision and bias are discussed in the following section.

Total fishing effort for all categories of fishing in the Illinois portion of Lake Michigan during the study period was 1.9 million angler-hours, with 66% of that attributable to summer pedestrian anglers. Anglers caught 1,823,241 yellow perch, 14,972 brown trout, 7,846 rainbow trout, 3,682 lake trout, 43,451 coho salmon, and 28,595 chinook salmon. We did not estimate the smelt harvest. Expenditures for boats, motors, trailers, fishing gear, and automobile gas used on Lake Michigan fishing trips were over \$7 million. The yield value of the Illinois sport-fishing harvest was \$3.9 million.

Detailed results are presented in Tables 3 - 11. Tables 3 and 4 summarize all expenditure, catch, and effort estimates. Tables 5a, 5b, and 6 list seasonal catch and effort estimates for pedestrians and anglers using launched boats. Tables 7a, 7b, and 8 present catch rates for pedestrians and launched boaters. Table 9 provides yield values. Tables 10a and 10b present average weights of the six most important species, with separate estimates given for the catch of boaters, pedestrians, and snaggers. Length distributions of the five salmonid species are given in Figure 2. Fin clips observed by our creel clerks are listed in Tables 11a and 11b, with the number of occurrences of each clip or clip combination listed by season and angler type.

#### Summer Pedestrian Fishing

During the summer of 1987, pedestrian anglers made nearly 300,000 trips to Lake Michigan and spent 1.25 million hours fishing. Yellow perch was the predominant species in their catch, with a harvest of 1,715,219 fish. Montrose Harbor was the most productive area, with 24% of the yellow perch harvest, although catch rates by anglers fishing for yellow perch at Waukegan Harbor usually exceeded those at Montrose Harbor during the midsummer period of best fishing for yellow perch (6/21-8/1). Coho salmon was the next most important species for summer pedestrians, with a catch of 13,101. Pedestrian anglers spent \$1,673,952 (\$5.79 per trip) for fishing gear and \$474,570 (\$1.64 per trip) for automobile gas.

#### Fishing by Boaters Using Launched Boats

Anglers who used launched boats made over 50,000 trips to Lake Michigan and spent 285,076 hours fishing. The most abundant species in their catch were yellow perch (84,172), coho salmon (14,861) and chinook salmon (8,266). For Pacific salmon, Waukegan Harbor was the most productive of the four primary launch areas, accounting for 30% of the coho salmon and 50% of the chinook salmon taken by anglers who used launched boats. Expenditures by anglers using launched boats reached \$3,163,353 (\$58.53 per trip), with over half of that amount going for boats, motors, and trailers.

### Fishing by Boaters Using Moored Boats

Our estimates for boaters using boats kept at moorings were derived by extrapolation from estimates for boaters using launched boats. This group of anglers caught 8,855 coho salmon and 4,057 chinook salmon and spent \$1,418,090 for boats, motors, trailers, fishing gear, and automobile gas (we do not include mooring costs here).

### Winter Fishing

Snaggers caught 1,144 rainbow trout and 6,513 chinook salmon in 39,745 hours of fishing. They spent \$62,546 (\$6.76 per trip). 1987-1988 was a poor year for ice fishing. Ice fishermen spent only \$19,134 (\$5.75 per trip). Conventional anglers were most active at the Waukegan Power Plant discharge and, during late fall of 1987 and very early spring of 1988, at Montrose Harbor. They caught 6,371 coho salmon, 2,947 brown trout, and 2849 rainbow trout in 159,131 hours of fishing, and spent \$337,674 (\$10.04 per trip).

### Smelt Fishing

We did not estimate total catch, effort, or expenditures by smelt fishermen because data collection was curtailed when the creel clerk assigned to Montrose Harbor broke his leg. Limited data, however, indicate that the total harvest probably exceeded 1,000,000. On five dates in early April when clerks visited both Waukegan and Montrose Harbors the estimated total harvest at those two sites alone was 139,049, with Montrose Harbor providing over 95% of that total.

### Yield Values

The estimated yield values of the three most popular sport species were \$1,507,966 (yellow perch), \$845,108 (coho salmon), and \$1,296,715 (chinook salmon).

### Minor Species

In addition to smelt and the species for which results are presented in detail in Tables 3-11, creel clerks reported several other species of fish in possession of pedestrian anglers: **common carp** (15 from the Waukegan Power Plant discharge channel); **sunfish** (4 bluegills from Diversey Harbor and 1 unidentified sunfish from the Shedd Aquarium vicinity); **rock bass** (6 from in Burnham Harbor and 1 from the Shedd Aquarium vicinity); **crappie** (1 from the Shedd Aquarium vicinity, 1 from Diversey Harbor, 2 from the McCormick Place vicinity, and 2 from Montrose Harbor); **catfish** (6 from Diversey Harbor, 1 from Jackson Park Harbor, and 1 from Burnham Harbor); **drum** (1 from Jackson Harbor); **sucker** (1 from the Waukegan Power Plant discharge channel and 1 from the Montrose Harbor vicinity); and **yellow bullhead** (2 from Burnham Harbor). Anglers also caught alewives for use as bait.

**Table 3. Effort and expenditures by anglers of all types.**

TYPE OF ANGLER	AREA	EFFORT (angler-trips)	EXPENDITURES		
			major (boat)	minor (gear)	other (travel)
<b>SUMMER (4/1-10/3)</b>					
Pedestrians	Wau.Power	14,120	\$0	\$106,272	\$36,383
	Wau.Harbor	28,463	\$0	\$172,697	\$49,933
	Montrose	75,373	\$0	\$342,391	\$118,483
	Diversey	12,887	\$0	\$78,765	\$14,230
	Burnham	21,553	\$0	\$169,501	\$36,728
	McCormick	6,225	\$0	\$40,342	\$8,084
	Jackson	8,476	\$0	\$45,629	\$9,610
	Calumet	10,177	\$0	\$37,597	\$13,386
	other	112,032	\$0	\$680,757	\$187,733
	<b>TOTALS</b>		<b>289,307</b>	<b>\$0</b>	<b>\$1,673,952</b>
Launched boats	Waukegan	19,641	\$894,810	\$184,846	\$52,956
	Diversey	4,370	\$72,726	\$71,907	\$5,061
	Burnham	3,652	\$139,076	\$64,275	\$5,831
	Calumet	5,615	\$446,089	\$54,349	\$7,719
	others	20,765	\$874,051	\$242,291	\$47,368
	<b>TOTALS</b>		<b>54,043</b>	<b>\$2,426,752</b>	<b>\$617,667</b>
Moored Boats	<b>TOTALS</b>	<b>28,911</b>	<b>\$995,572</b>	<b>\$363,065</b>	<b>\$59,453</b>
<b>WINTER</b>					
Pedestrians (10/4-3/31)	Wau.Power	9,467	\$0	\$131,592	\$24,433
	Wau.Harbor	2,343	\$0	\$5,602	\$4,623
	Winnetka	1,496	\$0	\$3,393	\$3,934
	Montrose	5,616	\$0	\$20,321	\$16,138
	Belmont	1,596	\$0	\$5,710	\$1,890
	Diversey	958	\$0	\$9,900	\$1,032
	Navy Pier	358	\$0	\$1,308	\$479
	Burnham	2,619	\$0	\$26,060	\$5,147
	Jackson	920	\$0	\$5,024	\$1,931
	others	8,258	\$0	\$51,958	\$17,199
<b>TOTALS</b>		<b>33,629</b>	<b>\$0</b>	<b>\$260,869</b>	<b>\$76,805</b>
Snaggers (10/1-12/31)	Wau.Power	614	\$0	\$8,484	\$1,490
	Wau.Harbor	1,070	\$0	\$4,543	\$4,848
	Winnetka	167	\$0	\$2,506	\$448
	Diversey	3,242	\$0	\$15,249	\$4,443
	Jackson	4,153	\$0	\$16,491	\$4,044
	<b>TOTALS</b>		<b>9,247</b>	<b>\$0</b>	<b>\$47,273</b>
Ice fishermen (12/1-2/29)	Montrose	142	\$0	\$0	\$284
	Belmont	1,879	\$0	\$9,759	\$3,139
	Diversey	790	\$0	\$1,723	\$2,087
	Navy Pier	123	\$0	\$567	\$333
	Burnham	375	\$0	\$719	\$449
	Jackson	15	\$0	\$43	\$31
<b>TOTALS</b>		<b>3,325</b>	<b>\$0</b>	<b>\$12,811</b>	<b>\$6,323</b>
<b>GRAND TOTALS</b>		<b>418,462</b>	<b>\$3,422,324</b>	<b>\$2,975,637</b>	<b>\$751,358</b>

**Table 4. Effort and catch by anglers of all types.**

TYPE OF ANGLER and AREA		EFFORT (angler- hours)	CATCH					chin salm'
			yellow perch	brown trout	r'bow trout	lake trout	coho salm'	
<b>SUMMER (4/1-10/3)</b>								
Peds	Wau.Pow.	61,189	50,493	2,667	457	27	380	243
	Wau.Har.	123,392	207,001	1,138	351	0	3,090	2,770
	Montrose	326,981	418,916	514	132	0	2,698	1,202
	Diversey	55,884	58,658	241	0	0	223	23
	Burnham	93,002	162,946	243	199	0	674	537
	McCorm.	26,859	32,634	28	64	0	144	176
	Jackson	36,572	66,906	560	0	0	297	73
	Calumet	43,915	36,998	541	154	0	124	0
	other	485,000	680,665	5,050	1,129	27	5,471	4,042
	<b>TOTALS</b>	<b>1,252,796</b>	<b>1,715,219</b>	<b>10,982</b>	<b>2,486</b>	<b>55</b>	<b>13,101</b>	<b>9,066</b>
Lau'd	Waukeg.	103,117	12,257	333	283	1,139	4,390	4,133
	Diversey	22,936	994	20	71	122	1,782	207
	Burnham	19,171	15,403	8	69	79	1,623	221
	Calumet	30,687	27,352	64	70	0	1,188	373
	others	109,166	28,167	265	319	959	5,878	3,332
	<b>TOTALS</b>	<b>285,076</b>	<b>84,172</b>	<b>690</b>	<b>811</b>	<b>2,299</b>	<b>14,861</b>	<b>8,266</b>
Moo'd	<b>TOTALS</b>	<b>151,770</b>	<b>20,964</b>	<b>330</b>	<b>444</b>	<b>1,286</b>	<b>8,855</b>	<b>4,057</b>
<b>WINTER (see dates in Table 3)</b>								
Peds	Wau.Pow.	44,796	0	1,799	1,593	42	355	123
	Wau.Har.	11,086	17	361	155	0	861	45
	Winnetka	7,080	0	26	69	0	275	0
	Montrose	26,573	0	306	162	0	1,558	243
	Belmont	7,553	102	0	0	0	126	0
	Diversey	4,533	23	0	0	0	0	0
	Navy Pr	1,691	395	0	0	0	44	0
	Burnham	12,392	843	46	344	0	188	92
	Jackson	4,353	92	0	0	0	585	0
	others	39,075	1,095	409	525	0	2,378	190
	<b>TOTALS</b>	<b>159,131</b>	<b>2,567</b>	<b>2,947</b>	<b>2,849</b>	<b>42</b>	<b>6,371</b>	<b>693</b>
Snag	Wau.Pow.	2,622	0	0	77	0	0	77
	Wau.Har.	4,809	0	0	685	0	0	2,074
	Winnetka	715	0	0	19	0	0	19
	Diversey	13,860	0	13	139	0	86	597
	Jackson	17,739	0	10	223	0	177	3,746
	<b>TOTALS</b>	<b>39,745</b>	<b>0</b>	<b>23</b>	<b>1,144</b>	<b>0</b>	<b>263</b>	<b>6,513</b>
Ice	Montrose	701	0	0	0	0	0	0
	Belmont	9,274	319	0	0	0	0	0
	Diversey	3,897	0	0	102	0	0	0
	Navy Pr	608	0	0	0	0	0	0
	Burnham	1,850	0	0	0	0	0	0
	Jackson	76	0	0	0	0	0	0
	<b>TOTALS</b>	<b>16,406</b>	<b>319</b>	<b>0</b>	<b>102</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>GRAND TOTALS</b>		<b>1,904,924</b>	<b>1,823,241</b>	<b>14,972</b>	<b>7,846</b>	<b>3,682</b>	<b>43,451</b>	<b>28,595</b>

Table 5a. Effort and catch by pedestrian anglers (northern areas).

TIME PERIOD	AREA	EFFORT (angler-hours)	CATCH					
			yellow perch	brown trout	r'bow trout	lake trout	coho salm'	chin salm'
4/1-	Wau'Power	10,068	0	1,179	107	27	0	27
4/18	Wau'Harbor	4,376	0	297	0	0	153	73
	Montrose	19,582	95	219	0	0	1,430	0
	Diversey	2,549	0	56	0	0	92	0
	others	22,608	34	1,571	107	27	704	97
4/19-	Wau'Power	8,480	0	1,105	85	0	0	0
5/9	Wau'Harbor	8,124	0	800	0	0	39	0
	Montrose	21,215	8,170	132	132	0	763	0
	Diversey	2,505	290	175	0	0	102	0
	others	25,152	3,059	2,012	132	0	364	0
5/10-	Wau'Power	4,010	0	62	90	0	15	0
5/30	Wau'Harbor	7,124	2,547	42	0	0	0	0
	Montrose	23,961	20,923	163	0	0	0	0
	Diversey	5,119	6,184	10	0	0	0	0
	others	22,154	13,289	166	90	0	15	0
5/31-	Wau'Power	3,803	3,041	321	0	0	0	0
6/20	Wau'Harbor	19,792	31,743	0	0	0	0	0
	Montrose	53,686	55,403	0	0	0	0	0
	Diversey	13,429	14,504	0	0	0	0	0
	others	49,200	61,051	321	0	0	0	0
6/21-	Wau'Power	7,727	8,795	0	0	0	0	0
7/11	Wau'Harbor	19,092	39,571	0	235	0	0	0
	Montrose	59,825	104,194	0	0	0	251	0
	Diversey	10,621	23,587	0	0	0	0	0
	others	53,073	96,632	0	224	0	89	0
7/12-	Wau'Power	12,998	35,223	0	0	0	173	0
8/1	Wau'Harbor	23,201	101,081	0	79	0	1,657	0
	Montrose	86,738	194,041	0	0	0	253	150
	Diversey	10,831	10,631	0	0	0	0	0
	others	71,930	206,448	0	76	0	1,845	53
8/2-	Wau'Power	4,576	2,514	0	0	0	49	10
8/22	Wau'Harbor	14,640	21,699	0	0	0	0	130
	Montrose	25,270	28,249	0	0	0	0	40
	Diversey	3,751	3,147	0	0	0	0	0
	others	29,599	34,995	0	0	0	49	148
8/23-	Wau'Power	4,131	235	0	17	0	25	18
9/12	Wau'Harbor	15,110	3,856	0	36	0	524	1,297
	Montrose	25,272	6,095	0	0	0	0	838
	Diversey	4,244	168	0	0	0	29	0
	others	29,877	6,171	0	51	0	541	1,554
9/13-	Wau'Power	5,396	686	0	158	0	118	187
10/3	Wau'Harbor	11,932	6,505	0	0	0	717	1,269
	Montrose	11,434	1,746	0	0	0	0	175
	Diversey	2,836	147	0	0	0	0	23
	others	22,417	7,596	0	158	0	803	1,474



Table 5b. Effort and catch by pedestrian anglers (southern areas).

TIME PERIOD	AREA	EFFORT (angler-hours)	CATCH					
			yellow perch	brown trout	r'bow trout	lake trout	coho salm'	chin salm'
4/1-	Burnham	2,861	0	0	51	0	246	0
4/18	McCormick	796	0	0	0	0	0	8
	Jackson	384	0	0	0	0	0	0
	Calumet	2,695	0	62	0	0	58	0
	others	4,580	0	21	43	0	224	9
4/19-	Burnham	3,271	0	243	79	0	102	0
5/9	McCormick	300	0	0	0	0	0	0
	Jackson	1,638	0	285	0	0	162	0
	Calumet	3,505	0	435	85	0	66	0
	others	5,894	0	636	95	0	269	0
5/10-	Burnham	3,013	203	0	0	0	0	0
5/30	McCormick	639	255	0	0	0	0	0
	Jackson	2,286	3,371	0	0	0	0	0
	Calumet	3,240	3,843	0	0	0	0	0
	others	6,618	5,152	0	0	0	0	0
5/31-	Burnham	17,122	38,938	0	0	0	0	0
6/20	McCormick	4,014	6,364	28	0	0	0	0
	Jackson	7,926	19,047	276	0	0	0	0
	Calumet	10,824	13,064	43	0	0	0	0
	others	30,360	62,975	322	0	0	0	0
6/21-	Burnham	20,727	37,915	0	0	0	0	0
7/11	McCormick	4,902	9,380	0	0	0	0	0
	Jackson	5,312	33,069	0	0	0	0	0
	Calumet	7,152	13,525	0	0	0	0	0
	others	30,467	79,701	0	0	0	0	0
7/12-	Burnham	18,086	40,825	0	0	0	0	0
8/1	McCormick	5,373	11,500	0	0	0	0	0
	Jackson	7,585	10,862	0	0	0	0	0
	Calumet	7,399	6,057	0	0	0	0	0
	others	31,167	59,715	0	0	0	0	0
8/2-	Burnham	13,284	43,506	0	0	0	0	0
8/22	McCormick	2,684	3,136	0	64	0	0	0
	Jackson	3,118	556	0	0	0	0	0
	Calumet	4,317	408	0	0	0	0	0
	others	18,632	40,273	0	73	0	0	0
8/23-	Burnham	7,256	1,517	0	0	0	162	179
9/12	McCormick	4,041	1,253	0	0	0	23	88
	Jackson	2,829	0	0	0	0	135	0
	Calumet	2,051	77	0	46	0	0	0
	others	14,094	2,693	0	16	0	296	248
9/13-	Burnham	7,383	42	0	68	0	163	358
10/3	McCormick	4,111	746	0	0	0	121	80
	Jackson	5,495	0	0	0	0	0	73
	Calumet	2,732	23	0	23	0	0	0
	others	17,179	882	0	65	0	272	459

Table 6. Effort and catch by anglers using launched boats.

TIME PERIOD	AREA	EFFORT (angler-hours)	CATCH					chin salm'
			yellow perch	brown trout	r'bow trout	lake trout	coho salm'	
4/1-	Waukegan	3,579	0	104	0	0	209	19
4/18	Diversey	882	0	0	0	0	123	0
	Burnham	1,448	0	0	0	0	565	40
	Calumet	2,079	0	0	0	0	159	8
	others	4,747	0	74	0	0	802	55
	Waukegan	15,684	0	73	24	58	1,935	128
4/19-	Diversey	2,923	0	6	0	0	667	8
	Burnham	1,654	0	8	24	0	128	8
	Calumet	3,067	169	13	24	0	266	20
	others	14,831	21	65	44	41	1,906	106
5/10-	Waukegan	17,471	0	0	34	313	872	218
5/30	Diversey	4,016	0	15	0	0	281	22
	Burnham	4,418	232	0	12	0	596	6
	Calumet	5,416	2,159	0	9	0	372	42
	others	19,765	506	8	37	223	1,419	179
5/31-	Waukegan	14,059	517	86	98	165	536	60
6/20	Diversey	5,053	784	0	8	6	538	6
	Burnham	2,820	2,590	0	6	19	222	35
	Calumet	6,829	7,980	40	0	0	291	9
	others	16,475	4,400	67	80	140	934	82
6/21-	Waukegan	10,345	2,820	7	19	136	111	360
7/11	Diversey	3,377	209	0	35	67	89	36
	Burnham	2,387	4,886	0	0	48	18	12
	Calumet	4,103	10,647	0	6	0	24	0
	others	12,133	8,365	5	33	182	149	288
7/12-	Waukegan	11,588	8,288	44	35	147	190	776
8/1	Diversey	2,280	0	0	16	0	0	67
	Burnham	2,322	7,597	0	22	12	22	21
	Calumet	2,829	4,306	0	7	0	76	14
	others	12,195	14,060	32	57	117	167	614
8/2-	Waukegan	10,230	631	18	49	218	84	1,040
8/22	Diversey	780	0	0	0	0	0	20
	Burnham	824	98	0	0	0	0	0
	Calumet	87	0	0	0	0	0	0
	others	8,562	548	13	35	156	60	753
8/23-	Waukegan	14,232	0	0	25	60	374	1,076
9/12	Diversey	2,228	0	0	12	49	16	49
	Burnham	991	0	0	6	0	34	68
	Calumet	2,213	264	0	24	0	0	60
	others	12,644	34	0	33	70	310	870
9/13-	Waukegan	5,927	0	0	0	43	78	455
10/3	Diversey	1,397	0	0	0	0	67	0
	Burnham	2,307	0	0	0	0	39	32
	Calumet	4,064	1,826	10	0	0	0	220
	others	7,816	232	1	0	31	131	384

Table 7a. Catch rates by pedestrian anglers (northern areas). For yellow perch, only data from anglers fishing for yellow perch were used. For the five salmonid species, only data from anglers fishing for salmonids were used. Asterisks represent missing data.

TIME PERIOD	AREA	CATCH PER ANGLER-HOUR					
		yellow perch	brown trout	rainbow trout	lake trout	coho salmon	chinook salmon
4/1-	Wau' Power	*	0.139	0.011	0.001	0.000	0.001
4/18	Wau' Harbor	*	0.065	0.000	0.000	0.074	0.013
	Montrose	0.000	0.012	0.000	0.000	0.064	0.000
	Diversey	*	0.025	0.000	0.000	0.050	0.000
4/19-	Wau' Power	*	0.141	0.009	0.000	0.000	0.000
5/9	Wau' Harbor	0.000	0.064	0.000	0.000	0.005	0.000
	Montrose	0.904	0.000	0.007	0.000	0.048	0.000
	Diversey	0.101	0.126	0.000	0.000	0.086	0.000
5/10-	Wau' Power	0.000	0.013	0.030	0.000	0.004	0.000
5/30	Wau' Harbor	0.044	0.006	0.000	0.000	0.000	0.000
	Montrose	0.889	0.000	0.000	0.000	0.000	0.000
	Diversey	1.514	0.000	0.000	0.000	0.000	0.000
5/31-	Wau' Power	1.140	0.012	0.000	0.000	0.000	0.000
6/20	Wau' Harbor	2.147	0.000	0.000	0.000	0.000	0.000
	Montrose	1.347	0.000	0.000	0.000	0.000	0.000
	Diversey	1.081	0.000	0.000	0.000	0.000	0.000
6/21-	Wau' Power	1.274	0.000	0.000	0.000	0.000	0.000
7/11	Wau' Harbor	3.482	0.000	0.000	0.000	0.000	0.000
	Montrose	1.547	0.000	0.000	0.000	0.013	0.000
	Diversey	1.557	0.000	0.000	0.000	0.000	0.000
7/12-	Wau' Power	3.375	0.000	0.000	0.000	0.083	0.000
8/1	Wau' Harbor	4.292	0.000	0.030	0.000	0.324	0.000
	Montrose	2.268	0.000	0.000	0.000	0.033	0.006
	Diversey	1.276	0.000	0.000	0.000	0.000	0.000
8/2-	Wau' Power	0.809	0.000	0.000	0.000	0.021	0.007
8/22	Wau' Harbor	1.672	0.000	0.000	0.000	0.000	0.260
	Montrose	1.628	0.000	0.000	0.000	0.000	0.000
	Diversey	0.734	*	*	*	*	*
8/23-	Wau' Power	0.167	0.000	0.022	0.000	0.005	0.000
9/12	Wau' Harbor	0.929	0.000	0.002	0.000	0.053	0.123
	Montrose	1.337	0.000	0.000	0.000	0.000	0.047
	Diversey	0.159	0.000	0.000	0.000	0.012	0.000
9/13-	Wau' Power	0.664	0.000	0.034	0.000	0.031	0.036
10/3	Wau' Harbor	4.691	0.000	0.000	0.000	0.039	0.116
	Montrose	0.534	0.000	0.000	0.000	0.000	0.008
	Diversey	0.618	0.000	0.000	0.000	0.000	0.010

Table 7b. Catch rates by pedestrian anglers (southern areas). For yellow perch, only data from anglers fishing for yellow perch were used. For the five salmonid species, only data from anglers fishing for salmonids were used. Asterisks represent missing data.

TIME PERIOD	AREA	CATCH PER ANGLER-HOUR					
		yellow perch	brown trout	rainbow trout	lake trout	coho salmon	chinook salmon
4/1-	Burnham	0.000	0.000	0.029	0.000	0.104	0.000
4/18	McCormick	*	0.000	0.000	0.000	0.000	0.006
	Jackson	*	0.000	0.000	0.000	0.000	0.000
	Calumet	*	0.039	0.000	0.000	0.034	0.000
4/19-	Burnham	0.000	0.119	0.038	0.000	0.062	0.000
5/9	McCormick	0.000	0.000	0.000	0.000	0.000	0.000
	Jackson	0.000	0.138	0.000	0.000	0.055	0.000
	Calumet	*	0.139	0.029	0.000	0.021	0.000
5/10-	Burnham	0.044	0.000	0.000	0.000	0.000	0.000
5/30	McCormick	0.596	0.000	0.000	0.000	0.000	0.000
	Jackson	1.360	0.000	0.000	0.000	0.000	0.000
	Calumet	0.843	0.000	0.000	0.000	0.000	0.000
5/31-	Burnham	2.417	*	*	*	*	*
6/20	McCormick	1.639	*	*	*	*	*
	Jackson	2.247	*	*	*	*	*
	Calumet	1.188	*	*	*	*	*
6/21-	Burnham	2.200	*	*	*	*	*
7/11	McCormick	1.795	*	*	*	*	*
	Jackson	2.321	0.000	0.000	0.000	0.000	0.000
	Calumet	1.526	0.000	0.000	0.000	0.000	0.000
7/12-	Burnham	2.609	0.000	0.000	0.000	0.000	0.000
8/1	McCormick	2.046		*	*	*	*
	Jackson	1.657	*	*	*	*	*
	Calumet	0.719	*	*	*	*	*
8/2-	Burnham	2.358	*	*	*	*	*
8/22	McCormick	1.751	0.000	0.000	0.000	0.000	0.000
	Jackson	0.501	*	*	*	*	*
	Calumet	0.162	*	*	*	*	*
8/23-	Burnham	0.596	0.000	0.000	0.000	0.022	0.023
9/12	McCormick	2.259	0.000	0.000	0.000	0.013	0.051
	Jackson	0.000	0.000	0.000	0.000	0.083	0.000
	Calumet	0.188	0.000	0.114	0.000	0.000	0.000
9/13-	Burnham	0.030	0.000	0.008	0.000	0.018	0.041
10/3	McCormick	1.169	0.000	0.000	0.000	0.048	0.029
	Jackson	*	0.000	0.000	0.000	0.000	0.011
	Calumet	0.030	0.000	0.019	0.000	0.000	0.000

**Table 8. Catch rates by anglers using launched boats. For yellow perch, only data from anglers fishing for yellow perch were used. For the five salmonid species, only data from anglers fishing for salmonids were used. Asterisks represent missing data.**

TIME PERIOD	AREA	CATCH PER ANGLER-HOUR					
		yellow perch	brown trout	rainbow trout	lake trout	coho salmon	chinook salmon
4/1-	Waukegan	*	0.023	0.000	0.000	0.043	0.018
4/18	Diversey	*	0.000	0.000	0.000	0.190	0.000
	Burnham	*	0.000	0.000	0.000	0.293	0.019
	Calumet	*	0.000	0.000	0.000	0.040	0.002
4/19-	Waukegan	*	0.010	0.001	0.003	0.106	0.008
5/9	Diversey	0.000	0.002	0.000	0.000	0.170	0.001
	Burnham	*	0.002	0.007	0.000	0.084	0.002
	Calumet	0.712	0.003	0.000	0.000	0.106	0.004
5/10-	Waukegan	*	0.000	0.002	0.016	0.046	0.012
5/30	Diversey	0.000	0.001	0.000	0.000	0.121	0.005
	Burnham	2.014	0.000	0.004	0.000	0.135	0.002
	Calumet	1.072	0.000	0.001	0.000	0.059	0.006
5/31-	Waukegan	1.509	0.005	0.006	0.007	0.032	0.003
6/20	Diversey	1.624	0.000	0.002	0.001	0.122	0.001
	Burnham	1.250	0.000	0.004	0.020	0.187	0.033
	Calumet	1.601	0.018	0.000	0.000	0.073	0.002
6/21-	Waukegan	2.025	0.000	0.001	0.013	0.009	0.044
7/11	Diversey	0.179	0.000	0.017	0.020	0.030	0.012
	Burnham	2.764	0.000	0.000	0.029	0.052	0.046
	Calumet	3.848	0.000	0.005	0.000	0.021	0.000
7/12-	Waukegan	3.333	0.005	0.004	0.013	0.024	0.080
8/1	Diversey	*	0.000	0.004	0.000	0.000	0.052
	Burnham	5.439	0.000	0.022	0.014	0.022	0.026
	Calumet	2.161	0.000	0.013	0.000	0.090	0.020
8/2-	Waukegan	1.019	0.001	0.010	0.011	0.023	0.077
8/22	Diversey	0.000	0.000	0.000	0.000	0.000	0.035
	Burnham	0.226	0.000	0.000	0.000	0.000	0.000
	Calumet	*	0.000	0.000	0.000	0.000	0.000
8/23-	Waukegan	0.000	0.000	0.002	0.005	0.026	0.069
9/12	Diversey	*	0.000	0.004	0.017	0.011	0.025
	Burnham	*	0.000	0.005	0.000	0.075	0.151
	Calumet	1.176	0.000	0.000	0.000	0.000	0.050
9/13-	Waukegan	*	0.000	0.000	0.004	0.019	0.089
10/3	Diversey	*	0.000	0.000	0.000	0.048	0.000
	Burnham	*	0.000	0.000	0.000	0.015	0.017
	Calumet	1.910	0.002	0.000	0.000	0.000	0.074

**Table 9. Yield values. Yellow perch are assumed to be prepared as fillets with 60% waste and salmonids as whole gutted fish with 25% waste. Prices for all except brown trout are those current in November 1988.**

SPECIES	TOTAL CATCH	AVE WT (lbs)	ROUND WT (lbs)	MARKET WT (lbs)	PRICE PER POUND	YIELD VALUE
yellow perch	1,823,241	0.23	419,345	167,738	\$8.99	\$1,507,966
brown trout	14,972	3.38	50,605	37,954	\$2.99	\$113,483
rainbow trout	7,846	5.09	39,936	29,952	\$3.69	\$110,523
lake trout	3,682	6.56	24,154	18,115	\$2.99	\$54,165
coho salmon	43,451	3.71	161,203	120,902	\$6.99	\$845,108
chinook salmon	28,595	8.65	247,347	185,510	\$6.99	\$1,296,715
<b>COMBINED YIELD VALUE OF ALL SPECIES:</b>						<b>\$3,927,960</b>

Table 10a. Average weights (coho salmon, chinook salmon, and rainbow trout). Weights are in pounds. Standard deviations (sd) and sample sizes (n) are shown. Averages for ice fishermen are not shown, but are included in the winter averages for all angler types. Seasons are defined by the following dates: spring = 4/1-5/9, early summer = 5/10-6/20, midsummer = 6/21-8/1, late summer = 8/2-9/10, fall = 9/11-11/30, winter = 12/1-3/31. Asterisks represent situations where no fish were measured.

SPECIES	ANGLER TYPE		Spring	Summer			Fall	Winter
				early	mid	late		
coho salmon	boater	ave	2.98	4.33	5.16	3.98	4.80	*
		sd	0.74	1.31	1.36	1.52	1.72	*
		n	154	127	26	34	9	0
	pedestrian	ave	2.84	5.07	6.51	5.43	4.49	2.18
		sd	0.77	0.00	1.25	1.54	1.02	0.80
		n	59	1	14	22	19	48
	snagger	ave	*	*	*	*	5.11	*
		sd	*	*	*	*	2.68	*
		n	0	0	0	0	5	0
all anglers	ave	2.95	4.34	5.63	4.55	4.13	2.18	
	sd	0.75	1.30	1.47	1.69	1.55	0.80	
	n	213	128	40	56	75	48	
chinook salmon	boaters	ave	8.87	6.39	9.48	7.34	8.04	*
		sd	4.46	4.61	5.00	5.03	4.61	*
		n	12	23	52	98	30	0
	pedestrians	ave	9.25	*	11.78	11.41	9.60	14.54
		sd	*	*	4.88	3.46	4.39	*
		n	1	0	3	48	53	1
	snaggers	ave	*	*	*	*	7.69	*
		sd	*	*	*	*	4.45	*
		n	0	0	0	0	83	0
all anglers	ave	8.90	6.39	9.60	8.68	9.16	14.54	
	sd	4.29	4.61	5.03	4.96	4.68	*	
	n	13	23	55	146	144	1	
rainbow trout	boaters	ave	5.61	6.36	8.88	4.67	*	*
		sd	1.42	1.85	4.23	2.71	*	*
		n	5	12	9	5	0	0
	pedestrians	ave	4.58	5.12	1.30	6.90	4.50	4.82
		sd	2.80	0.17	0.84	0.55	1.99	2.69
		n	15	2	5	3	37	25
	snaggers	ave	*	*	*	*	4.97	*
		sd	*	*	*	*	1.34	*
		n	0	0	0	0	11	0
all anglers	ave	4.84	6.18	6.18	5.51	5.00	4.92	
	sd	2.57	1.77	4.99	2.43	2.44	2.58	
	n	20	14	14	8	58	28	

Table 10b. Average weights (lake trout, brown trout, and yellow perch). Weights are in pounds. Standard deviations (sd) and sample sizes (n) are shown. Averages for ice fishermen are not shown but are included in the winter averages for all angler types. Seasons are defined by the following dates: spring = 4/1-5/9, early summer = 5/10-6/20, midsummer = 6/21-8/1, late summer = 8/2-9/10, fall = 9/11-11/30, winter = 12/1-3/31. Asterisks represent situations where no fish were measured.

SPECIES	ANGLER TYPE		Spring	-----Summer-----			Fall	Winter
				early	mid	late		
lake trout	boaters	ave	6.94	7.13	6.79	5.52	4.30	*
		sd	1.17	3.59	3.51	1.99	0.77	*
		n	3	28	18	10	2	0
	pedestrians	ave	1.50	*	*	*	5.51	*
		sd	0.00	*	*	*	*	*
		n	1	0	0	0	1	0
	snaggers	ave	*	*	*	*	*	*
		sd	*	*	*	*	*	*
		n	0	0	0	0	0	0
all anglers	ave	5.58	7.13	6.79	5.52	5.12	*	
	sd	2.56	3.59	3.51	1.99	2.25	*	
	n	4	28	18	10	4	0	
brown trout	boaters	ave	3.33	5.24	5.47	2.96	4.63	*
		sd	1.14	3.08	2.07	2.21	*	*
		n	16	8	3	2	1	0
	pedestrians	ave	3.28	2.11	*	*	4.07	3.50
		sd	1.41	1.92	*	*	1.77	2.09
		n	178	14	0	0	6	47
	snaggers	ave	*	*	*	*	4.90	*
		sd	*	*	*	*	1.50	*
		n	0	0	0	0	3	0
all anglers	ave	3.29	3.25	5.47	2.96	3.40	3.50	
	sd	1.39	2.84	2.07	2.21	1.86	2.09	
	n	194	22	3	2	49	47	
yellow perch	boaters	ave	*	0.36	0.42	*	*	*
		sd	*	0.37	0.20	*	*	*
		n	0	25	9	0	0	0
	pedestrians	ave	0.22	0.21	0.22	0.26	0.32	*
		sd	0.06	0.09	0.11	0.14	0.24	*
		n	41	441	505	100	13	0
	all anglers	ave	0.22	0.22	0.23	0.26	0.26	1.28
		sd	0.06	0.13	0.11	0.14	0.16	0.37
		n	41	466	514	100	20	6



**Figure 2. Length distributions of five salmonid species. All salmonids measured during all seasons are included.**

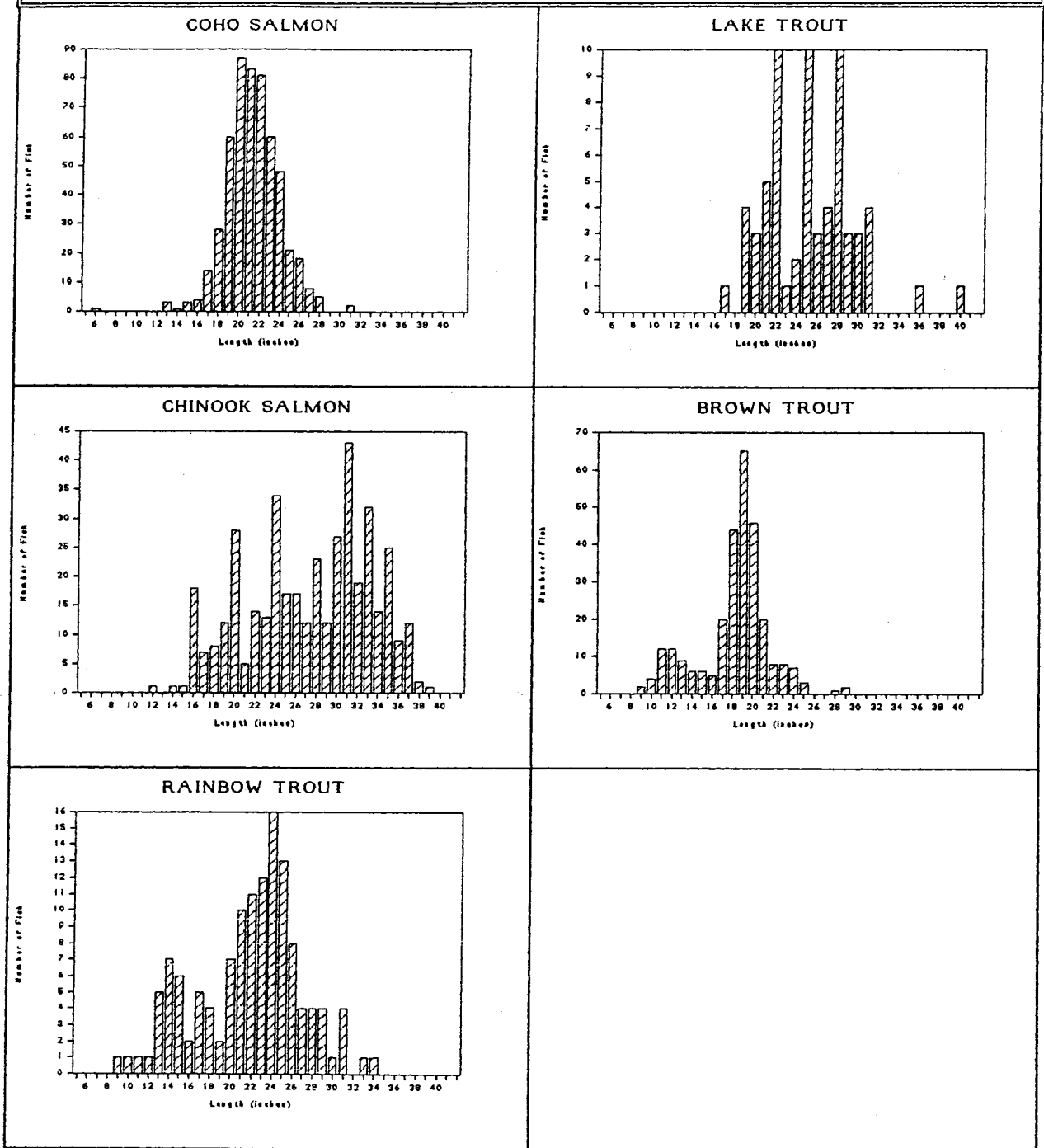


Table 11a. Fin clip summary (coho salmon, chinook salmon, and rainbow trout). Seasons are defined by the following dates: spring = 4/1-5/9, early summer = 5/10-6/20, midsummer = 6/21-8/1, late summer = 8/2-9/10, fall = 9/11-11/30, winter = 12/1-3/31. Occurrences of clips are shown separately for four types of anglers: boaters (b), pedestrians (p), snaggers (s), and ice fishermen (i).

SPECIES	CLIP	SPRING		SUMMER						FALL		WINTER		
		b	p	early		mid		late		b	p	s	p	i
				b	p	b	p	b	p					
coho salmon	ad	4	0	3	0	0	0	1	0	0	0	0	0	0
	ad,lp	1	0	0	0	0	0	0	0	0	0	0	0	0
	do	0	2	0	0	0	0	0	0	0	0	0	0	0
	do,rp	0	0	0	0	0	0	1	0	0	0	0	0	0
	lm	1	0	1	0	0	0	0	0	0	0	0	4	0
	lp	6	1	3	0	1	0	3	3	2	2	0	0	0
	rm	0	1	0	0	0	0	0	0	0	0	0	2	0
	rp	2	1	2	0	1	0	0	0	0	1	0	1	0
	rv	0	0	1	0	0	0	0	0	0	0	0	0	0
	no clips	234	58	147	1	37	14	30	23	8	22	5	42	0
chinook salmon	ad	0	0	0	0	2	0	1	1	0	1	0	0	0
	ad,lp	0	0	0	0	0	0	0	0	1	0	0	0	0
	ad,rv	0	0	1	0	0	0	0	0	0	0	0	0	0
	do	0	0	0	0	0	0	2	1	0	0	1	0	0
	do,rp	0	0	0	0	0	0	0	0	0	0	1	0	0
	lp	0	0	0	0	1	0	0	0	0	3	2	0	0
	lv	0	0	0	0	0	0	0	0	1	1	1	0	0
	lm	0	0	0	0	0	0	1	0	0	0	0	0	0
	rp	0	0	0	0	0	0	1	1	1	0	3	0	0
	rv	0	0	0	0	0	0	2	1	0	0	0	0	0
	rv,lv	0	0	0	0	1	0	0	0	0	0	0	0	0
no clips	13	2	24	0	68	3	141	46	30	51	78	1	0	
rainbow trout	ad	0	0	0	0	1	0	0	0	0	0	0	0	0
	ad,rv	0	0	0	0	0	0	1	0	0	0	0	0	0
	do	0	0	1	0	1	0	1	0	0	3	0	1	0
	do,lp	0	0	0	0	0	2	0	0	0	0	0	0	0
	do,rp	0	0	0	0	0	0	0	1	0	0	0	0	0
	do,rv	0	1	0	0	0	0	0	0	0	0	0	0	0
	do,rp,lp	0	0	0	0	0	0	0	0	0	0	0	2	0
	lp	0	1	0	0	0	0	0	1	0	2	1	2	0
	lv	0	0	0	0	0	0	0	0	0	1	0	0	0
	rm	0	1	0	0	0	0	0	0	0	0	0	0	0
	rp	0	1	0	0	0	1	1	0	0	2	0	4	0
	rp,lp	0	1	0	0	1	1	0	0	0	0	0	0	0
	rv	0	0	0	0	1	0	0	0	0	0	0	0	0
	rv,lv	1	0	1	0	0	0	0	0	0	0	0	0	0
	no clips	4	11	10	2	8	2	3	2	0	26	9	13	1

Table 11b. Summary of fin clips (lake trout and brown trout). Seasons are defined by the following dates: spring = 4/1-5/9, early summer = 5/10-6/20, midsummer = 6/21-8/1, late summer = 8/2-9/10, fall = 9/11-11/30, winter = 12/1-3/31. Occurrences of clips are shown separately for four types of anglers: boaters (b), pedestrians (p), snaggers (s), and ice fishermen (i).

SPECIES	CLIP	SPRING		-----SUMMER-----						FALL			WINTER		
		b	p	early		mid		late		b	p	s	p	i	
				b	p	b	p	b	p						
lake trout	ad	0	0	3	0	5	0	0	0	0	0	0	0	0	
	ad,lp	0	0	2	0	5	0	3	0	0	0	0	0	0	
	ad,lv	0	0	0	0	0	0	1	0	0	0	0	0	0	
	ad,rp	0	0	1	0	3	0	3	0	0	0	0	0	0	
	ad,rp,lp	0	0	1	0	1	0	0	0	0	0	0	0	0	
	ad,rv	0	0	0	0	0	0	1	0	0	0	0	0	0	
	do	0	0	1	0	2	0	2	0	0	0	0	0	0	
	do,lp	0	0	1	0	3	0	0	0	0	0	0	0	0	
	lp	1	0	3	0	5	0	4	0	0	0	0	0	0	
	lv	0	0	3	0	5	0	1	0	0	0	0	0	0	
	rp	0	0	3	0	2	0	1	0	0	0	0	0	0	
	rp,lp	0	0	1	0	0	0	0	0	0	0	0	0	0	
	rv	0	0	4	0	2	0	1	0	0	0	0	0	0	
	rv,lv	0	0	2	0	2	0	2	0	0	0	0	0	0	
	no clips		1	1	6	0	1	0	0	0	2	1	0	0	0
	brown trout	ad	2	5	0	0	0	0	0	0	0	0	0	0	0
ad,do		0	2	0	0	0	0	0	0	0	0	0	0	0	
ad,do,lp		0	1	0	0	0	0	0	0	0	0	0	0	0	
ad,do,rp		0	1	0	0	0	0	0	0	0	0	0	0	0	
ad,lm		0	0	0	0	0	0	0	0	0	0	0	3	0	
ad,lp		0	2	0	0	0	0	0	0	0	0	0	0	0	
ad,lv		0	0	0	0	0	0	1	0	0	0	0	0	0	
ad,rp		3	21	1	0	0	0	0	0	0	0	0	0	0	
ad,rp,lp		0	1	0	0	0	0	0	0	0	0	0	0	0	
ad,rv		1	2	0	0	0	0	0	0	0	0	0	0	0	
do		0	2	1	0	0	0	0	0	0	0	0	0	0	
do,lp		0	1	0	0	0	0	0	0	0	1	0	0	0	
do,rp		0	10	0	0	0	0	0	0	0	0	0	0	0	
lm		0	6	0	0	0	0	0	0	0	0	0	0	0	
lp		2	16	1	1	0	0	0	0	0	1	2	4	0	
lv		0	4	0	1	0	0	0	0	0	0	0	3	0	
rm		0	1	0	0	0	0	0	0	0	0	0	0	0	
rp		2	20	0	1	0	0	1	0	0	0	1	0	0	
rp,lp		0	5	2	4	0	0	0	0	0	1	0	5	0	
rv		0	1	0	0	1	0	0	0	0	0	0	2	0	
rv,lv		0	5	0	0	0	0	0	0	0	1	0	2	0	
no clips			10	78	3	7	3	0	0	0	1	2	0	27	0

#### IV DISCUSSION

##### Comparison with 1986

These results can be compared with those from 1986 (Tables 12 and 13). Yellow perch catch was high in both years; it was just under 1.8 million in 1986 and slightly more in 1987. The harvest of coho salmon declined markedly, however, and this decline is most apparent among summer boating anglers; the estimated harvest by anglers using launched boats was 44,000 in 1986 but only 15,000 in 1987. The lower harvest may, in part, reflect a reduction in fishing activity, as the estimated number of fishing trips (angler-trips) in launched boats dropped from 71,000 in 1986 to 54,000 in 1987. But the estimated coho salmon catch by summer pedestrian anglers also dropped, from 20,000 in 1986 to 13,000 in 1987, while estimated fishing activity by that group remained near 300,000 angler-trips. Tables 12 and 13 summarize these and other results from our 1986 and 1987 creel surveys. Creel survey methods were different in the two years, so comparisons should be made with caution, especially where estimates for anglers using moored boats are concerned.

<b>Table 12. Effort and expenditures in 1986 and 1987 (1986 data from Horns and Gorden 1988; 1987 data from present report).</b>					
TYPE OF ANGLER	YEAR	EFFORT	EXPENDITURES		
		(angler-trips)	major (boat)	minor (gear)	other (travel)
<b>SUMMER</b>					
Pedestrians	1986	299,454	\$0	\$844,000	\$397,000
	1987	289,307	\$0	\$1,674,000	\$475,000
Launched Boats	1986	71,009	\$2,079,000	\$1,598,000	\$131,000
	1987	54,043	\$2,427,000	\$618,000	\$119,000
Moored Boats	1986	74,307	\$2,022,000	\$2,395,000	\$138,000
	1987	28,911	\$996,000	\$363,000	\$60,000
<b>WINTER</b>					
Pedestrians	1986	22,141	\$0	\$225,000	\$56,000
	1987	33,629	\$0	\$260,000	\$77,000
Snaggers	1986	7,716	\$0	\$26,000	\$18,000
	1987	9,247	\$0	\$47,000	\$15,000
Ice fishermen	1986	5,323	\$0	\$20,000	\$18,000
	1987	3,325	\$0	\$12,000	\$6,000
<b>TOTALS</b>	1986	<b>479,950</b>	<b>\$4,101,000</b>	<b>\$5,108,000</b>	<b>\$758,000</b>
	1987	<b>418,462</b>	<b>\$3,422,324</b>	<b>\$2,975,637</b>	<b>\$751,358</b>

**Table 13. Effort and catch in 1986 and 1987 (1986 data from Horns and Gorden 1988; 1987 data from present report).**

ANGLER TYPE and YEAR	EFFORT (angler- hours)	CATCH						
		yellow perch	brown trout	r'bow trout	lake trout	coho salm'	chin salm'	
<u>SUMMER</u>								
Peds	1986	1,278,678	1,614,979	5,478	2,914	171	20,415	5,455
	1987	1,252,796	1,715,219	10,982	2,486	55	13,101	9,066
Lau'd	1986	386,287	53,316	2,094	2,849	1,030	43,539	11,856
	1987	285,076	84,172	690	811	2,299	14,861	8,266
Moo'd	1986	404,232	24,973	1,633	3,772	641	52,219	12,482
	1987	151,770	20,964	330	444	1,286	8,855	4,057
<u>WINTER</u>								
Ped	1986	88,348	20,811	784	760	0	600	915
	1987	159,131	2,567	2,947	2,849	42	6,371	693
Snag	1986	30,555	57	174	181	54	1,025	2,100
	1987	39,745	0	23	1,144	0	263	6,513
Ice	1986	16,348	65,106	0	106	0	0	0
	1987	16,406	319	0	102	0	0	0
<b>TOTALS</b>	<b>1986</b>	<b>2,204,448</b>	<b>1,779,242</b>	<b>10,163</b>	<b>10,582</b>	<b>1,896</b>	<b>117,798</b>	<b>32,808</b>
	<b>1987</b>	<b>1,904,924</b>	<b>1,823,241</b>	<b>14,972</b>	<b>7,846</b>	<b>3,682</b>	<b>43,451</b>	<b>28,595</b>

The most important differences between the methods of collecting and analyzing data used in 1986 and 1987 are these: (1) In 1986 six pedestrian areas and three launch areas were visited for interviews; in 1987 eight pedestrian areas and four launch areas were visited. Thus higher proportions of total catch, effort, and expenditures were estimated directly in 1987 than in 1986, and lower proportions were estimated by extrapolation to areas that were not visited. (2) Several parameters used in deriving estimates are themselves estimated, and the estimated values were different in 1987 than in 1986. Table 14 lists the values of these parameters used each year. (3) The formula for extrapolating catch, effort, and expenditures by anglers using launched boats to estimate those things for anglers using moored boats was quite different in 1987 than in 1986. This difference occurred because the estimated ratio of moored boat traffic to launched boat traffic for Diversey Harbor changed greatly between 1986 and 1987 and because a similar ratio was estimated for the first time in 1987 for Burnham Harbor. The consistent apparent decline in catch, effort, and expenditures for anglers using moored boats is, therefore, mostly a result of changes in the extrapolation formula.

**Table 14. Parameters used in deriving estimates for 1986 and 1987.**

PARAMETER	1986	1987
Duration of fishing trip (hours)		
summer pedestrians	4.27	4.31
snaggers	3.96	4.49
ice fishermen	3.07	4.99
winter pedestrians	3.99	4.31
launched boats	5.44	5.25
Number of anglers per launched boat	2.91	2.77
Ratio of number of launched boats returning in a day to the number returning between 11:00 a.m. and 1:00 p.m.	3.125	2.94
Ratio of number of moored boats used for fishing on any day to number of launched boats used for fishing		
Waukegan Harbor	0.82	0.83
Diversey Harbor	2.39	1.54
Burnham Harbor	not estimated	0.34
Distributions of pedestrian anglers, launched boats, and moored boats (Tables 1 and 2).	Differences between years were slight.	

### Confidence Intervals and Bias

Estimates of catch, effort, and expenditures are presented above without confidence intervals. Confidence intervals presented without a discussion of bias are meaningful only if bias is assumed to be negligible, an assumption that we are not willing to make. Although we have collected and will continue to collect data with which to partially assess biases, we are presently unable to make such assessments. Table 14 lists the parameters used in our estimation procedures. Those parameters, to the extent that they are incorrect, introduce bias into the estimation process. Other sources of bias in this survey include the assumption that fishing effort and catch rates during the times of our interview sets (6:00 a.m. to 8:00 a.m. or 8:30 a.m. to 10:30 a.m. for pedestrians; 11:00 a.m. to 1:00 p.m. for launched boat anglers) are, on average, representative of the entire day.

Even when substantial bias is suspected, however, computation of confidence intervals is helpful in assessing the extent of possible error attributable to sources other than bias: random variation and measurement error. Table 15 presents confidence intervals for total summer catch and effort at the primary fishing areas. These were derived from daily estimates obtained as described in section II and follow conventional methods for generating confidence intervals from stratified random samples (Cochran 1977), but without the finite population correction.

Table 15. Summer catch and effort at primary areas, with 95% confidence intervals. The primary pedestrian fishing areas were Waukegan Power Plant, Waukegan Harbor, Montrose Harbor, Diversey Harbor, Burnham Harbor, McCormick Place, Jackson Park, and Calumet Park. The primary areas for launched-boat fishing were Waukegan Harbor, Diversey Harbor, Burnham Harbor, and Calumet Park. These estimates cover the period from 1 April 1987 through 3 October 1987.

	EFFORT (angler- hours)	CATCH					
		yellow perch	brown trout	r'bow trout	lake trout	coho salmon	chinook salmon
<b>Launched Boats</b>							
Estimate	175,910	56,006	425	493	1,340	8,983	4,934
95% C.I.:							
at least	148,024	20,661	202	288	803	5,924	2,990
not over	203,795	91,351	648	698	1,878	12,042	6,878
<b>Pedestrians</b>							
Estimate	767,795	1,034,554	5,932	1,357	27	7,630	5,024
95% C.I.:							
at least	721,790	606,998	3,924	671	0	0	2,378
not over	813,800	1,462,110	7,940	2,043	151	15,928	7,670

## V REFERENCES

Cochran, W.G. 1977. Sampling techniques, 3rd ed. John Wiley and Sons, New York. 428 pp.

Horns, W.H., and R.W. Gorden. 1986. A sport fishing creel survey of the Illinois portion of Lake Michigan. Aquatic Biology Technical Report 86/3. Illinois Natural History Survey, Champaign, Illinois, 46 pp.

Horns, W.H., and R.W. Gorden, 1988. A sport fishing creel survey of the Illinois portion of Lake Michigan. Aquatic Biology Technical Report 88/2. Illinois Natural History Survey, Champaign, Illinois, 49 pp.

Malvestuto, S.P. 1983. Sampling the recreational fishery. Pages 397-419 in L.A. Nielsen and D.L. Johnson, eds., Fisheries Techniques. American Fisheries Society, Bethesda, Maryland. 1983.

Muench, B. 1981. 1979 Sport fishing creel survey on the Illinois portion of Lake Michigan. Division of Fisheries, Illinois Department of Conservation (mimeo). 25 p.



## VI APPENDIX A - DATA FORM AND INSTRUCTIONS TO CLERKS

Interviews are obtained in sets. You visit one of the areas and interview a number of angling parties. The interviews are taken from pedestrian anglers or from boaters returning to a launch ramp. When pedestrian anglers are being interviewed, interview either all present or all that can be interviewed in two hours. Instantaneous counts of pedestrian anglers are made at the start and finish of the interview set. **When all pedestrian fishing parties cannot be interviewed, interview a representative cross section.** Thus, if the area includes harbor, shore, and structure areas (see area maps), interview parties from all three areas in proportion to their numbers. Approach all types of people (men, women, Chinese, hispanic, white, polite, surly, etc.) without special favor for or against any. To assure impartiality skip a fixed number of angling parties between interviews, with the number to skip determined so that the entire site is covered during the interview period.

When boaters are interviewed, stay at the ramp for a predetermined time (usually two hours) and record data for all returning boats. Sometimes it is not possible to interview all boats. When a boat returning to the ramp is not interviewed, you record an ID number, the time (under "interview time"), and one of five notes: "anglers - no interview", "no anglers - power", "no anglers - sail", "charter", and "moored". Counts of trailers are made at the start and finish of the interview period. It is important that the counts indicate the number of trailers at the exact times when you start and finish your interview set. Non-anglers, sailors, or non-angling power boat operators are never interviewed.

The interview form has four areas for recording data: 1) Site Data, 2) Party Record, 3) Catch Record, and 4) Fish Record.

1) The **Site Data** area is a condensed version of the Instantaneous Counts Form. Counts are recorded at the start and finish of each interview set. **Fill all spaces for the site in question.** When conducting boat interviews, record slashes in the pedestrian spaces. When conducting pedestrian interviews of any kind, enter a slash in the trailers space. When conducting pedestrian interviews with "regular peds", always enter slashes for all three types of "special peds". When conducting pedestrian interviews with "special peds", always enter slashes for all three types of "regular peds".

2) and 3) The areas designated as **Party Record** and **Catch Record** are filled-in during the interviews. **Remember, the numbers you record should apply to the entire fishing party, not just the individual you speak with.** Column headings are explained here:

ID - Interviews (and non-interviewed boats) are sequentially numbered. Assign a number to each pedestrian party interviewed or to each boat that returns to the ramp during an interview period, including those that have not been used for fishing.



angler type - One of eight mutually exclusive possibilities is circled: harbor (har), shore (sho), structure (str), launched (lau), snagger (sna), smelter (smt), ice-angler (ice), and moored (moo).

# angs - For each party record the total number of anglers (tot) and the number who are Illinois residents (res).

# lines - For each party record the number of fishing rods (rod) and the number of power lines (pwr) in use by that party (in the case of pedestrians) or used during the trip (in the case of boaters). Count trolley lines under power lines here.

# nets - For smelt fishing parties record the number of gill nets, the number of dip nets, and the number of seines.

trip times - Record three times: the time the fishing trip started, the time of the interview, and the time the trip ended or will end. **Always record times in 24-hour time (e.g., two o'clock p.m. is 1400).** When the fishing trip has started the previous day, still record the time of day that fishing started. Fishing trips by pedestrians are considered to start when the angling party arrives at the shoreline. Fishing trips using boats are considered to start when the boat leaves the ramp and to end when the boat arrives back at the ramp.

expenses - Three specific items are recorded. Remember, the data you record applies to the entire party that you are interviewing. 1) For major expenses (maj), record the purchase price of boat, motor, and/or trailer, **if acquired since the last fishing trip on Lake Michigan.** Include newly acquired used equipment. 2) For minor expenses (min), record the purchase price of any fishing gear (rods, reels, downriggers, line, hooks, lures, bait, nets, etc.) purchased **since the last fishing trip on Lake Michigan.** Include only things directly used in the capture of fish. Exclude sonar equipment, food and drink, and items for the boat. 3) In the column headed "other", record the round trip distance driven for the present fishing trip, divided by ten (i.e., the estimated cost of driving if we assume a cost of ten cents per mile). This should be **total** round trip distance for all cars used by members of the group, if more than one car was used.

sought - Record species sought as p (perch), s (salmonid), ps (perch or salmonid or "anything"), or o (other).

numbers in possession - Record only the numbers of fish in possession of the angling party. BK - brook trout, BN - brown trout, RB - rainbow trout, LT - lake trout, CO - coho salmon, CH - chinook salmon, YP - yellow perch, SM - smallmouth bass, NP - northern pike. **Accurate identification is extremely important; don't hesitate to use your key if you have any doubt about the identification of any fish.**

(blank heading) - Record, for boating anglers only, the percentage of the fishing trip spent in Indiana or Wisconsin waters of Lake Michigan. This will only be important for launched boats returning to Calumet Park and Illinois Beach State Park. **At Waukegan Harbor, use this space to record "D" if the boat was launched with a daily pass and "S" if a seasonal pass was used.**

4) In the area labelled **Fish Record** (back side of the interview form), record physical measurements made in connection with the interviews. You should be able to weigh, measure, and note clips and marks on **all** salmonids that you encounter in possession of anglers. When an angler has more than 5 yellow perch, select five fish **at random** from the catch to weigh and measure. One line in the form is allowed for each fish. At the top of the back side of the interview form, record the start time of the interview set that produced the measurements recorded on that page. At launch ramps when fishing is very good, you will often have too many fish to deal with while still conducting enough interviews. When that is the case you can dispense with weighing and measuring fish until ten interviews are complete, including counting and identifying fish. At that point, you should weigh, measure, and examine as many fish as you can while still not obstructing the flow of boats and not failing to record all boats that return to the ramp.

ID - Record the same number recorded in "Party Record" for the angling party that caught this fish.

species - Record the two-letter code indicating the species. The codes used are those that appear as headings in the "Catch Record" section.

weight - Record the weight of the fish in grams. Do not record weights of gutted or beheaded fish. Be sure to "zero" the scale and to use the appropriate scale for the size of the fish being weighed.

length - Record total length (distance from tip of snout to tip of tail) in centimeters.

clipped fins - Examine each salmon, trout, and lake trout for clipped fins. The permitted entries are do (dorsal), ad (adipose), lp (left pectoral), rp (right pectoral), lv (left ventral), rv (right ventral), an (anal), fl (floy tag), lm (left maxillary), rm (right maxillary) and none. **Notes:** 1) More than one clip may be present on one fish, so the codes can be combined (e.g., "ad,lp"). 2) When a floy tag is present, make a note of the color and all information printed on the tag. 3) If you encounter a lake trout with no clips, attempt to collect (with the angler's permission) some scales and both otoliths.

# scars and # wounds - Examine each salmonid for lamprey scars and wounds. The distinction is that wounds are still all or partly red; scars are not. We are not interested in scars and wounds from causes other than lampreys.

## VII APPENDIX B - PROJECT F-52-R2 PERFORMANCE REPORT

The foregoing report does not directly report on progress toward the specific objectives listed in the Application for Federal Assistance for this Federal Aid Project. The purpose of this Appendix is to list the jobs defined in that AFA and to comment on progress toward the objectives of those jobs.

### **Job 1. Census Design**

Objective: To specify procedures and design a sampling schedule for a creel census of pedestrian and boating anglers.

Progress: A complete set of procedures is in place. All aspects of the survey design are subject to continuing review. We feel that the principal weak point of the present design is the estimation of catch, effort, and expenditures by anglers using moored boats (see Job 6).

### **Job 2. Interviews and Instantaneous Counts**

Objective: Collect data needed to estimate (for pedestrian anglers and boating anglers) the amount of fishing taking place, the numbers of fish caught, the numbers of stocked fish caught, the catch per unit of effort, and the expenditures for fishing. The only elements of Illinois' Lake Michigan sport fishery not covered here are the smelt fishery (see Job 5) and the charter boat fishery.

Progress: As shown in the foregoing report, this objective was met.

### **Job 3. Aerial Counts**

Objective: To estimate the numbers of pedestrian anglers at locations other than the 27 fishing areas routinely visited.

Progress: This objective was accomplished using several helicopter flights over the entire Illinois shoreline.

### **Job 4. Fishing Contest Survey**

Objective: To determine effort and harvest by organized fishing contest participants.

Progress: Our estimates of total effort and harvest include effort and harvest by fishing contest participants. In order to estimate separately the impact of fishing contests, we interviewed fishing contest participants and obtained data from Salmon Unlimited, the principal tourney sponsor. Those data have not yet been analyzed.

### **Job 5. Smelt Fishing Census**

Objective: To obtain an estimate of the activity of and harvest by smelt fishermen.

Progress: This objective was partially accomplished, as discussed in the report. Interviews with smelt fishermen were discontinued when the creel clerk assigned to the principal smelt fishing location fell while working and broke his leg.

## **Job 6. Moored Fishing Boat Activity**

Objective: To determine the amount of fishing and the harvest from boats kept at moorings.

Progress: This objective was accomplished. As discussed in the report, estimates of catch, effort, and expenditures by anglers using moored boats were based entirely on extrapolations from estimates for anglers using launched boats. We are attempting more other methods. Attempts to interview anglers in mooring areas are unsatisfactory because it is too difficult to make contact with a sufficient number of anglers when they return from the fishing trip. Attempts to use postal surveys in 1986 and 1987 were unsatisfactory because of poor response. In 1988 we conducted a postal survey in which mailings requesting information about fishing on specific dates were paired with boat traffic counts and launch ramp interviews on those dates. We found that if the respondent only is asked to supply minimal information about fishing activity on a recent day, and if he/she is provided with a stamped, pre-addressed card with clear questions, approximately 67% of the the potential respondents will return the card. Results from the 1988 postal survey will be included in the final report for this project.

## **Job 7. Fishing Expenditures**

Objective: To determine detailed information about fishing-related expenditures of anglers of all types.

Progress: As shown in the foregoing report, this objective was met.

## **Job 8. Growth and Diet of Sport Fish**

Objective: To estimate the growth rates and diets of sport fish captured in Illinois.

Progress: In 1987 we attempted to use the creel survey interview as an occasion to request and collect biological material from anglers, but this was not successful; it added too much confusion and paraphernalia to the interview process and anglers were usually not receptive. We do not believe that adequate and reliable diet information can be obtained without a much larger effort than can be incorporated into this creel survey without compromising other objectives.

## **Job 9. Data Computerization**

Objective: To develop a computerized system of data entry, checking, and summarization that can be used without special training.

Progress: We believe that we have come a long way toward this objective. Data entry and checking is now well-automated and people without special prior computer training have quickly learned the essentials. The first steps in data summarization are also well-automated. Data entry, checking, and summarization is accomplished using the software package R:BASE System V and an IBM System/2 Model 60 computer.

## **Job 10. Analysis and Reporting**

Objective: To develop reports summarizing all data.

Progress: This objective has been met, as demonstrated by the report.