



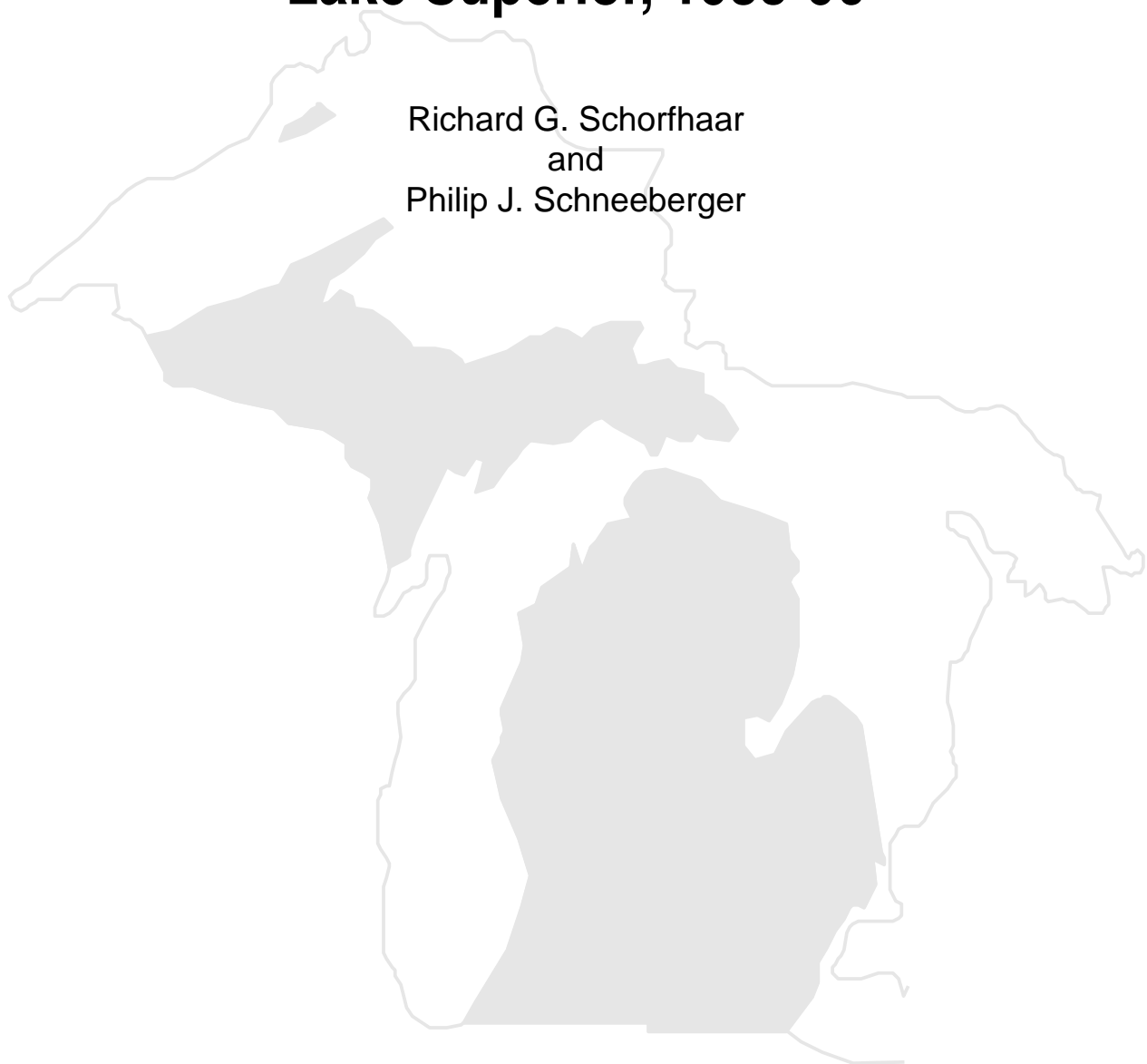
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**Commercial and Sport Fisheries for Lake Whitefish
in Michigan Waters of Lake Superior, 1983-96**

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Abstract.—Lake whitefish were harvested in Michigan waters of Lake Superior by state-licensed commercial trap netters, tribal commercial gill netters, and sport anglers. Catch and effort statistics were obtained from state summaries, tribal reports, and creel survey estimates. Biological data were analyzed for trap net and sport fisheries. Commercial catches increased from 1983 to 1986, fluctuated between 1987 and 1992, then generally decreased through 1996. Average annual commercial catch was 354,364 kg during 1983-96. Average annual sport catch at Keweenaw Bay, Marquette, and Munising was less than 4,000 fish (~2,000 kg) during 1985-96. Total annual mortality rates were generally below the target maximum rate of 55% at Ontonagon, Big Bay, Marquette, Munising, and Grand Marais. Higher mortality rates were estimated for Upper Entry and Keweenaw Bay stocks. Weight-length regression coefficients and von Bertalanffy growth coefficients were generally similar regardless of fishing area or year. Calculations of total allowable catch did not match actual harvests, mostly because commercial fishing effort was variable and unpredictable from year to year. Annual estimates of mean length and mean age of fish in trap-net catches were greater than means for sport-caught fish. Compared to sport-caught whitefish, those in trap nets were significantly longer for ages near the age of recruitment to commercial gear (age 5) at Marquette, and for a broader range of ages at Munising. At Keweenaw Bay there were instances where sport-caught fish were longer at age than those in trap nets. Among like-aged fish from different fishing areas, whitefish from Marquette and Munising were generally longest for commercial fisheries and those from Keweenaw were longest for sport fisheries. Length-at-age was generally greatest in 1983 and 1984 for lake whitefish in trap nets, and in 1988 for sport catches. There did not appear to be much conflict between sport and commercial trap-net fisheries where they occurred together.

Lake whitefish *Coregonus clupeaformis* is the most important commercial species in Michigan waters of Lake Superior in terms of value per kg and number of kg landed. Annual

catch of lake whitefish averaged around 165,000 kg between 1929 and 1943 (Baldwin et al. 1979), then declined due in part to heavy depredation by sea lamprey *Petromyzon marinus*. Following successful efforts to control sea lamprey, lake whitefish populations rebounded beginning in the early 1960s. During 1976-81, commercial catches averaged about 329,000 kg per year for traditionally exploited stocks, and some additional stocks have been exploited since the 1980s (Rakoczy 1983).

State-licensed lake whitefish fisheries in Lake Superior have been managed by manipulating seasons, size limits, gear limits (number, dimension, and mesh size), and fishing depths. As required by a court-ordered consent decree governing state and tribal fishing, total allowable catches (TACs) have been calculated in advance of fishing seasons for fishing areas in 1836 treaty-ceded waters, which consist of Lake Superior waters east of the mouth of the Chocoday River near Marquette (Figure 1). TACs have also been calculated for lake whitefish stocks in waters west of Marquette (1842 Treaty area), not covered by the consent decree. Regulators have not enforced TACs, but instead have regarded them as predictions of catch to be compared with actual harvests.

Total annual mortality is regarded as an indicator of the health and stability of lake whitefish stocks. Clark (1984) reviewed available literature on lake whitefish stocks that had been subjected to various levels of exploitation and concluded that stocks with total annual mortality rates above 70% suffer severe population fluctuations. It was decided that a conservative approach was warranted in setting target maximum total annual mortality rates for stocks in treaty waters because Lake Superior whitefish populations were prone to wide fluctuations in year-class strength. A target maximum mortality rate of 55% was chosen, and by reasonable extension, the same target maximum was chosen as a benchmark for stocks in all Lake Superior fishing areas considered herein.

Natural mortality of previously unexploited lake whitefish populations was calculated to have been 36% in Grand Traverse Bay, Lake Michigan (Rybicki 1980), and between 80 and 85% at Upper Entry, Lake Superior (Peck 1994).

Koziol (1982) determined that total annual mortality (most of which was attributable to natural mortality) of a lightly exploited whitefish population near Isle Royale was between 51 and 56%. Rakoczy (1983) examined various rates of natural mortality and judged that yield estimates using a natural mortality of 22% (instantaneous natural mortality rate of 0.25) were most satisfactory for exploited Lake Superior whitefish populations in Michigan waters.

In Lake Superior (Figure 1), state-licensed commercial trap-net fisheries currently operate at Keweenaw Bay, Marquette, and Munising, and under research permit at Big Bay. In past years, intermittent, exploratory, or permit fisheries have also operated near Ontonagon, Upper Entry, and Grand Marais. State-licensed whitefish catches have been produced from single trap net operations in each area except when a second trap netter fished briefly at Munising during the early 1990s. Native American gill-net fisheries have harvested whitefish since the mid-1980s.

State-licensed commercial fishing is permitted during all months of the year except November (lake whitefish spawning season). However, ice and weather conditions effectively restrict the fishing season to May through October during most years. Minimum size is set at 432 mm total length (TL), except minimum size limit was 483 mm for 3-4 years at both Big Bay (1983 through 1987) and Upper Entry (1983 through July of 1986). Minimum pot mesh size is 114-mm (stretched) and nets cannot be fished at depths greater than 27 m. Fishers are allowed to retain and sell lake whitefish (legal size), white suckers *Catostomus commersoni*, longnose suckers *C. catostomus*, carp *Cyprinus carpio*, and burbot *Lota lota*. Beginning in 1996, lake herring *Coregonus artedii* could also be retained. All other species are required to be returned to the water whether dead or alive.

Sport fishers catch lake whitefish by hook and line or spearing through the ice, from boats, and off piers and breakwalls. Currently in Michigan waters, sport anglers may fish for lake whitefish throughout the year, there are no size limits, and the possession limit is 12. Sport and commercial fisheries for lake whitefish are in fairly close proximity to one another at various Great Lakes locations.

In this report, data were examined to determine size and age structures of lake whitefish harvested from different areas of Lake Superior by commercial and sport fishers. Trap-net data were summarized and tabulated to facilitate calculations of TACs in each fishing area. Parameters and statistics were compared in an attempt to discern changes and differences in fisheries over time, by fishing location, and by fishing method.

Methods

Catch (dressed kg) and effort (trap-net lifts) were reported monthly by each state-licensed commercial fisher, and annual totals through 1996 were summarized by Michigan Department of Natural Resources Fisheries Division personnel in Lansing, Michigan. Catch per unit of effort (CPE) for legal-sized lake whitefish was calculated as dressed-weight kg per trap-net lift. Although nets were usually lifted every 4 days, effort and CPE were not adjusted when there were differences in number of days fished between lifts. In general, Marquette Fisheries Station personnel sampled the fishery in each area, one day per week, for 4-6 consecutive weeks, on an annual basis. On each sampling day, 50-100 net-run legal-size lake whitefish were measured (TL) and scales were collected for age determinations. Weights were obtained from 100 to 403 fish per fishing area during most years.

Catch (dressed kg) and fishing effort (gill-net length) were summarized for tribal gill-net fisheries that harvested lake whitefish from fishing areas near state-licensed trap-net operations (tribal fisheries also exist in Michigan waters of Lake Superior both east and west of the areas identified in this report). Gill-net data were obtained from Great Lakes Indian Fish and Wildlife Commission Administrative Reports (Ebener et al. 1985, 1989; Ebener and Bronte 1986, 1987, 1988, 1990; Mattes et al. 1997) and from Tripartite Technical Fisheries Review Committee Reports (TFRC 1985, 1986, 1987, 1988, 1989, 1992). Gill-net CPE was defined as dressed-weight kg per 305 m of net. As with trap-net data, gill net effort and CPE were not adjusted for number of days fished between lifts.

Sport catch and effort data were obtained from on-site random stratified creel surveys conducted under the supervision of the Charlevoix Fisheries Station (Rakoczy and Rogers 1987, 1988, 1990, 1991; Rakoczy and Lockwood 1988; Rakoczy 1992 a, 1992 b; Rakoczy and Svoboda 1994, 1995; Rakoczy personal communication 1997). Catch and effort estimates were made for individual ports for each survey month using standard creel survey analysis methods described by Ryckman (1981). Lake whitefish biological data (length, weight, sex, maturity) were recorded and scale samples were collected by creel survey clerks. Biological data were collected randomly and were assumed to have been representative of sport-caught populations.

Ages of lake whitefish sampled in the commercial and sport fisheries were determined from scales. Mean length-at-age was used to determine von Bertalanffy growth coefficients using FISHPARM (Prager et al. 1989). Weight-length regression coefficients were calculated using natural logs of the dependent and independent variables. Total annual mortality rates were approximated using minimum-variance unbiased estimators of survival derived from coded age frequencies (Robson and Chapman 1961). Total annual mortalities were partitioned between fishing and natural mortality based on an instantaneous natural mortality of 0.25 (Rakoczy 1983). Weight-length regression, von Bertalanffy, and total annual mortality calculations were made for fish at each fishing area using pooled data sets. Data were pooled in an attempt to reduce the effects of variable year-class strength. When possible, data from commercial trap-nets were pooled over 3 years. A relative dearth of sport fishery biological data necessitated pooling over the 1980s and the 1990s at each area.

TACs were calculated using the Stock Assessment Package One (SAP 1) computer model developed by Clark and Smith (1985). Model inputs from pooled commercial data sets were von Bertalanffy parameters, weight-length regression coefficients, mortality estimates (natural, fishing, target), minimum legal length of fish, average weight of individual fish in trap-net catches, and average total weight of annual

commercial catches (trap net and gill net combined).

For each year and each fishing area, calculations were made to determine mean length and mean age of fish in commercial trap net and sport catches. Means were examined for trends over time within areas, and for differences among fishing areas and between fishing methods (commercial trap net and sport).

Length-at-age, and weight-at-age were calculated and compared each year for fish from each fishing area, using trap-net and creel survey biological data. Creel survey biological data from Grand Traverse Bay, Lake Michigan were included in comparisons to provide contrast to Lake Superior creel data. The following comparisons were made for length-at-age data: area versus area by year by fishing method; year versus year by area by fishing method; and commercial trap net versus sport by area by year. Small sample sizes and considerable variability of weight data precluded comparisons for this parameter.

For any given set of parameters, comparisons were made only if confidence intervals could be calculated ($N > 1$). Parameter values were considered significantly different if 95% confidence intervals did not overlap.

Results

Commercial Catch Statistics

Ontonagon - Total annual commercial catch of lake whitefish near Ontonagon during 1994-96 ranged from 9,954 to 32,152 kg (average = 18,455 kg; Table 1). Overall catch increased 33% from 1994 to 1995, then increased 142% from 1995 to 1996. Gill net catches accounted for 100% of the commercial catch in 1994 and 1996, and 72% in 1995. Gill net effort and CPE were nearly identical in 1994 and 1995, but jumped dramatically in 1996. From 1994 to 1996, gill net effort averaged 127,490 m and gill net CPE averaged 38 kg per 305 m of net.

Upper Entry - Between 1983 and 1996, annual commercial catch ranged from 18,674 to 206,161 kg (average = 95,119 kg; Table 1). Catches were largest during 1983-86 and

fluctuated at lower levels thereafter. Lake whitefish were harvested only in trap nets in 1983, only in gill nets in 1990-91 and 1996, and in both gear types during 1984-89 and 1992-95. Trap-net effort averaged 398 lifts per year in the 1980s and 212 lifts per year in the 1990s. Trap net CPEs declined during 1983-89 and fluctuated from 1992 through 1995. Overall trap-net CPE averaged 155 kg per lift. Annual gill net catch, effort, and CPE fluctuated between 1984 and 1996, and averaged 46,156 kg, 396,006 m, and 36 kg per 305 m of net.

Keweenaw Bay - Annual catches varied by nearly four fold from 38,412 to 149,233 kg; Table 1. Catches were highest between 1985 and 1992 (average = 134,358 kg) and considerably lower during 1983-84 and 1993-96 (average = 57,648 kg). Catch, effort, and CPE fluctuated without trend for both trap-net and gill-net fisheries. Gill nets were not fished in 1983 and 1984, and trap nets were not fished during 1988-92 and 1995. Average catch, effort and CPE were 27,118 kg, 200 lifts, and 129 kg per lift for the trap-net fishery, and 100,318 kg, 1,224,372 m, and 28 kg per 305 m for the gill-net fishery.

Big Bay - Harvest was relatively low during 1983-85 (average = 13,548 kg), peaked at 130,183 kg in 1986, fluctuated during 1987-90, then declined through 1996; Table 1. Trap-net catches generally increased in the 1980s, decreased in the 1990s and averaged 17,931 kg overall. Trap-net CPEs were highest when effort was lowest in 1983 and 1996. Average trap-net effort was 122 lifts per year and average CPE was 156 kg per lift. Gill-net catch, effort, and to a lesser extent CPE varied widely from year to year. Gill-net catch ranged from 2,495 to 115,214 kg per year (average = 28,648 kg), gill net effort ranged from 15,555 m to 895,480 m (average = 266,700 m), and gill net CPE ranged from 16 to 70 kg per 305 m (average = 34 kg per 305 m).

Marquette - Commercial fishing in the Marquette area produced between 15,972 and 78,997 kg (average = 40,139 kg) of lake whitefish per year between 1983 and 1996; Table 1. Trap-net fishers caught 88% of the

total over all years. Annual trap-net effort varied from 196 to 416 lifts (average = 308 lifts) and trap-net CPE ranged from 59 to 264 kg per lift (average = 113 kg per lift). Gill-net catch was fairly consistent at around 11,000 kg from 1986 to 1990 even though effort and CPE varied more than three fold over the same period. Gill-net catch dropped to 2,252 kg in 1991, rose back to 8,734 kg in 1992, then fell to less than 750 kg from 1993 to 1995. Gill-net effort and CPE fluctuated considerably in the 1990s.

Munising - Annual lake whitefish catches generally increased from 49,306 to 160,414 kg between 1983 and 1990, then the trend reversed and catch fell to 25,375 kg by 1996; Table 1. Trap-net catches (range :13,740 - 117,613 kg; average = 56,819 kg) and trap-net effort (range: 284 - 1,157 lifts; average = 728 lifts) mirrored these trends fairly closely but gill net catches (range: 3,646 - 42,801 kg; average: 20,687 kg) and gill-net effort (range: 109,800 - 734,440 m; average: 495,375 m) less so. Trap-net CPE averaged 99 kg per lift between 1983 and 1990 and was half of that for 1991-96. Gill-net CPE averaged 12 kg per 305 m of net over all years.

Grand Marais - Only about 1,000 kg of lake whitefish per year were commercially harvested during 1983-84; Table 1. Average trap net effort was 28 lifts per year and average CPE was 39 kg per lift for the two years.

All areas - Average commercial catch of lake whitefish between 1983 and 1996 was 354,364 kg per year for Michigan waters of Lake Superior between Ontonagon and Grand Marais; Table 1. Trap-net catches and CPEs generally followed a decreasing trend from 1984 to 1996, but gill-net catches and CPEs varied without trend. Disregarding extreme high and low values in 1984 and 1996, trap-net effort was fairly consistent at an average of 1,618 lifts per year. Gill-net effort varied more than trap-net effort and averaged 2,078,118 m of net per year. Considering combined trap- and gill-net catches, Ontonagon fisheries contributed 5% of the overall catch in 1994, 8% in 1995, and 17% in 1996. Catches from Upper Entry composed over 50% of the commercial total in 1983 and 1984, only 4% in 1990, and 27% overall between 1983

and 1996. Keweenaw Bay fisheries contributed between 13 and 37% (average 29%), and Big Bay fisheries contributed 3-22% (average = 10%). Lake whitefish catches from Marquette represented between 6 and 16% (average = 11%) of the total and Munising fisheries contributed 13-35% (average = 20%).

Sport catch and CPE

Creel surveys conducted between 1985 and 1996 have documented sport catches of lake whitefish in Lake Michigan, Lake Superior, Lake Huron, and St. Marys River (Appendix 1). Lake whitefish were targeted by sport anglers at productive sites such as Grand Traverse Bay (including East and West Arms of the bay and Elk Rapids - open water and ice fisheries), Keweenaw Bay and Munising (Lake Superior - ice fisheries), Marquette (Lake Superior - open water/pier fisheries), and St. Marys River (open water fishery). Sport catches were relatively low and were incidental at most of the other 32 creel survey sites where lake whitefish creel data were available.

East Arm of Grand Traverse Bay - Open-water catch estimates ranged from 861 in 1993 to 58,598 in 1985. Minimum and maximum CPE estimates coincided with the same two years: 0.0212 fish per angler hour in 1993 and 0.3189 fish per angler hour in 1985. Average catch was 12,561 fish and average CPE was 0.1334 fish per angler hour between 1985 and 1996. Estimates of catch during two ice-fishing seasons were 19,974 in 1986 and 3,562 in 1989. CPE during the 1986 ice-fishing season (0.5554 fish per angler hour) was higher than for any other survey site at any time of year.

West Arm of Grand Traverse Bay - Open-water catches ranged between 127 and 31,268 fish per season (average = 5,891) during 1985-96. CPEs were 0.0013 - 0.1304 fish per angler hour (average = 0.0304). Ice fishing in 1986 and 1989 resulted in catches of 1,819 and 2,509 fish with corresponding CPEs of 0.0453 and 0.1045 fish per angler hour.

Elk Rapids - Average open-water catch between 1986 and 1996 was 1,741 (range: 208 - 4,897). Average CPE was 0.0421 fish per angler hour (range: 0.0049 - 0.1213).

Keweenaw Bay - Incidental catches of lake whitefish were noted during the 1991 and 1992 open-water seasons. Ice fishing produced catch estimates of 10 to 4,902 fish (average = 1,014) for 1988-96. CPEs ranged from 0.0003 to 0.0652 fish per angler hour (average = 0.0154).

Marquette - Between 1988 and 1996, open-water sport anglers caught 288-1,385 lake whitefish (average = 764). CPEs were between 0.0051 and 0.0284 fish per angler hour (average = 0.158). Ice fishing produced 2-278 fish during the 1990s and average CPE was 0.0101 fish per angler hour.

Munising - Creel surveys running 1987-88 and 1991-96 documented open-water catches of 90-951 fish (average = 388) and CPEs of 0.0059-0.0296 fish per angler hour (average = 0.0145). Ice fishery estimates ranged from 410 to 6,805 (average = 3,313). Ice-season CPEs were between 0.0175 and 0.2410 fish per angler hour (average = 0.1322).

St. Marys River - Only two creel surveys were conducted, one in 1987 and the other in 1991. Estimations from the two years were very different. Catch in 1987 was 21,174 fish with a CPE of 0.1473 fish per angler hour and catch in 1991 was 204 fish with a CPE of 0.0003 fish per angler hour.

All areas - Based on combined estimates for all Great Lakes creel survey sites between 1985 and 1996, the total number of lake whitefish caught in sport fisheries was 359,293 (average = 29,941 fish per year). By far the most productive sites (East and West Arms of Grand Traverse Bay and Elk Rapids) were in Grand Traverse Bay, Lake Michigan, which accounted for 75% of the grand total. Of the Lake Superior sites, catches at Munising, Keweenaw Bay, and Marquette represented 8%, 3%, and 2% of the grand total. Along with catches from the St. Marys River (6% of the grand total), the sites mentioned above accounted for 94% of the

estimated total of all sport-caught lake whitefish during 1985-96. Using average weights of whitefish in creel surveys at Lake Superior sites, catch numbers translated to about 1,078 kg per year at Keweenaw Bay, 838 kg per year at Munising, and 269 kg per year at Marquette. In terms of weight, sport catches represented about 1% of the annual lake whitefish harvests at Keweenaw Bay, Marquette, and Munising.

Vital Population Statistics

Commercial trap net fishery - Between 1 and 12 estimates of total annual mortality, instantaneous fishing mortality, weight-length regression coefficients, and von Bertalanffy growth coefficients were made for lake whitefish in each of seven fishing areas depending on the availability of appropriate commercial data sets (Tables 2 and 3). Total annual mortality estimates ranged from a low of 30% for fish from Marquette (1994-96) to a high of 78% for fish from Upper Entry (1993-95). Comparing pooled data sets from similar years, mortality rates generally were higher in western areas than in eastern areas. Mortality rates fluctuated over time in all areas for which multiple estimates were made. The range of ages included in mortality estimates was 6 to 18.

Weight-length regression coefficients and von Bertalanffy growth coefficients varied without trend for whitefish in different fishing areas. Weight-length regression coefficients were similar among areas.

Sport fishery - Total annual mortality calculated from sport fish age frequencies was lower for the 1980s data set than for the 1990s data set at Keweenaw Bay and Grand Traverse Bay (Lake Michigan) (Tables 4 and 5). The opposite was true at Marquette and Munising. Ages of fish included in mortality estimates ranged from 4 to 15.

Instantaneous fishing mortality rates ranged from 0.13 at Keweenaw Bay in the 1980s to 1.07 at Marquette in 1988. Weight-length regression coefficients were fairly similar in both decades at all four sites. Growth coefficients from von Bertalanffy equations were variable between decades and among sites.

TACs - Lake whitefish TACs were calculated for 3 years (1985-87) at Keweenaw Bay and 6 years (1985-89 and 1991) at Big Bay, Marquette, and Munising (Table 6). Correspondence between TAC and reported catch was closest (97%) at Keweenaw Bay in 1985. Reported catch exceeded TACs by 223% at Big Bay in 1989 and by 122% at Marquette in 1991. Reported catches were only 21-84% of TACs for other years in all areas.

Mean length and age in catches

Commercial trap-net fishery - Mean length of lake whitefish in catches varied among years in all fishing areas, but no trend was evident in any particular area (Table 7). Overall mean lengths (all years combined) were similar for Keweenaw Bay, Big Bay, Marquette, Munising, and Grand Marais, but were slightly smaller for Ontonagon and Upper Entry. Mean age data for whitefish also varied without trend. Keweenaw Bay fish had the oldest overall mean age followed by Big Bay, Munising, Marquette, Ontonagon, Upper Entry, and finally Grand Marais.

Sport fishery - Mean lengths and mean ages of lake whitefish in sport catches fluctuated without trend in each fishing area (Table 7). Among Lake Superior creel survey sites, fish from Ontonagon and Keweenaw Bay were larger than those from Marquette, Munising, and Grand Marais overall. Sport-caught whitefish from Grand Traverse Bay (Lake Michigan) were larger and older than those from Lake Superior. Overall mean age for fish in Lake Superior areas ranged from 2.9 at Grand Marais to 5.8 at Munising. Overall mean age was 6.1 at Grand Traverse Bay.

Commercial trap-net fishery versus sport fishery - Direct comparisons of mean length and age by year between commercial trap net and sport fisheries were possible for two years at Keweenaw Bay, nine years at Marquette, and ten years at Munising (Table 7). Wherever significant differences occurred, commercial fish were larger and older than sport fish.

Change in minimum size regulation at Big Bay - Mean length was 586.9 ± 3.0 mm and mean age was 8.7 ± 0.1 years for lake whitefish under the 483-mm minimum size regulation between 1983 and 1987 (Table 7). Mean length and mean age both dropped to 522.7 ± 2.0 mm and 6.8 ± 0.1 years, respectively, during 1988-96 when the minimum size regulation was changed to 432 mm.

Length-at-age

Area versus area - commercial trap-net fishery - Lake whitefish at Marquette were significantly longer than fish in other Lake Superior fishing areas over most years and a broad range of ages (Table 8; Appendix 2). Munising fish were also generally longer than fish in most other areas except Marquette. Conversely, fish at Ontonagon, Upper Entry, and Keweenaw were generally shorter than fish to the east of these areas. Fish at Big Bay were intermediate in length-at-age.

Year versus year - commercial trap-net fishery - Mean length of 6-yr-old fish decreased between 1992 and 1995 at Upper Entry but only a few comparisons were possible due to limited data (Table 9; Appendix 2). At Keweenaw Bay, fish in 1983 (especially), 1984, and 1986 were significantly longer than fish in other years over most ages. Fish in the 1980s were generally longer than those in the 1990s at comparable ages. In general, Big Bay comparisons showed that 1983 and 1993 were years in which fish were significantly longer and 1988 and 1992 were years in which fish were significantly shorter. Over the ages compared, Marquette fish caught from 1983 to 1986 were generally longest, fish from 1987 to 1992 were shortest, and fish from 1993 to 1996 were intermediate. At Munising, length-at-age was relatively large in 1983 and 1984, diminished during 1985-93, increased during 1994-95, and dropped again in 1996.

Area versus area - sport fishery - Lake whitefish caught at Keweenaw Bay were significantly longer than those at Marquette for a few ages over four different years, and were

more broadly longer than fish caught at Munising (Table 10; Appendix 3). Keweenaw Bay fish were even longer than Lake Michigan fish (Grand Traverse Bay) over four comparisons. Grand Traverse Bay fish were generally longer than fish at Marquette and Munising.

Year versus year - sport fishery - Age 4 fish caught in Keweenaw Bay were significantly longer during 1987 and 1988 compared to 1992 (Table 11). At both Marquette and Munising, fish caught during 1988 were significantly longer than fish caught during most other years over limited age ranges. In general, fish caught at Grand Traverse Bay, were longest in 1991 and 1994 and shortest in 1989 and 1990.

Sport fishery versus commercial trap-net fishery - Comparisons indicated that in instances where significant differences were observed, sport-caught fish were longer than commercial fish at Keweenaw Bay but commercial fish were longer than sport fish at Marquette and Munising (Table 12; Appendices 2 and 3). The lack of significant differences for most ages during most years was noteworthy at Keweenaw Bay and Marquette.

Discussion

Commercial catches of lake whitefish increased from 1983 to 1986, fluctuated between 1987 and 1992, then generally decreased through 1996. Trap net and gill net fisheries each produced 50% of the 1983-96 total commercial catch. There was no obvious correlation between trap net and gill net catch or CPE statistics for any given fishing area in any given year.

Noteworthy sport catches of lake whitefish occurred at only a handful of Great Lakes creel survey locations. At any given site, year-to-year fluctuations in catches could have been attributable to varying stock densities, differences in weather (ice cover and open-water conditions), and changes in the number and skill level of anglers who exploited whitefish fisheries. Sport catches at Grand Traverse Bay and Munising declined from the 1980s to the

1990s, but interpreting trends was confounded by the lack of data relating to targeted effort.

In general, total annual mortality rates calculated from pooled Lake Superior trap-net data sets decreased from west to east. Highest total annual mortality estimates at each fishing site corresponded with years for which the initial age of fish included in calculations was relatively high. At Big Bay for example, mortality estimates were above 60% when the initial age included in calculations was 12, but mortality was 37-58% when initial age in calculations was 9 or less (Table 2). With the Robson-Chapman method of calculating survival/mortality, younger ages are progressively kicked out of calculations when numbers-at-age are not deemed to be representative (the χ^2 test comparing two independent estimates of survival is used to determine appropriateness of age inclusion). Usually, numbers-at-age would not be representative if fish of a given age were too small to be fully recruited to the fishing gear. But Lake Superior lake whitefish are fully recruited to trap nets at age 5 (Rakoczy 1983) so the expectation would be that ages 5 and above would be included in Robson-Chapman estimates. Weak year-class strength is another reason numbers-at-age might not be representative, but our practice of pooling data over 3 years should have tempered this problem unless weak year classes persisted through several successive years. After consideration, we concluded that total annual mortalities were overestimated when rates were calculated from ages beginning at 12 and above. Eliminating such rates from consideration, total annual mortality rates were generally well below the target maximum rate of 55% for stocks in all fishing areas except Upper Entry and Keweenaw Bay. The combined pressures of gill- and trap-net fisheries in Upper Entry and Keweenaw Bay may be threatening the stability of these stocks. Compared to mortality rates calculated from commercial trap-net fishery data, rates from sport-fishery data were lower at Keweenaw Bay and Munising, but higher at Marquette. True mortality rates may lie in between the commercial- and sport-based estimates.

At Keweenaw Bay, Marquette, or Munising, weight-length regression coefficients and von

Bertalanffy growth coefficients were similar for commercial trap net and sport data sets. The most obvious dissimilarity was in estimates of asymptotic length (L_{∞}) at Munising. The estimate from sport-fishery data was considerably smaller than the commercial-fishery estimate. This could have been due to differential size selectivities for the sport and commercial gear, or may have indicated the two fisheries were exploiting separate stocks at Munising. Past evidence for separate stocks was provided by Edsall (1960) who documented that during the 1950s, lake whitefish in Munising Bay grew slower and matured at smaller sizes compared to commercially caught whitefish outside the bay.

TACs appeared to be very poor predictors of actual harvest. Population fluctuations, variable year-class strength, seasonal fish movements, and weather conditions were some of the factors that could have affected harvest and that were not adequately measured or modeled. Rybicki and Schneeberger (1990) concluded that contradictions between calculated catch quotas and reported yields may result from using 3-yr averages for model parameters. But in our study, probably the biggest reason that predicted catch did not approximate actual catch was because fishing effort was so variable and unpredictable. During any given year in any given fishing area, harvests were all from trap nets, all from gill nets, or from some combination of both gear types. There was also considerable annual variability in trap-net and/or gill-net effort even during years when use of either or both types of fishing gear was consistent. We conclude that there is little value in continuing to calculate TACs for different fishing areas unless quotas are to be enforced or until fishing effort becomes more stabilized.

An examination of mean length and mean age data revealed no trends among fishing areas over time whether for commercial-trap net or sport-caught whitefish. For year-to-year comparisons between commercial trap net and sport fisheries, mean length and mean age were consistently greater for commercial whitefish, perhaps reflecting spatial and seasonal differences both for fish distribution and fishing effort (commercial versus sport).

The differences in mean length and mean age at Big Bay (1983-87 versus 1988-96) illustrated the effects of manipulating minimum size limits. Mean age of maturity was found to be 5 yr for lake whitefish populations in eastern Lake Superior (W. MacCallum, Ontario Ministry of Natural Resources, 1980, unpublished), but Rakoczy (1983) reported the mean age of first maturity was 5.2 yr for whitefish stocks in Michigan waters of Lake Superior. Based on studies by Abrosov (1969) and Christie and Regier (1972), Rakoczy (1983) concluded that mean age of harvested Lake Superior whitefish should range from 6.7 to 7.2 yr to allow fish to spawn an average of 1.5 times during their lives and to allow the population to maintain itself. Applying this criterion, average age of lake whitefish harvested at Big Bay was unnecessarily high under the 483-mm minimum size limit (average age = 8.7) and was on target under the 432-mm minimum size limit (average age = 6.8).

Differences in mean sizes of fish caught by commercial versus sport gears were difficult to interpret and may not be biologically meaningful. Problems include gear biases, harvests occurring at different times of the year (mean lengths were not back-calculated), small sample sizes of sport caught fish, and the possibility that the two fisheries were exploiting separate stocks. Depth contours and differences in seasonal accessibility tended to separate commercial and sport fishing activities at both Keweenaw Bay and Munising. Peck (1994) concluded that differences in age composition and back-calculated length-at-age were indications of separate whitefish stocks in north and south areas of Upper Entry.

Lake whitefish lengths-at-age were generally shorter for comparable areas during 1983-96 than what was reported by Dryer (1962) and Rakoczy (1983). This may have been due to density-dependent growth factors because lake whitefish were more numerous during 1983-96 than in the 1960s through the early 1980s. Also, an increase in lake herring biomass since the early 1980s (Great Lakes Fishery Commission Lake Superior Committee Annual Report 1993, unpublished) may have resulted in greater inter-specific competition between herring and whitefish.

Year-to-year comparisons indicated that 1983 and, to a lesser extent, 1984 were years of greatest length-at-age over most commercial fishing areas. It is not known what combinations of weather, food availability, and stock abundance existed to make those two years better than most other years during this study. For sport fishery year-to-year comparisons, lake whitefish caught in 1988 were generally largest at Marquette and Munising, and fish caught in 1991 were largest at Grand Traverse Bay.

Where they occurred together, there did not appear to be much conflict between sport and commercial trap net fisheries for lake whitefish. Compared to commercial-caught whitefish, sport-caught fish were generally smaller and younger and were caught mostly in winter at Lake Superior sites. This indicates that, for the most part, sport anglers harvested whitefish before they were vulnerable to commercial gear, and sport harvests occurred when little or no commercial trap-net fishing was taking place. Sport catches were too small to affect commercial harvests. There were reasons to question whether sport and commercial fisheries were exploiting the same stocks, especially at Keweenaw Bay and Munising, but even if they were, temporal, spatial, and biological factors tended to segregate the two fisheries.

Recommendations

We should continue to work with tribal fisheries management authorities to ensure that combined trap net and gill net harvest does not threaten stock stability in any fishing area.

We should continue annual monitoring of the whitefish stocks to detect trends and changes in total annual mortality and other vital population statistics. The current sampling regime has been adequate for obtaining whitefish population parameters, but it would be advantageous to have monitors from every state and tribal management entity using comparable sampling methodologies throughout the Great Lakes.

In fishing area where total annual mortality exceeds 55%, additional sampling should be implemented during September to monitor pre-spawning fish and to update maturity schedules.

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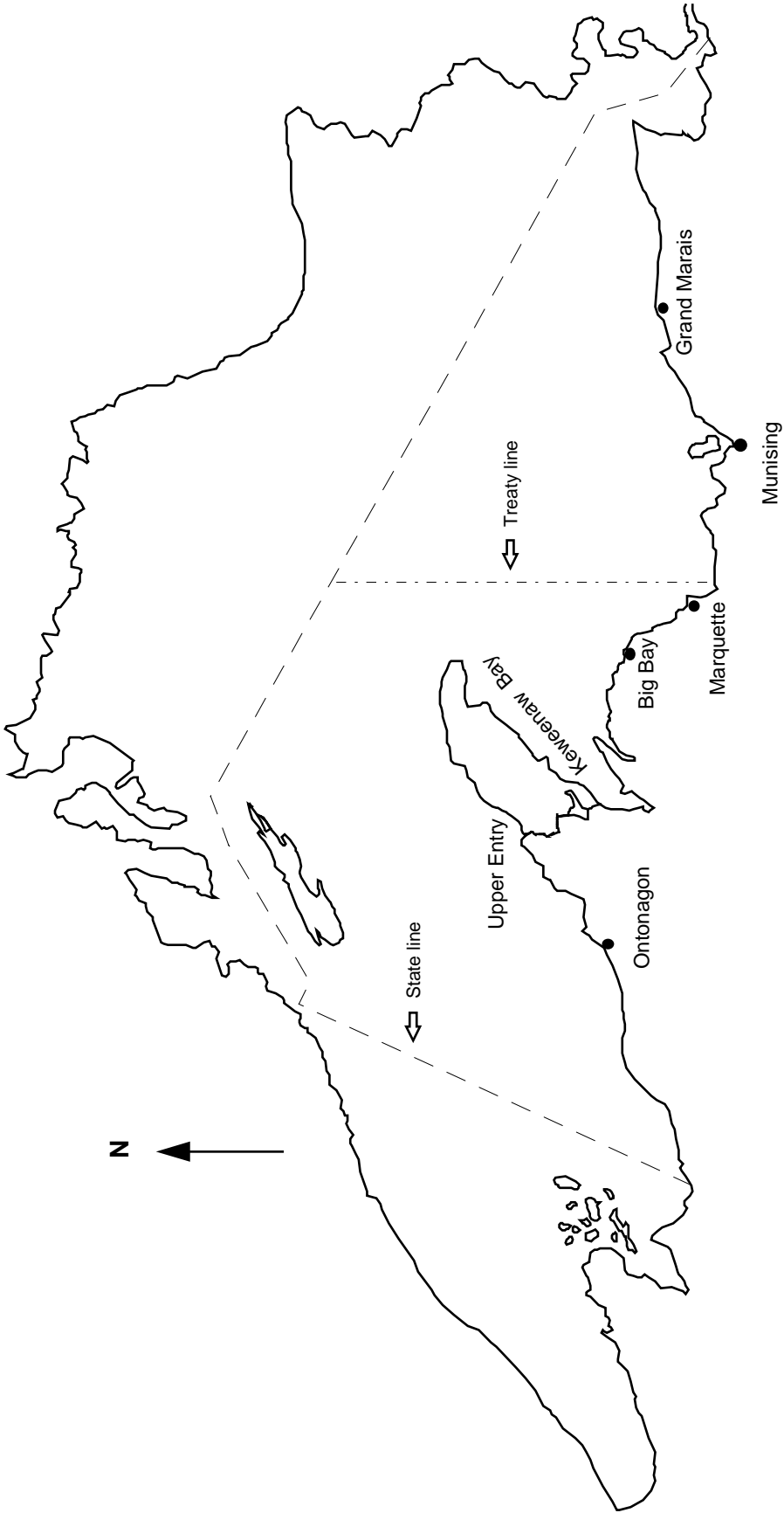


Figure 1.-Location of state-licensed commercial fisheries for lake whitefish in Michigan waters of Lake Superior.

Table 1.—Lake whitefish catch (dressed kg), effort (trap-net lifts, 305 m of gill net), and catch per unit effort (CPE - kg per trap-net lift, kg per 305 m of gill net) in Lake Superior commercial fisheries, 1983-96.

Fishing area	Year	Trap net ^a			Gill net ^b			Total catch
		Catch	Effort	CPE	Catch	Effort	CPE	
Ontonagon	1994				9, 9	294	34	9, 9
	1995	3, 7	72	52	9, 5	302	32	13, 2
	1996				32, 1	658	49	32, 1
Upper Entry	1983	170, 8	546	313				170, 8
	1984	172, 1	716	240	34, 0	500	68	206, 1
	1985	67, 9	440	154	112, 9	2, 3	49	180, 8
	1986	47, 4	367	129	114, 8	2, 8	40	162, 2
	1987	34, 6	234	148	27, 0	1, 1	24	61, 7
	1988	24, 5	210	117	50, 8	1, 4	34	75, 4
	1989	19, 7	275	72	35, 4	744	48	55, 2
	1990				18, 6	792	24	18, 6
	1991				24, 0	946	25	24, 0
	1992	62, 5	322	194	53, 1	1, 5	34	115, 6
	1993	39, 1	378	104	50, 9	1, 3	37	90, 1
	1994	51, 9	434	120	20, 3	1, 3	15	72, 2
	1995	40, 6	352	115	25, 9	1, 0	24	66, 5
1996				31, 8	797	40	31, 8	
Keweenaw Bay	1983	43, 5	232	188				43, 5
	1984	51, 4	342	151				51, 4
	1985	39, 3	238	165	103, 5	1, 6	64	142, 8
	1986	17, 6	200	88	131, 5	3, 2	40	149, 2
	1987	9, 7	114	86	118, 0	2, 6	45	127, 8
	1988				111, 9	2, 8	39	111, 9
	1989				137, 0	5, 3	26	137, 0
	1990				140, 8	6, 8	21	140, 8
	1991				124, 6	6, 6	19	124, 6
	1992				140, 3	5, 3	26	140, 3
	1993	19, 2	154	125	68, 2	5, 5	12	87, 4
	1994	17, 7	190	94	39, 9	3, 5	11	57, 7
	1995				38, 4	1, 9	19	38, 4
1996	18, 0	133	136	49, 0	2, 5	19	67, 1	
Big Bay	1983	10, 1	42	241				10, 1
	1984	12, 8	103	125				12, 8
	1985	15, 1	104	146	2, 4	51	49	17, 6
	1986	14, 9	118	127	115, 2	1, 6	70	130, 1
	1987	25, 3	163	156	36, 6	901	41	61, 9
	1988	18, 7	149	126	16, 8	350	48	35, 5
	1989	35, 5	194	183	39, 1	1, 5	25	74, 7
	1990	25, 2	188	134	57, 1	2, 9	19	82, 3
	1991	26, 2	170	154	11, 0	684	16	37, 2
	1992	19, 8	151	131	12, 7	362	35	32, 6
	1993	14, 9	129	116	15, 6	759	21	30, 5
	1994	11, 7	95	123	4, 5	294	16	16, 2
	1995	8, 5	50	172	3, 6	101	36	12, 2
1996	11, 7	46	256				11, 7	

Table 1.—Continued.

Fishing area	Year	Trap net ^a			Gill net ^b			Total catch
		Catch	Effort	CPE	Catch	Effort	CPE	
Marquette	1983	44, 1	399	111				44, 1
	1984	57, 8	344	168				57, 8
	1985	78, 9	299	264				78, 9
	1986	57, 8	311	186	10, 9	210	52	68, 8
	1987	20, 0	244	82	9, 3	408	23	29, 3
	1988	35, 6	331	108	11, 1	292	38	46, 8
	1989	24, 3	279	87	11, 0	132	84	35, 4
	1990	41, 1	416	99	12, 0	246	49	53, 2
	1991	42, 5	379	112	2, 2	60	38	44, 8
	1992	21, 8	356	61	8, 7	142	62	30, 5
	1993	16, 1	272	59	738	61	12	16, 8
	1994	18, 2	260	70	524	36	15	18, 7
	1995	15, 4	222	69	565	12	47	15, 9
	1996	20, 3	196	104				20, 3
Munising	1983	49, 3	513	96				49, 3
	1984	62, 5	611	102				62, 5
	1985	70, 0	680	103				70, 0
	1986	63, 4	674	94	31, 3	2, 3	13	94, 7
	1987	66, 1	777	85	27, 3	2, 1	13	93, 4
	1988	70, 0	751	93	28, 6	2, 3	12	98, 7
	1989	70, 5	713	100	21, 0	2, 4	9	91, 6
	1990	117, 6	976	121	42, 8	2, 3	19	160, 4
	1991	75, 5	1, 1	65	27, 4	2, 1	13	103, 0
	1992	44, 3	904	49	17, 2	1, 5	11	61, 5
	1993	38, 2	935	41	4, 1	464	9	42, 3
	1994	29, 8	695	43	12, 2	1, 1	10	42, 1
	1995	23, 9	520	46	3, 6	360	10	27, 6
	1996	13, 7	284	48	11, 6	675	17	25, 3
Grand Marais	1983	967	23	42				967
	1984	1, 2	33	36				1, 2
All	1983	318, 9	1, 7	182				318, 9
	1984	358, 0	2, 1	167	34, 0	500	68	392, 0
	1985	271, 5	1, 7	154	218, 9	3, 9	55	490, 4
	1986	201, 3	1, 6	121	403, 8	10, 3	39	605, 2
	1987	155, 9	1, 5	102	218, 4	7, 1	30	374, 3
	1988	148, 9	1, 4	103	219, 5	7, 3	30	368, 5
	1989	150, 2	1, 4	103	243, 7	10, 1	24	394, 0
	1990	184, 0	1, 5	116	271, 5	13, 1	21	455, 5
	1991	144, 3	1, 7	85	189, 4	10, 4	18	333, 7
	1992	148, 4	1, 7	86	232, 2	8, 9	26	380, 6
	1993	127, 7	1, 8	68	139, 7	8, 1	17	267, 4
	1994	129, 5	1, 6	77	87, 5	6, 7	13	217, 1
	1995	92, 2	1, 2	76	81, 7	3, 8	21	174, 0
	1996	63, 9	659	97	124, 6	4, 7	26	188, 6

^a Large-mesh trap nets used by state-licensed fishers.

^b Large-mesh gill nets used by tribal fishers. Gill-net catch statistics are from Great Lakes Indian Fish and Wildlife Commission for Upper Entry, Keweenaw Bay, Big Bay, and Marquette. Statistics from Chippewa-Ottawa Treaty Fishery Management Authority for Munising.

Table 2.—Total annual mortality rates of lake whitefish in commercial trap-net catches, with 2 SE and ages included in calculations. When possible, data from each Lake Superior fishing area were pooled over 3-year intervals.

Fishing area	Years pooled	Mortality	2 SE	Ages
Ontonagon	1995	0.47	0.04	6-14
Upper Entry	1992-93	0.59	0.04	7-12
	1992-94	0.63	0.03	7-12
	1993-95	0.78	0.03	7-11
	1994-95	0.77	0.04	7-11
Keweenaw Bay	1983-85	0.32	0.02	7-16
	1984-86	0.67	0.07	12-16
	1985-87	0.73	0.09	12-15
	1986-87	0.43	0.03	8-14
	1993-94	0.71	0.04	7-12
	1994 & 1996	0.62	0.03	6-14
Big Bay	1983-85	0.64	0.06	12-17
	1984-86	0.64	0.05	12-17
	1985-87	0.64	0.05	12-17
	1986-88	0.65	0.08	12-15
	1987-89	0.44	0.04	8-15
	1988-90	0.45	0.08	9-15
	1989-91	0.47	0.05	8-16
	1990-92	0.38	0.03	7-16
	1991-93	0.38	0.02	7-16
	1992-94	0.37	0.02	6-16
	1993-94	0.53	0.03	6-16
		1994 & 1996	0.58	0.05
Marquette	1983-85	0.39	0.02	6-15
	1984-86	0.36	0.02	7-15
	1985-87	0.36	0.02	6-16
	1986-88	0.40	0.02	6-16
	1987-89	0.43	0.02	6-16
	1988-90	0.51	0.02	6-15
	1989-91	0.46	0.07	9-15
	1990-92	0.45	0.02	7-16
	1991-93	0.42	0.03	8-17
	1992-94	0.41	0.03	9-17
	1993-95	0.49	0.06	13-17
1994-96	0.30	0.02	8-17	
Munising	1983-85	0.39	0.02	7-18
	1984-86	0.39	0.02	8-18
	1985-87	0.44	0.03	8-17
	1986-88	0.39	0.02	7-17
	1987-89	0.42	0.03	7-16
	1988-90	0.42	0.03	7-17
	1989-91	0.45	0.04	8-16
	1990-92	0.38	0.02	7-17
	1991-93	0.54	0.07	12-17
	1992-94	0.55	0.06	12-17
	1993-95	0.51	0.05	12-17
1994-96	0.40	0.03	10-17	
Grand Marais	1983-84	0.51	0.06	6-13

Table 3.—Vital statistics from commercial trap-net data sets (pooled over 3 years when possible) used to generate lake whitefish total allowable catches.

Fishing area	Years pooled	Instantaneous fishing mortality ^a (F)	Weight-length coefficients ^b		Von Bertalanffy coefficients			Mean dressed weight of fish in catch (kg)	Catch (dressed kg) ^c
			Intercept	Slope	K	L _∞ (mm)	t ₀		
Ontonagon	1995	0.38	-13.00	3.22	0.115	894	-0.108	1.5	13, 26
Upper Entry	1992-93	0.65	-12.67	3.17	0.314	552	-0.004	1.0	102, 91
	1992-94	0.75	-12.05	3.07	0.314	551	-0.005	1.0	92, 69
	1993-95	1.26	-12.02	3.07	0.362	531	-0.002	0.9	76, 32
	1994-95	1.21	-10.74	2.86	0.496	507	-0.001	0.9	56, 87
Keweenaw Bay	1983-85	0.13	-	-	0.156	783	-0.004	-	79, 30
	1984-86	0.91	-10.52	2.82	0.145	808	-0.005	1.9	114, 53
	1985-87	1.05	-10.52	2.82	0.155	782	-0.024	1.9	139, 98
	1986-87	0.32	-10.52	2.82	0.141	824	-0.029	1.9	138, 52
	1993-94	1.00	-13.26	3.27	0.020	800	-0.500	1.0	72, 64
	1994 & 96	0.73	-12.69	3.18	0.1286	809	-0.164	1.1	62, 47
Big Bay	1983-85	0.79	-	-	0.201	734	-0.035	-	13, 54
	1984-86	0.76	-12.27	3.10	0.178	766	-0.043	1.8	53, 57
	1985-87	0.77	-12.27	3.10	0.186	756	-0.045	1.8	69, 94
	1986-88	0.79	-13.24	3.25	0.183	761	-0.038	1.6	75, 90
	1987-89	0.33	-13.16	3.24	0.203	718	-0.061	1.2	57, 42
	1988-90	0.34	-12.49	3.14	0.210	706	-0.064	1.1	64, 22
	1989-91	0.38	-13.04	3.23	0.225	692	-0.051	1.2	64, 80
	1990-92	0.23	-11.29	2.94	0.277	629	-0.047	1.2	50, 75
	1991-93	0.23	-12.92	3.20	0.358	596	-0.007	1.4	33, 47
	1992-94	0.22	-12.25	3.09	0.365	590	-0.006	1.4	26, 47
	1993-94	0.50	-12.70	3.17	0.272	662	-0.018	1.5	23, 41
1994 & 96	0.61	-12.52	3.14	0.225	680	-0.008	1.4	14, 01	
Marquette	1983-85	0.24	-13.54	3.30	0.176	804	-0.001	1.6	60, 33
	1984-86	0.19	-13.34	3.27	0.169	814	-0.010	1.7	68, 55
	1985-87	0.20	-13.49	3.30	0.167	803	-0.014	1.8	59, 05
	1986-88	0.26	-12.10	3.08	0.176	783	-0.078	1.9	48, 34
	1987-89	0.31	-14.22	3.41	0.182	761	-0.084	1.2	37, 21
	1988-90	0.46	-12.80	3.18	0.187	763	-0.073	1.3	45, 16
	1989-91	0.36	-13.48	3.29	0.182	777	-0.080	1.4	44, 48
	1990-92	0.35	-13.90	3.36	0.199	754	-0.072	1.8	42, 85
	1991-93	0.30	-14.67	3.48	0.176	790	-0.040	1.9	30, 73
	1992-94	0.28	-14.44	3.45	0.178	792	-0.026	1.9	22, 04
	1993-95	0.43	-13.59	3.31	0.183	786	-0.020	2.1	17, 19
1994-96	0.11	-13.51	3.30	0.168	801	-0.022	2.0	18, 35	
Munising	1983-85	0.24	-	-	0.186	774	-0.072	-	60, 63
	1984-86	0.25	-12.00	3.06	0.169	795	-0.095	1.4	75, 78
	1985-87	0.33	-12.00	3.06	0.159	806	-0.039	1.4	86, 11
	1986-88	0.24	-12.00	3.06	0.172	783	-0.100	1.4	95, 66
	1987-89	0.29	-12.64	3.16	0.177	768	-0.120	1.2	94, 61
	1988-90	0.29	-11.91	3.43	0.175	767	-0.136	1.3	116, 92
	1989-91	0.35	-12.23	3.09	0.231	692	-0.048	1.4	118, 35
	1990-92	0.22	-11.39	2.96	0.231	690	-0.060	1.6	108, 32
	1991-93	0.52	-11.94	3.05	0.202	731	-0.111	1.8	68, 98
	1992-94	0.56	-13.03	3.23	0.212	727	-0.080	2.0	48, 69
	1993-95	0.46	-12.23	3.11	0.219	733	-0.016	2.5	37, 38
1994-96	0.27	-14.50	3.46	0.201	740	-0.035	2.2	31, 71	
Grand Marais	1983-84	0.47	-	-	0.201	766	-0.026	-	1, 09

^a Instantaneous rate of natural mortality (M) was assumed to be 0.25 (Rakoczy 1983) in all fishing areas.

^b $\log_e(\text{Weight})=a + b(\log_e[\text{Length}])$

^c Computed from catch data in Table 1.

Table 4.—Total annual mortality rates of lake whitefish in sport catches, with 2 SE and ages included in calculations. Data from each Lake Superior and Lake Michigan creel survey area were pooled over the 1980s and the 1990s.

Fishing area	Years pooled	Mortality	2 SE	Ages included
Keweenaw Bay	1984, 1987-89	0.32	0.05	4-13
	1990-93, 1996	0.56	0.11	5-12
Marquette	1988	0.73	0.13	4-6
	1990-96	0.58	0.05	4-10
Munising	1985, 1987-88	0.36	0.05	5-14
	1991-96	0.32	0.03	5-15
Grand Traverse	1986-89	0.58	0.07	7-11
	1990-96	0.74	0.08	8-13

Table 5.—Vital statistics from creel survey data.

Fishing area	Years pooled	Instantaneous fishing mortality ^a (F)	Weight-length coefficients ^b		Von Bertalanffy coefficients			Mean weight of fish in catch (kg)
			Intercept	Slope	K	L _∞ (mm)	t ₀	
Keweenaw Bay	1984, 1987-89	0.13	-11.06	2.90	0.170	820	-0.238	1.2
	1990-93, 1996	0.58	-12.44	3.14	0.184	795	-0.001	1.2
Marquette	1988	1.07	-12.05	3.04	0.324	545	-0.006	0.5
	1990-96	0.64	-12.90	3.19	0.112	944	-0.186	0.4
Munising	1985, 1987-88	0.19	-12.98	3.20	0.307	438	-0.064	0.3
	1991-96	0.15	-12.33	3.10	0.166	548	-0.305	0.4
Grand Traverse Bay	1986-89	0.42	-12.83	3.20	0.172	742	-0.029	1.0
	1990-96	0.91	-14.80	3.49	0.700	530	-0.064	1.1

^a Instantaneous rate of natural mortality (M) was assumed to be 0.25 in Lake Superior (Rakoczy (1983) and 0.45 in Lake Michigan; (Rybicki 1980).

^b $\log_e(\text{Weight})=a + b(\log_e[\text{Length}])$

Table 6.—Total allowable catch estimate (TAC) and reported catch of lake whitefish, by Lake Superior fishing area. TAC and catch in kilograms dressed weight.

Fishing area	Year	TAC	Reported catch	Proportion of TAC
Keweenaw Bay	1985	147,419	142,883	0.97
	1986	303,910	149,233	0.49
	1987	209,108	127,823	0.61
Big Bay	1985	73,029	17,691	0.24
	1986	73,029	130,183	1.78
	1987	265,808	61,961	0.23
	1988	171,913	35,562	0.21
	1989	33,566	74,753	2.23
	1991	44,163	37,275	0.84
Marquette	1985	105,688	78,997	0.75
	1986	138,347	68,804	0.50
	1987	125,646	29,373	0.23
	1988	79,379	46,844	0.59
	1989	53,524	35,421	0.66
	1991	36,592	44,810	1.22
Munising	1985	139,254	70,065	0.50
	1986	151,501	94,773	0.62
	1987	131,997	93,499	0.71
	1988	141,522	98,736	0.70
	1989	174,635	91,618	0.52
	1991	147,868	103,023	0.70

Table 7.—Mean length and age (with \pm factor for 95% confidence intervals) of Lake Superior lake whitefish in commercial trap net and sport catches. Underlined lengths and ages were significantly larger than corresponding lengths and ages for the other fishing method.

Fishing area	Year	Commercial catch				Sport catch			
		Mean length	\pm Factor	Mean age	\pm Factor	Mean length	\pm Factor	Mean age	\pm Factor
Ontonagon	1986					463.4	45.3	4.6	1.3
	1987					356.0	—	3.0	—
	1990					437.0	—	4.0	—
	1992					480.0	99.4	4.8	1.3
	1995	496.4	6.5	7.0	0.2				
	All	496.4	6.5	<u>7.0</u>	0.2	460.0	35.5	4.5	0.9
Upper Entry	1992	476.8	3.4	6.9	0.1				
	1993	473.6	2.5	6.4	0.1				
	1994	465.2	2.3	6.5	0.1				
	1995	470.8	3.5	6.7	0.1				
	1993	478.8	3.4	6.9	0.1				
	1994	473.6	3.0	6.2	0.1				
	1996	487.5	5.0	6.6	0.2				
	All	471.6	1.5	6.6	0.1				
Keweenaw Bay	1983	580.7	8.1	8.0	0.2				
	1984	610.4	8.1	<u>10.1</u>	0.3	506.1	107.8	6.4	2.4
	1985	545.3	7.8	8.4	0.2				
	1986	595.2	6.2	9.2	0.2				
	1987	511.3	5.5	<u>7.5</u>	0.1	503.7	26.2	5.8	0.6
	1988					437.4	40.2	3.8	0.5
	1989					446.6	21.1	4.6	0.4
	1990					584.0	—	7.0	—
	1991					506.7	38.9	5.2	0.9
	1992					451.2	27.4	5.0	0.5
	1993					486.1	29.5	5.1	0.5
	All	<u>566.9</u>	3.7	<u>8.6</u>	0.1	483.0	14.6	5.3	0.3
Big Bay	1983	546.4	8.0	6.3	0.2				
	1984	585.9	7.3	8.8	0.2				
	1985	610.0	5.0	9.8	0.2				
	1986	597.2	5.7	8.9	0.2				
	1987	546.0	6.2	7.5	0.2				
	1988	510.8	5.3	6.8	0.1				
	1989	511.2	5.1	6.5	0.2				
	1990	509.1	4.8	6.2	0.1				
	1991	535.8	5.9	7.0	0.2				
	1992	542.0	4.9	9.0	0.2				
	1993	542.6	6.5	6.3	0.2				
	1994	519.6	5.4	6.5	0.1				
	1996	515.9	5.7	6.6	0.2				
	All	550.8	2.0	7.7	0.1				

Table 7.—Continued.

Fishing area	Year	Commercial catch				Sport catch			
		Mean length	± Factor	Mean age	± Factor	Mean length	± Factor	Mean age	± Factor
Marquette	1983	568.8	10.9	6.9	0.2				
	1984	560.6	8.7	7.2	0.3				
	1985	557.0	7.1	7.3	0.2				
	1986	575.0	8.0	7.6	0.2				
	1987	538.6	7.0	7.4	0.2				
	1988	<u>514.6</u>	5.6	<u>6.7</u>	0.2	391.2	14.7	4.1	0.3
	1989	512.6	5.4	6.3	0.2				
	1990	<u>532.4</u>	4.9	<u>6.6</u>	0.1	391.7	33.0	4.5	0.6
	1991	<u>556.7</u>	5.1	<u>7.2</u>	0.2	326.4	15.0	3.6	0.3
	1992	<u>589.0</u>	6.0	<u>8.1</u>	0.2	345.3	12.6	4.1	0.2
	1993	<u>587.7</u>	7.2	<u>8.0</u>	0.2	327.4	23.3	3.7	0.5
	1994	<u>585.0</u>	7.9	<u>7.8</u>	0.2	360.9	33.7	4.6	0.6
	1995	<u>639.6</u>	5.8	<u>9.9</u>	0.2	361.8	18.1	4.4	0.3
	1996	<u>524.4</u>	6.6	<u>7.2</u>	0.2	383.1	42.6	5.0	1.1
All	<u>561.4</u>	2.1	<u>7.5</u>	0.1	355.0	7.7	4.1	0.1	
Munising	1983	534.2	7.6	6.0	0.2				
	1984	591.1	9.2	8.1	0.3				
	1985	<u>534.3</u>	5.4	<u>7.2</u>	0.2	313.1	9.8	4.9	0.3
	1986	554.7	7.1	7.7	0.2				
	1987	<u>557.8</u>	6.0	<u>7.4</u>	0.2	349.6	13.5	6.1	0.5
	1988	<u>538.2</u>	7.2	<u>7.7</u>	0.2	390.8	17.3	4.6	0.4
	1989	492.9	4.5	5.9	0.1				
	1990	528.7	4.8	6.6	0.1				
	1991	<u>556.5</u>	5.2	<u>7.7</u>	0.2	349.7	14.5	6.0	0.4
	1992	<u>559.9</u>	7.0	<u>8.7</u>	0.3	354.2	17.6	6.7	0.6
	1993	<u>581.8</u>	7.0	<u>8.3</u>	0.3	323.2	24.5	6.3	0.9
	1994	<u>609.7</u>	6.1	<u>8.7</u>	0.3	373.6	24.7	7.1	1.1
	1995	<u>624.6</u>	5.7	<u>9.1</u>	0.3	316.2	12.2	5.5	0.4
	1996	<u>509.7</u>	5.6	<u>7.5</u>	0.2	347.7	19.5	6.0	0.6
All	<u>555.4</u>	1.9	<u>7.6</u>	0.1	338.0	5.4	5.8	0.2	
Grand Marais	1983	533.5	14.3	5.9	0.3				
	1984	515.9	8.4	6.1	0.2				
	1985					306.1	15.6	2.7	0.3
	1986					343.0	13.9	3.0	0.2
	All	<u>521.4</u>	7.3	<u>6.0</u>	0.2	328.1	10.9	2.9	0.8
Grand Traverse	1986					521.5	22.4	7.0	0.6
	1987					474.4	17.2	6.0	0.3
	1988					451.8	21.0	5.1	0.3
	1989					469.2	8.0	6.3	0.2
	1990					485.1	9.8	6.9	0.4
	1991					507.8	13.0	4.5	0.3
	1992					518.2	10.3	6.9	0.3
	1993					537.5	15.5	6.7	0.4
	1994					509.8	14.0	5.4	0.3
	1995					498.8	19.3	6.6	0.4
	1996					516.2	13.8	6.5	0.3
All					495.2	4.5	6.1	0.1	

Table 8.—Summary of significant differences of length-at-age by fishing area by year for lake whitefish in commercial catches. Letters in a cell indicate fish from those letter designations were significantly longer than fish from the column in which they appear.

Year	Age	Fishing area						
		Ontonagon (O)	Upper Entry (U)	Keweenaw Bay (K)	Big Bay (B)	Marquette (Q)	Munising (M)	Grand Marais (G)
1983	6			B, Q, M, G				
	7			Q, M, G	G	G		
	8			Q, M	M			
	9			Q, M, G				
	11			Q				
	12			M				
1984	6			Q				Q
	7			Q, M	Q, M, G			
	8				K, Q, M			
	9			Q, M, G	M			
	10			Q, M	Q, M			
	11			B, Q				
1985	6			B, Q, M				
	7			B, Q, M	Q		Q	
	8			Q	Q		Q	
	9			B, Q	Q		Q	
	10			B, Q	Q			
	11			B, Q	Q			
1986	6				Q		Q	
	7			Q	Q		Q	
	8			B, Q, M	Q		Q	
	9			B, Q				
	10			Q	Q			
	11			Q	Q			
1987	5			B, Q, M				
	6			B, Q, M		B, M		
	7			B, Q, M	M	M		
	8			B, Q, M	M			
	9			B, Q, M				
	10			M				
1988	9						Q	
	11						Q	
1989	6						Q	
1990	8				Q, M			
	9				Q, M			

Table 8.—Continued.

Year	Age	Fishing area					
		Ontonagon (O)	Upper Entry (U)	Keweenaw Bay (K)	Big Bay (B)	Marquette (Q)	Munising (M)
1991	6				Q		
	7				Q		Q
	8						Q
1992	5		Q M				
	6		B, Q M		Q		Q
	7		B, Q M		Q		Q
	8		B, Q M		Q		Q
	9		B, Q M		Q, M		Q
	10		Q		Q, M		Q
	11		Q		Q, M		Q
	12		Q M		Q, M		
	13				Q, M		Q
	14				Q, M		
1993	5		B, Q M	B, Q, M			
	6		B, Q M	B, Q, M			
	7		B, Q M	B, Q, M			
	8		B, Q M	B, Q, M			Q
	9		B, Q M	B, Q, M			
	10			B, Q, M			
1994	5		M	Q, M	M	M	
	6		K, B, Q M	B, Q, M	M	M	
	7		K, B, Q M	B, Q, M	Q, M		
	8		B, Q M	Q, M	Q, M		
	9		B, Q M	Q, M	Q, M		
	10				Q		Q
1995	5	M				M	
	6	Q, M	O, Q M				
	7	Q, M	O, Q M				
	8	Q, M	Q M				
	9	Q, M	Q M				
	13					O	O
1996	5			B, M			
	6			B, Q			
	7			B, Q			B, Q
	8			B, Q			B, Q
	9			B, Q, M			

Table 9.—Summary of significant differences of length-at-age by year by fishing area for lake whitefish in commercial trap-net catches. Numbers in a cell indicate fish from those year designations (19__) were significantly larger than fish from the column in which they appear.

Commercial fishing area	Age	Year														
		1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	
Upper Entry	6	-	-	-	-	-	-	-	-	-	-	-	93	92, 93, 94	-	
	7	-	-	-	-	-	-	-	-	-	-	-	93, 95	-	-	
	5	-	-	-	-	94, 96	-	-	-	-	-	-	96	-	-	
	6	-	83, 84, 86, 96	-	-	83, 86	-	-	-	-	-	-	83, 84, 86, 83, 84, 86, 96	-	83, 86	
	7	-	83, 84, 86	83	83	83, 84, 86	-	-	-	-	-	-	83, 84, 85, 83, 84, 86, 86, 87, 96	-	83, 84, 86	
	8	-	83, 84	83, 84	83, 84	83, 84, 85, 86	-	-	-	-	-	-	83, 84, 85, 83, 84, 85, 86	-	83, 84, 85, 86	
	9	-	83	83	83	83, 85, 86	-	-	-	-	-	-	83, 84, 85, 83, 86	-	83, 84, 85, 86, 87, 93, 94	
	10	-	83	83, 86	83	83	-	-	-	-	-	-	83, 84, 85, 86, 87	-	83, 84, 85, 86, 87	
	11	-	83, 86	83, 86	83	83	-	-	-	-	-	-	-	-	-	83, 84, 86
	12	-	86	83, 84, 86	-	-	-	-	-	-	-	-	-	-	-	-
	Big Bay	5	-	-	-	-	-	83, 86, 87, 90, 91, 93	83, 93	83, 93	83, 93	-	-	83, 84, 86, 87, 90, 91, 93	-	83, 93
		6	-	83, 93	83, 93	83, 87, 93, 94	83, 93	83, 84, 85, 83, 87, 93, 86, 87, 89, 90, 91, 93, 94, 96	83, 93	83, 93	83, 93	83, 93	83, 93	83, 93	-	83, 93
7		-	83, 93	83, 93	83, 93	83, 91, 93, 94	83, 84, 85, 83, 91, 93	83, 93	83, 93	83, 93	83, 91, 93	83, 93	-	-	83, 93	
8		-	83, 93	83, 93	83, 93	83, 84, 86, 83, 84, 85, 83, 86, 93, 86, 93	83, 84, 86, 83, 84, 85, 83, 84, 86, 83, 86, 93, 86, 93, 94	83, 84, 86, 83, 84, 85, 83, 84, 86, 83, 86, 93, 86, 93, 93	83, 93	83, 93	83, 84, 85, 86, 93	83, 84, 85, 86, 93	83, 84, 86, 83, 84, 86, 93	-	-	83, 86, 93
9		-	93	86, 93	93	93	93	86, 93	86, 93	84, 85, 86, 87, 88, 91, 93, 96	84, 85, 86, 87, 88, 91, 93, 96	84, 85, 86, 87, 88, 91, 93, 96	93	-	86, 93	

Table 9.-Continued.

Commercial fishing area	Age	Year													
		1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Big Bay continued	10									85	83, 84, 85, 86, 87, 88, 89, 91, 93, 94				
	11			86							84, 85, 86, 87, 88, 89, 91, 94				
	12			86							84, 85, 86, 87, 88, 89				
	13										85, 86				
14		-								84, 85, 86, 87					
Marquette	5			90, 91, 93	90, 93	83, 84, 90, 91, 92, 93	83, 84, 90, 91, 92, 93	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94
	6			83, 84, 86, 91, 92, 93, 94		83, 84, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	83, 84, 85, 86, 87, 89, 91, 92, 93, 94	
	7			95		83, 84, 85, 86, 90, 91, 92, 93, 94, 95	83, 84, 85, 86, 90, 91, 92, 93, 94, 95	83, 84, 85, 86, 90, 91, 92, 93, 94, 95	83, 84, 85, 86, 90, 91, 92, 93, 94, 95	83, 84, 85, 86, 90, 91, 92, 93, 94, 95	83, 84, 85, 86, 90, 91, 92, 93, 94, 95	83, 84, 85, 86, 90, 91, 92, 93, 94, 95	83, 84, 85, 86, 90, 91, 92, 93, 94, 95	83, 84, 85, 86, 90, 91, 92, 93, 94, 95	
	8				94	83, 84, 85, 86, 92, 93, 94, 95	83, 84, 85, 86, 92, 93, 94, 95	83, 84, 85, 86, 92, 93, 94, 95	83, 84, 85, 86, 92, 93, 94, 95	83, 84, 85, 86, 92, 93, 94, 95	83, 84, 85, 86, 92, 93, 94, 95	83, 84, 85, 86, 92, 93, 94, 95	83, 84, 85, 86, 92, 93, 94, 95	83, 84, 85, 86, 92, 93, 94, 95	
	9			83		83, 94	83	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	
	10			83		83, 85, 86, 94, 95	83	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	83, 84, 85, 86, 88, 90, 92, 93, 94, 95	

Table 9.-Continued.

Commercial fishing area	Age	Year													
		1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Marquette continued	11			83	83	83, 85, 86, 89	83		83	83, 85, 86, 88, 89, 95	83	83	83, 86, 89		
	12	-				84, 86							84, 85, 86		
	13	-											84, 86		
Mumising	4				93										
	5	94, 95	94, 95	83, 90, 91, 93, 94, 95	83, 90, 91, 92, 93, 94, 95	83, 90, 91, 92, 93, 94, 95	83, 90, 91, 92, 93, 94, 95	83, 90, 91, 92, 93, 94, 95	94	94, 95	94, 95				94, 95
	6	94, 95	94, 95	83, 87, 90, 91, 93, 94, 95	83, 84, 87, 90, 91, 93, 94, 95	83, 84, 87, 90, 91, 93, 94, 95	83, 84, 87, 90, 91, 93, 94, 95	83, 84, 87, 90, 91, 93, 94, 95	94, 95	83, 84, 87, 90, 91, 93, 94, 95	94, 95				83, 84, 87, 90, 91, 93, 94, 95
	7		95	83, 84, 87, 90, 91, 93, 94, 95	83, 84, 87, 90, 91, 93, 94, 95	83, 84, 87, 90, 91, 93, 94, 95	83, 84, 87, 90, 91, 93, 94, 95	83, 84, 87, 90, 91, 93, 94, 95	95	83, 84, 87, 90, 91, 93, 94, 95	83, 95	95			83, 84, 85, 87, 88, 90, 91, 93, 94, 95
	8		83	83, 84, 94, 95	83, 84, 95	83, 95	83, 84, 85, 86, 87, 90, 93, 94, 95	83, 84, 86, 87, 90, 94, 95	83, 84, 94, 95	83, 84, 86, 87, 90, 94, 95	83, 84, 86, 87, 90, 94, 95	83	83	83	83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95
9			83	83, 84, 86, 87, 93, 94, 95	83, 84, 94	83, 84	83, 84, 86, 87, 93, 94, 95	83, 84, 94	83, 84, 94, 95	83, 84, 86, 87, 93, 94, 95	83, 84	83			83, 84, 86, 87, 90, 91, 92, 93, 94, 95
	10			83	83	83, 84, 94, 95	83, 84, 94, 95	83, 84, 94, 95	83, 95	83, 84, 85, 86, 87, 88, 90, 91, 93, 94, 95	83	83			83, 84, 85, 86, 87, 88, 90, 91, 92, 93, 94, 95
11															
Grand Marais	5														
	7														

Table 10.—Summary of significant differences of length-at-age by fishing area by year for lake whitefish in sport catches. Letters in a cell indicate fish from those letter designations were significantly longer than fish from the column in which they appear.

Year	Age	Fishing area				
		Keweenaw Bay (K)	Marquette (Q)	Munising (M)	Grand Traverse Bay (T)	
1987	3			K		
	4			K, T	K	
	5			K, T		
	6			K, T	K	
	7			K, T	K	
	8			K, T		
	9			T		
	10			K		
	11			K		
	1988	4		K	K	
		5			Q	
1989	6				K	
1991	2		T			
	3		T	Q, T		
	4		K, T	K, Q, T		
	5		K, T	K, T		
	6			T		
	1992	4		K	K, Q	
5		K, T	K, Q, T			
6			K, T			
7			T			
8			T			
9			T			
1993	3			Q		
	4		K	K		
	5		K	K, Q, T		
	6			K, T		
	7			T		
	8			T		
	1994	3		M, T	T	
	4			T	T	
5			T	T		
6			T			
8			T			
1995	4		T	Q, T		
	5		T	Q, T		
	6			T		
	7			T		
	8			T		
1996	4			Q, T		
	5		T	Q, T		
	6			T		
	7			T		

Table 11. – Summary of significant differences of length-at-age by year by fishing area for lake whitefish in sport catches. Numbers in a cell indicate fish from those year designations (19__) were significantly larger than fish from the column in which they appear.

Sport fishing area	Age	Year												
		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	
Keweenaw Bay	4	-	-	-	-	-	-	-	-	-	-	-	-	-
								87, 88						
Marquette	3	-	-	-	-	-	88	88, 93, 95	88	88, 91, 93, 95				
	4	-	-	-	-	-	88	88	88	88	88	88	88	88
	5	-	-	-	-	-		88	88	88	88	88	88	88
	6	-	-	-	-	-			-	90				-
Munising	3	87, 94	-	-	-	-	94	-	85, 87, 91, 94					
	4	88	-	88	-	-	88	85, 88	88	88	88	85, 88	88	88
	5	88	-	88	-	-	88	88	85, 88, 91	88	88	85, 88, 91	88	88
Grand Traverse Bay	3	-	-	91, 94, 86, 88, 91, 94, 95	-	-	-	-	-	-	-	-	-	-
	4	-	91, 94	91, 94	91, 94	91, 94	91	-	-	-	91	91, 94	-	91, 94
	5	-	91	91, 94	91, 94	91, 94	91, 94	91, 94	91, 94	91, 94	91	91, 92, 94	91, 94	91, 94
	6	-	91, 94	91, 94	91, 94	87, 91, 92, 93, 94, 96	87, 91, 92, 93, 94	91, 94	91, 94	91, 94	91	91, 94	91, 94	91, 94
	7	-	-	96	-	87, 92, 93, 94, 95, 96	87, 92, 93, 94	93, 94, 96	93, 94, 96	93, 94, 96		96		
	8	-	94, 96	-	-	94, 96	87, 93, 94, 95, 96	87, 93, 94, 95, 96	87, 94, 96	87, 94, 96		94, 96		
	9	-	-	-	-	86, 87	-	-	-	-	-	-	-	-

Table 12.–Summary of significant differences between length-at-age for sport- and commercial trap net-caught lake whitefish in Lake Superior (S = sport-caught fish significantly longer, C = commercial-caught fish significantly longer).

Fishing area	Year	Ages	Significantly greater length-at-age
Keweenaw	1987	5, 6, 7, 8	S
	1993	5, 6	S
Marquette	1990	4, 5, 6	C
	1991	5	C
	1992	5	C
	1993	5	C
	1994	5, 6	C
	1995	5	C
	1996	5	C
Munising	1985	5, 6, 7, 8, 9, 11	C
	1987	4, 5, 6, 7, 8, 9, 10	C
	1988	4, 5	C
	1991	4, 5, 6, 7, 9, 11	C
	1992	4, 5, 6, 7, 8, 9, 10, 12	C
	1993	4, 5, 6, 7, 8, 9, 10	C
	1994	5, 8, 9	C
	1995	5, 6, 7, 8, 9, 10	C
1996	5, 6, 9, 11	C	

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Appendix 1.-Estimated numbers of lake whitefish caught in Great Lakes sport fisheries (2SE in parentheses). All data from creel surveys conducted under D-JF-53-R Study 427.

Year	Location	Mode	Total catch/hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Season total	
1985	Lake Michigan	all	0.0129 (0.0038)	4			4	677 (1,126)	1,895 (8,450)	45,545 (23,124)	10,097 (6,209)	6,278 (3,878)	9,074 (5,439)	0	89,870 (26,279)	
		boat	0.0153 (0.0045)	0			0	677 (1,126)	18,195 (8,450)	45,545 (23,124)	10,097 (6,209)	6,278 (3,878)	9,074 (5,439)	0	89,866 (26,279)	
		pier	<0.0001 (<0.0001)	4			4	0	0	0	0	0	0	0	0	4
		all	<0.0001 (<0.0001)	4			4	0	0	0	0	0	0	0	0	4
St. Joe, Benton Harbor	all	0.1106 (0.0726)	0			0	546 (1,108)	5,851 (6,605)	24,273 (19,237)	522 (548)	0	0	76 (160)	0	31,268 (20,377)	
	all	0.3189 (0.0936)	0			0	131 (203)	12,344 (5,270)	21,272 (12,832)	9,575 (6,185)	6,278 (3,878)	8,998 (5,437)	0	0	58,598 (16,593)	
1986	West Grand Traverse Bay	ice	0.0453 (0.0348)		476 (550)	1,343 (1,258)									1,819 (1,373)	
		ice	0.5554 (0.2336)		6,040 (2,771)	13,934 (7,099)									19,974 (7,621)	
Lake Michigan	all	all	0.0082 (0.0023)	0			0	5,396 (4,091)	10,780 (8,074)	22,462 (9,667)	12,470 (5,566)	502 (1,026)	2,418 (1,742)	0	54,028 (14,507)	
		boat	0.0095 (0.0027)	0			0	5,396 (4,094)	10,664 (8,073)	22,462 (9,667)	12,470 (5,566)	502 (1,026)	2,381 (1,740)	0	53,875 (14,506)	
		pier	0.0000 (0.0000)	0			0	0	0	0	0	0	0	0	0	37
		shore	0.0007 (0.0006)	0			0	0	116 (101)	0	0	0	0	0	0	116 (101)
Mantisee	all	all	0.0001 (0.0002)	0			0	0	0	0	0	0	0	0	37 (75)	
		all	0.1304 (0.0607)	0			0	274 (275)	9,431 (7,982)	5,357 (4,483)	7,803 (4,830)	0	75 (-)	0	22,865 (10,354)	
West Grand Traverse Bay	all	all	0.2592 (0.0927)	0			0	5,122 (4,082)	1,233 (1,208)	16,359 (8,417)	4,473 (2,756)	502 (1,026)	2,381 (1,740)	0	30,070 (10,032)	
		all	0.0216 (0.0370)	0			0	0	0	746 (1,585)	194 (240)	0	0	0	940 (1,603)	
Charlevoix	all	all	0.0012 (0.0011)	0			0	0	116 (101)	0	0	0	0	0	116 (101)	
		all	0.0001 (0.0001)	0			0	0	0	572 (749)	0	0	0	0	572 (749)	
St. Ignace	boat	all	0.0100 (0.0133)	0			0	0	0	572 (749)	0	0	0	0	572 (749)	
		all	0.0024 (0.0039)	0			0	0	0	0	0	0	403 (656)	0	403 (656)	

Appendix 1.-Continued.

Year	Location	Mode	Total catch/hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Season total
1987	Huron Bay	ice	0.1310 (0.0643)		414 (273)	770 (431)									1,184 (510)
	Munising Bay	ice	0.2410 (0.1208)		6458 (3,061)	347 (267)									6805 (3,073)
	Lake Michigan	all	0.0035 (0.0013)			0 (-)	272 (304)	1,249 (961)	8,969 (5,494)	7,924 (4,819)	1,269 (894)	183 (228)	145 (158)		20,011 (7,436)
	West Arm Grand Traverse Bay	all	0.0015 (0.0697)				0 (-)	131 (269)	5,494 (5,032)	4,819 (2,282)	894 (657)	228 (177)	145 (-)		10,886 (5,573)
	East Arm Grand Traverse Bay	all	0.0369 (0.0986)				0 (-)	1,118 (923)	2,432 (2,206)	3,113 (3,864)	692 (606)	96 (144)	145 (158)		7,596 (4,589)
	Elk Rapids	all	0.0604 (0.0299)				272 (304)	0 (-)	0 (-)	0 (-)	1,257 (1,755)	0 (-)	0 (-)		1,529 (1,781)
	Lake Huron	all	0.0011 (0.0021)				0 (-)	5 (10)	4,013 (8,211)	94 (199)	41 (91)	0 (91)	62 (124)	0 (-)	4,215 (8,215)
	Oscoda	boat	0.0013 (0.0026)				0 (-)	5 (10)	4,013 (8,211)	94 (199)	41 (91)	0 (91)	0 (-)		4,153 (8,214)
	Alpena	all	0.0004 (0.0009)				0 (-)	0 (-)	0 (-)	94 (199)	0 (-)	0 (-)	0 (-)		94 (199)
	Rogers City	all	0.0001 (0.0002)				0 (-)	5 (10)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)		5 (10)
	Detour	all	0.0007 (0.0014)				0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	62 (124)		62 (124)
	Drummond Island	all	0.0025 (0.0120)				0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)		41 (91)
	St. Marys River	all	0.0246 (0.1473)						0 (-)	4,013 (8,211)	0 (-)	0 (-)	0 (-)		4,013 (8,211)
	Ontonagon	all	0.0508 (0.0010)						5,059 (3,854)	9,561 (4,041)	5,773 (2,551)	391 (427)	163 (341)	227 (194)	
Big Bay	all	0.0021 (0.0006)						0 (-)	0 (-)	0 (-)	0 (-)	0 (-)		0 (-)	
Munising	all	0.0191 (0.0154)						48 (76)	119 (124)	0 (-)	0 (-)	0 (-)		0 (-)	
Keweenaw Bay	ice	0.0652 (0.0481)		4,590 (3,534)	312 (268)										4,902 (3,544)
Huron Bay	ice	0.0881 (0.1319)		424 (608)	0 (-)									0 (-)	424 (608)
Munising	ice	0.1483 (0.0568)		4,646 (1,934)	1,260 (967)										5,906 (2,162)

Appendix 1.-Continued.

Year	Location	Mode	Total catch/hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Season total
1988	Bay City	ice	0.0004 (0.0008)	22 (46)	0 (-)	0 (-)	0 (-)	2,048 (2,671)	6,787 (3,489)	2,058 (1,643)	392 (838)	1,933 (1,020)	1,485 (1,196)	0 (-)	22 (46)
	Lake Michigan	all	0.0030 (0.0010)	0 (-)	0 (-)	0 (-)	60 (60)	2,044 (2,671)	6,787 (3,489)	2,058 (1,643)	392 (838)	1,933 (1,020)	1,027 (998)	0 (-)	14,733 (5,018)
		boat	0.0033 (0.0012)	0 (-)	0 (-)	0 (-)	0 (-)	2,044 (2,671)	6,787 (3,489)	2,058 (1,643)	392 (838)	1,933 (1,020)	1,027 (998)	0 (-)	14,241 (4,974)
		pier	0.0009 (0.0013)	0 (-)	0 (-)	0 (-)	30 (60)	4 (9)	0 (-)	0 (-)	0 (-)	0 (-)	439 (657)	0 (-)	473 (660)
		shore	0.0002 (0.0005)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	19 (44)	0 (-)	19 (44)
	St. Joe	all	0.0004 (0.0008)	0 (-)	0 (-)	0 (-)	0 (-)	171 (353)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	171 (353)
	Frankfort	all	0.0018 (0.0025)	0 (-)	0 (-)	0 (-)	30 (60)	4 (9)	0 (-)	0 (-)	0 (-)	0 (-)	439 (657)	0 (-)	473 (660)
	Platte Bay	all	0.0052 (0.0059)	0 (-)	0 (-)	0 (-)	0 (-)	6 (13)	85 (130)	63 (113)	0 (-)	0 (-)	0 (-)	0 (-)	154 (173)
	Leland	all	0.0020 (0.0045)	0 (-)	0 (-)	0 (-)	0 (-)	299 (669)	299 (669)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	299 (669)
	West Grand Traverse Bay	all	0.0056 (0.0052)	0 (-)	0 (-)	0 (-)	0 (-)	96 (197)	0 (-)	714 (720)	0 (-)	0 (-)	0 (-)	0 (-)	810 (746)
	East Grand Traverse Bay	all	0.1441 (0.0550)	0 (-)	0 (-)	0 (-)	0 (-)	159 (170)	6,403 (3,422)	1,281 (1,473)	0 (-)	1,933 (1,020)	1,046 (999)	0 (-)	10,822 (3,993)
	Elk Rapids	all	0.0457 (0.0632)	0 (-)	0 (-)	0 (-)	0 (-)	1,612 (2,635)	0 (-)	0 (-)	392 (838)	0 (-)	0 (-)	0 (-)	2,004 (2,765)
	Lake Huron	all	0.0001 (0.0001)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	312 (299)	35 (73)	0 (-)	0 (-)	0 (-)	347 (308)
		boat	0.0001 (0.0001)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	312 (299)	35 (73)	0 (-)	0 (-)	0 (-)	347 (308)
	Eagle Bay	all	0.0001 (0.0002)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	35 (73)	0 (-)	0 (-)	0 (-)	35 (73)
	Harrisville	all	0.0008 (0.0013)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	133 (216)	0 (-)	0 (-)	0 (-)	0 (-)	133 (216)
	Alpena	all	0.0001 (0.0001)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	7 (9)	0 (-)	0 (-)	0 (-)	0 (-)	7 (9)
	St. Ignace	boat	0.0056 (0.0068)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	172 (206)	0 (-)	0 (-)	0 (-)	0 (-)	172 (206)
	Lake Superior	all	0.0135 (0.0071)	0 (-)	0 (-)	0 (-)	626 (476)	809 (605)	978 (1,008)	15 (29)	0 (-)	0 (-)	0 (-)	0 (-)	2,428 (1,269)
	Ontonagon	all	0.0025 (0.0036)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	53 (77)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	53 (77)
	Huron Bay	boat	0.0191 (0.0239)	0 (-)	0 (-)	0 (-)	0 (-)	258 (319)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	258 (319)

Appendix 1.-Continued.

Year	Location	Mode	Total catch/hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Season total	
1988	Presque Isle Harbor	all	0.0256	0	388	778	0	0	0	0	0	0	0	0	1,166	
			(0.0240)	(-)	(471)	(976)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(1,084)
			0.0296	626	163	147	15	0	0	0	0	0	0	0	0	951
1989	Keweenaw Bay	ice	0.0385	0	3,188	0	0	0	0	0	0	0	0	0	(572)	
			(0.0441)	(-)	(3,572)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(3,572)	
			0.1116	551	227	551	29	0	0	0	0	0	0	0	0	3,188
1990	Huron Bay	ice	0.0755	(417)	(257)	0	0	0	0	0	0	0	0	0	778	
			(0.1243)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(490)
			0.1993	551	227	551	29	0	0	0	0	0	0	0	0	2,509
1988	West Arm Grand Traverse Bay	ice	0.1594	0	2,509	0	0	0	0	0	0	0	0	0	778	
			(0.1243)	(-)	(2,607)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(2,607)
			0.1993	551	227	551	29	0	0	0	0	0	0	0	0	2,509
1989	East Arm Grand Traverse Bay	ice	0.0049	0	2,509	0	0	0	0	0	0	0	0	0	778	
			(0.0019)	(-)	(2,607)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(2,607)
			0.0058	551	227	551	29	0	0	0	0	0	0	0	0	2,509
1990	Lake Michigan	all	0.0733	0	2,509	0	0	0	0	0	0	0	0	0	778	
			(0.0496)	(-)	(2,607)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(2,607)
			0.1279	551	227	551	29	0	0	0	0	0	0	0	0	2,509
1988	East Grand Traverse Bay	boat	0.0646	0	2,509	0	0	0	0	0	0	0	0	0	778	
			(0.0022)	(-)	(2,607)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(2,607)
			0.0103	551	227	551	29	0	0	0	0	0	0	0	0	2,509
1989	West Grand Traverse Bay	all	0.0080	0	2,509	0	0	0	0	0	0	0	0	0	778	
			(0.0024)	(-)	(2,607)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(2,607)
			0.1174	551	227	551	29	0	0	0	0	0	0	0	0	2,509
1990	Traverse Bay	boat	0.1099	0	2,509	0	0	0	0	0	0	0	0	0	778	
			(0.0000)	(-)	(2,607)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(2,607)
			0.0096	551	227	551	29	0	0	0	0	0	0	0	0	2,509
1988	Huron Bay	boat	0.0060	0	2,509	0	0	0	0	0	0	0	0	0	778	
			(0.0025)	(-)	(2,607)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(2,607)
			0.0071	551	227	551	29	0	0	0	0	0	0	0	0	2,509
1989	Little Bay de Noc	ice	0.0015	0	2,509	0	0	0	0	0	0	0	0	0	778	
			(0.0031)	(-)	(2,607)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(2,607)
			0.0634	551	227	551	29	0	0	0	0	0	0	0	0	2,509
1990	Keweenaw Bay	ice	0.0074	0	2,509	0	0	0	0	0	0	0	0	0	778	
			(0.0074)	(-)	(2,607)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(2,607)
			0.1824	551	227	551	29	0	0	0	0	0	0	0	0	2,509
1988	Lake Michigan	all	0.0029	0	2,509	0	0	0	0	0	0	0	0	0	778	
			(0.0029)	(-)	(2,607)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(2,607)
			0.0015	551	227	551	29	0	0	0	0	0	0	0	0	2,509
1989	Elk Rapids	all	0.0031	0	2,509	0	0	0	0	0	0	0	0	0	778	
			(0.0031)	(-)	(2,607)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(2,607)
			0.0634	551	227	551	29	0	0	0	0	0	0	0	0	2,509
1990	East Arm Grand Traverse Bay	all	0.0074	0	2,509	0	0	0	0	0	0	0	0	0	778	
			(0.0074)	(-)	(2,607)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(2,607)
			0.1824	551	227	551	29	0	0	0	0	0	0	0	0	2,509
1988	West Arm Grand Traverse Bay	all	0.0074	0	2,509	0	0	0	0	0	0	0	0	0	778	
			(0.0074)	(-)	(2,607)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(2,607)
			0.1824	551	227	551	29	0	0	0	0	0	0	0	0	2,509

Appendix 1.—Continued.

Year	Location	Mode	Total catch/hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Season total	
1990	St. Joe/Benton Harbor	all	0.0000 (0.0000)	0 (-)		0 (-)	0 (-)	0 (-)	6 (14)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	6 (14)	
	Lake Superior	all	0.0062 (0.0049)			85 (102)	200 (365)	83 (162)	83 (162)	83 (162)	0 (-)	0 (-)	348 (390)		716 (567)	
	Black River Harbor	all	0.0003 (0.0006)			0 (-)	0 (-)	0 (-)	0 (-)	3 (6)	0 (-)	0 (-)	0 (-)		3 (6)	
	Traverse Bay	boat	0.0013 (0.0018)			15 (21)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)		15 (21)	
	Presque Isle Harbor	all	0.0103 (0.0116)			70 (100)	200 (365)	80 (162)	80 (162)	80 (162)	0 (-)	0 (-)	0 (-)	17 (34)		367 (413)
	Marquette Lower Harbor	all	0.0261 (0.0311)			0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	331 (389)		331 (389)
	Rogers City	all	0.0001 (0.0002)						0 (-)	0 (-)	12 (25)	0 (-)	0 (-)			12 (25)
	Keweenaw Bay	ice	0.0029 (0.0026)		218 (223)	49 (70)										267 (234)
	Marquette	ice	0.0080 (0.0070)			44 (38)										44 (38)
	Munising	ice	0.1283 (0.0682)		1,738 (1,207)	886 (652)										2,624 (1,372)
1991	Lake Michigan	all	0.0046 (0.0017)			38 (59)	13 (26)	1,272 (902)	201 (257)	2,187 (1,494)	5,356 (3,502)	726 (481)	991 (503)	0 (-)	10,784 (3,983)	
		boat	0.0054 (0.0020)			5 (15)	13 (26)	1,272 (902)	201 (257)	2,187 (1,494)	5,356 (3,502)	726 (481)	991 (503)			10,751 (3,983)
		pier	0.0001 (0.0002)			33 (57)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)		0 (-)	33 (57)
	New Buffalo	all	0.0000 (0.0000)			5 (15)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)			5 (15)
	St. Joe	all	0.0001 (0.0002)			33 (57)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)			33 (57)
	West Arm Grand Traverse Bay	all	0.0058 (0.0063)			13 (26)	13 (26)	0 (-)	0 (-)	174 (251)	452 (668)	16 (31)	0 (-)	0 (-)		655 (715)
	East Arm Grand Traverse Bay	all	0.1253 (0.0587)			103 (212)	0 (-)	103 (212)	27 (54)	27 (54)	1,735 (1,336)	5,340 (3,502)	174 (273)	942 (490)		8,321 (3,796)
	Elk Rapids	all	0.0529 (0.0294)			1,169 (877)	0 (-)	1,169 (877)	0 (-)	0 (-)	0 (-)	0 (-)	552 (396)	49 (112)		1,770 (969)
	Lake Huron	all	0.0000 (0.0000)			0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	67 (74)	11 (25)	8 (17)	0 (-)		86 (80)
		boat	0.0000 (0.0000)			0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	67 (74)	11 (25)	8 (17)	0 (-)		86 (80)
Rogers City	boat	0.0001 (0.0002)							0 (-)	9 (19)	0 (-)	0 (-)			9 (19)	

Appendix 1.-Continued.

Year	Location	Mode	Total catch/hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Season total	
1991	Rockport	all	0.0000 (0.0000)					0	0	3	0	0	0	0	3	
	Alpena	all	0.0000 (0.0000)	0				0	(-)	(7)	(-)	(-)	(-)	0	(7)	
	Harrisville	boat	0.0002 (0.0005)	(-)				0	(-)	(5)	(-)	(-)	(-)	0	2	
	Oscoda	all	0.0003 (0.0004)					0	0	15	0	0	0	0	15	
	Eagle Bay to Harbor Beach	all	0.0001 (0.0002)	0				0	(-)	(34)	(-)	(-)	(-)	0	(34)	
	St. Marys River	all	0.0003 (0.0006)	(-)				0	0	38	(62)	(-)	(-)	0	46	
	Sault Ste. Marie to Neebish Isl.	All	0.0027 (0.0053)					0	(-)	0	0	11	(-)	0	11	
	Lake Superior	all	0.0074 (0.0123)					0	0	191	(-)	(25)	(-)	0	(25)	
	Keweenaw Bay	boat	0.0353 (0.0319)	267 (207)				0	516 (511)	291 (367)	17 (35)	0 (-)	43 (85)	395 (219)	0	1,529 (704)
	Marquette	all	0.0083 (0.0039)	103 (99)				165 (212)	0	0	17 (35)	0 (-)	43 (85)	395 (219)	0	115 (102)
	Munising	all	0.0216 (0.0192)	164 (182)				236 (454)	291 (367)	0	0	0	0	0	0	691 (611)
	Dead River	shore	0.0061 (0.0123)					0	0	0	0	0	0	51 (103)	0	51 (103)
	1992	Keweenaw Bay	ice	0.0100 (0.0115)		235 (322)	110 (226)		(-)	(-)	(-)	(-)	(-)	(-)	0	345 (393)
		Marquette	winter boat	0.0352 (0.0289)			278 (225)		0	0	0	0	0	0	0	278 (225)
Munising		ice	0.1709 (0.0658)		4,755 (1,906)	1,107 (964)		0	0	0	0	0	0	0	5,862 (2,136)	
Lake Michigan		all	0.0022 (0.0013)			23 (34)		307 (418)	137 (161)	565 (674)	3,613 (2,895)	13 (26)	220 (237)	0	5,001 (3,018)	
		boat	0.0026 (0.0016)			9 (19)		307 (418)	137 (161)	565 (674)	3,613 (2,895)	13 (26)	220 (237)	0	4,987 (3,018)	
		pier	0.0000 (0.0000)			14 (28)		0	0	0	0	0	0	0	14	
Elk Rapids		all	0.0065 (0.0136)			0		0	(-)	(-)	(-)	(-)	(-)	0	240 (500)	
East Arm Grand Traverse Bay		all	0.0849 (0.0575)			123 (111)		56 (88)	97 (139)	523 (669)	3,373 (2,851)	0	220 (237)	0	4,392 (2,945)	
West Arm Grand Traverse Bay		all	0.0037 (0.0046)			0		251 (409)	40 (81)	42 (84)	0	0	13 (26)	0	346 (426)	

Appendix 1.-Continued.

Year	Location	Mode	Total catch/hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Season total
1992	St. Joe	all	0.0001 (0.0001)			23 (34)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)		23 (34)
	Lake Huron	all	0.0000 (0.0000)				0 (-)	0 (-)	0 (-)	25 (55)	36 (76)	0 (-)	0 (-)		61 (94)
		boat	0.0000 (0.0000)				0 (-)	0 (-)	0 (-)	25 (55)	36 (76)	0 (-)	0 (-)		61 (94)
	Oscoda	all	0.0004 (0.0006)				0 (-)	0 (-)	0 (-)	25 (55)	36 (76)	0 (-)	0 (-)		61 (94)
	Lake Superior	all	0.0055 (0.0033)				306 (293)	279 (323)	375 (457)	12 (24)	0 (-)	37 (59)	90 (123)		1,099 (647)
	Ontonagon	boat	0.0060 (0.0101)				26 (53)	177 (356)	177 (356)	12 (24)	0 (-)	0 (-)	0 (-)		215 (361)
	Keweenaw Bay	all	0.0014 (0.0015)				19 (20)	19 (20)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)		19 (20)
	Marquette	all	0.0070 (0.0055)				243 (282)	234 (318)	0 (-)	0 (-)	0 (-)	0 (-)	90 (123)		567 (442)
	Munising Bay	all	0.0113 (0.0116)				63 (80)	0 (-)	198 (286)	0 (-)	0 (-)	37 (59)			298 (303)
1993	Keweenaw Bay	ice	0.0063 (0.0038)		358 (227)	46 (74)									404 (239)
	Marquette	winter	0.0032 (0.0056)			11 (19)									11 (19)
	Munising Bay	ice	0.0805 (0.0580)		1,343 (1,227)	419 (339)	311 (331)								2,073 (1,315)
	Quanicassee to Sebewaing		0.0002 (0.0004)	0 (-)	0 (-)	6 (11)									6 (11)
	Lake Michigan	all	0.0010 (0.0005)				0 (-)	641 (675)	975 (550)	624 (826)	95 (137)	18 (36)	185 (196)		2,538 (1,224)
		boat	0.0011 (0.0005)				0 (-)	641 (675)	975 (550)	624 (826)	95 (137)	18 (36)	185 (196)		2,538 (1,224)
	Manistee	all	0.0002 (0.0004)				0 (-)	0 (-)	0 (-)	58 (118)	0 (-)	0 (-)	0 (-)		58 (118)
	West Grand Traverse Bay	all	0.0085 (0.0059)				0 (-)	0 (-)	691 (491)	27 (55)	0 (-)	0 (-)	0 (-)		718 (494)
	East Grand Traverse Bay	all	0.0212 (0.0144)				0 (-)	405 (490)	217 (207)	0 (-)	95 (137)	18 (36)	126 (175)		861 (578)
	Elk Rapids	all	0.0190 (0.0202)				0 (-)	236 (464)	67 (137)	539 (816)	0 (-)	0 (-)	59 (89)		901 (953)
	Lake Huron	all	0.0000 (0.0000)				0 (-)	0 (-)	0 (-)	5 (10)	3 (7)	0 (-)	0 (-)		8 (12)
		boat	0.0000 (0.0000)				0 (-)	0 (-)	0 (-)	5 (10)	3 (7)	0 (-)	0 (-)		8 (12)

Appendix 1.-Continued.

Year	Location	Mode	Total catch/hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Season total	
1993	Alpena	all	0.0001 (0.0002)	0 (-)				0 (-)	0 (-)	5 (10)	0 (-)	0 (-)	0 (-)		5 (10)	
	Harrisville	all	0.0000 (0.0000)					0 (-)	0 (-)	0 (-)	3 (7)	0 (-)	0 (-)		3 (7)	
	Lake Superior	all	0.0084 (0.0040)	135 (158)				50 (73)	157 (192)	67 (156)	0 (-)	0 (-)	67 (133)	1,242 (754)		1,718 (823)
	Ontonagon	boat	0.0019 (0.0024)					20 (41)	40 (65)	0 (-)	0 (-)	0 (-)	0 (-)			60 (77)
	Traverse Bay	all	0.0067 (0.0159)					0 (-)	0 (-)	67 (156)	0 (-)	0 (-)	0 (-)	23 (52)		67 (156)
	Marquette	all	0.0182 (0.0103)				63 (128)	30 (60)	29 (43)	0 (-)	0 (-)	0 (-)	0 (-)	1,242 (754)		1,364 (768)
	Munising Bay	all	0.0062 (0.0065)				72 (93)	0 (-)	88 (176)	0 (-)	0 (-)	0 (-)	67 (133)			227 (239)
	Keweenaw Bay	ice	0.0042 (0.0033)	348 (301)	53 (107)		7 (14)	0 (-)								408 (320)
	Marquette	ice	0.0030 (0.0054)			10 (18)										10 (18)
	Munising Bay	ice	0.0175 (0.0132)		282 (225)	128 (206)										410 (305)
1994	Lake Michigan	all	0.0018 (0.0006)	34 (51)				1,674 (822)	1,164 (958)	68 (108)	169 (197)	0 (-)	1,082 (531)		4,191 (1,389)	
	Grand Haven	all	0.0000 (0.0000)					0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	5 (11)		5 (11)	
	Muskegon	all	0.0002 (0.0004)				16 (35)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)		16 (35)	
	Mantissee	all	0.0001 (0.0002)				18 (37)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)		18 (37)	
	West Arm Grand Traverse Bay	all	0.0040 (0.0048)				0 (-)	253 (350)	0 (-)	51 (103)	0 (-)	0 (-)	0 (-)		304 (365)	
	East Arm Grand Traverse Bay	all	0.0633 (0.0232)				0 (-)	1,298 (700)	1,079 (941)	17 (34)	169 (197)	0 (-)	1,077 (531)		3,640 (1,303)	
	Elk Rapids	all	0.0049 (0.0073)				0 (-)	123 (252)	85 (178)	0 (-)	0 (-)	0 (-)	0 (-)		208 (309)	
	Lake Huron	all	0.0000 (0.0000)				28 (42)	0 (-)	0 (-)	0 (-)	0 (-)	4 (9)	0 (-)		32 (43)	
	Alpena	all	0.0000 (0.0000)				2 (5)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)		2 (5)	
	Harrisville	all	0.0000 (0.0000)						0 (-)	0 (-)	0 (-)	4 (9)	0 (-)		4 (9)	
	Tawas	all	0.0001 (0.0002)				6 (13)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)		6 (13)	

Appendix 1.-Continued.

Year	Location	Mode	Total catch/hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Season total	
1994	Au Gres	all	0.0001 (0.0002)				20 (40)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	20 (40)	
	Lake Superior	all	0.0068 (0.0036)				286 (205)	543 (442)	2 (5)	0 (-)	0 (-)	0 (-)	104 (73)	0 (-)	935 (493)	
	Black River Harbor	all	0.0035 (0.0072)				0 (-)	17 (35)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	17 (35)
	Marquette	all	0.0129 (0.0083)				174 (154)	408 (408)	2 (5)	0 (-)	0 (-)	0 (-)	104 (73)	0 (-)	0 (-)	688 (442)
	Munising	all	0.0123 (0.0116)				112 (136)	118 (166)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	230 (215)
	Keweenaw Bay	ice	0.0003 (0.0006)	0 (-)	10 (21)	0 (-)										10 (21)
	Munising Bay	ice	0.2355 (0.1536)		2,371 (1,688)	379 (328)	0 (-)	2,750 (1,720)								2,750 (1,720)
	Lake Michigan	all	0.0022 (0.0009)				482 (598)	2,001 (1,167)	295 (288)	1,507 (1,185)	113 (126)	17 (34)	17 (34)	31 (39)		4,613 (1,806)
	St. Joseph-Benton Harbor	all	0.0008 (0.0009)				0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	167 (190)
	South Haven	all	0.0000 (0.0000)				0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	8 (16)	0 (-)	8 (16)
1995	West Arm Grand Traverse Bay	all	0.0076 (0.0082)				426 (590)	0 (-)	0 (-)	243 (490)	53 (107)	0 (-)	0 (-)	0 (-)	0 (-)	722 (774)
	East Arm Grand Traverse Bay	all	0.0515 (0.0245)				56 (94)	2,001 (1,167)	292 (288)	370 (518)	53 (65)	17 (34)	23 (36)	0 (-)	0 (-)	2,812 (1,315)
	Elk Rapids	all	0.0243 (0.0259)				0 (-)	0 (-)	0 (-)	894 (946)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	894 (946)
	Petoskey	all	0.0004 (0.0006)				0 (-)	0 (-)	3 (6)	0 (-)	7 (14)	0 (-)	0 (-)	0 (-)	0 (-)	10 (15)
	Lake Huron	all	0.0000 (0.0000)				0 (-)	19 (39)	0 (-)	24 (32)	17 (29)	17 (27)	0 (-)	0 (-)	0 (-)	77 (64)
	Rogers City	all	0.0001 (0.0002)					0 (-)	0 (-)	0 (-)	13 (26)	2 (4)	0 (-)	0 (-)	0 (-)	15 (26)
	Rockport	all	0.0002 (0.0004)					0 (-)	0 (-)	0 (-)	0 (-)	15 (29)	0 (-)	0 (-)	0 (-)	15 (29)
	Alpena	all	0.0000 (0.0000)				0 (-)	0 (-)	0 (-)	2 (4)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	2 (4)
	Harrisville	all	0.0001 (0.0002)					0 (-)	0 (-)	0 (-)	9 (19)	0 (-)	0 (-)	0 (-)	0 (-)	9 (19)
	Oscoda	all	0.0002 (0.0003)					19 (39)	0 (-)	0 (-)	0 (-)	0 (-)	17 (27)	0 (-)	0 (-)	36 (47)
Lake Superior	all	0.0111 (0.0041)				376 (298)	273 (294)	0 (-)	0 (-)	0 (-)	0 (-)	6 (11)	820 (333)	0 (-)	1,475 (535)	

Appendix 1.-Continued.

Year	Location	Mode	Total catch/hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Season total
1995	Marquette	all	0.0284 (0.0105)				376 (298)	189 (239)	0	0	0	0	820 (333)		1,385 (507)
	Munising Bay	all	0.0059 (0.0112)				0 (-)	84 (171)	0	(-)	(-)	(-)	6 (11)		90 (171)
1996	Little Bay de Noc	ice	0.0002 (0.0003)	0 (-)	0 (-)	27 (41)									27 (41)
	Keweenaw Bay	ice	0.0016 (0.0023)	97 (137)	0 (-)	0 (-)									
	Marquette	ice	0.0009 (0.0018)			2 (4)									2 (4)
	Munising Bay	ice	0.0356 (0.0197)		379 (291)	324 (249)									703 (383)
	Lake Michigan	all	0.0049 (0.0019)			251 (165)	339 (219)	474 (427)	4,996 (3,559)	1,243 (1,548)	0	0	0	3,860 (1,529)	11,163 (4,202)
	St. Joseph-Benton Harbor	all	0.0032 (0.0016)			251 (165)	326 (217)	0 (-)	0 (-)	0 (-)	(-)	(-)	0	0	577 (273)
	Grand Haven	all	0.0000 (0.0000)				0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	3 (7)		3 (7)
	Ludington	all	0.0004 (0.0008)				0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	93 (190)		93 (190)
	Elk Rapids	all	0.1213 (0.0547)				0 (-)	0 (-)	0 (-)	1,133 (1,539)	0	0	3,764 (1,517)		4,897 (2,161)
	East Grand Traverse Bay	all	0.1234 (0.0822)				0 (-)	435 (420)	4,996 (3,559)	35 (72)	0	0	0		5,466 (3,584)
	West Grand Traverse Bay	all	0.0013 (0.0018)				13 (27)	39 (79)	0 (-)	75 (152)	0	0	0		127 (173)
	Lake Superior	all	0.0032 (0.0020)				52 (41)	76 (86)	132 (265)	26 (56)	0	0	213 (123)		499 (312)
	Marquette	all	0.0051 (0.0026)				27 (30)	22 (38)	0 (-)	26 (56)	0	0	213 (123)		288 (144)
	Munising	all	0.0098 (0.0129)				25 (28)	54 (77)	132 (265)	0 (-)	0	0	0		211 (277)
	Lake Huron	all	0.0001 (0.0001)				2 (4)	0 (-)	16 (25)	48 (61)	81 (159)	20 (41)	18 (37)		185 (181)
	Harbor Beach	all	0.0002 (0.0004)				0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	20 (41)	0		20 (41)
	Saginaw Bay	all	0.0000 (0.0000)				0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	18 (37)		18 (37)
	Au Gres	all	0.0000 (0.0000)				0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	0 (-)	18 (37)		18 (37)
	Oscoda	all	0.0007 (0.0010)				0 (-)	0 (-)	0 (-)	36 (58)	81 (159)	0 (-)	0 (-)		117 (169)

Appendix 1.-Continued.

Year	Location	Mode	Total catch/hr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Season total
1996	Alpena	all	0.0002 (0.0002)				2 (4)	0 (-)	16 (25)	3 (7)	0 (-)	0 (-)	0 (-)		21 (26)
	Rockport	all	0.0001 (0.0002)					0 (-)	0 (-)	9 (18)	0 (-)	0 (-)			9 (18)

Appendix 2.—Age frequency and size-at-age (with \pm Factor for 95% confidence interval) of lake whitefish sampled from commercial trap nets in Lake Superior, 1983-96.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)			
			N	Mean	\pm Factor	N	Mean	\pm Factor	
Keweenaw Bay	1983	5	1	406		0			
		6	18	499	11	0			
		7	55	544	8	0			
		8	70	582	8	0			
		9	34	617	7	0			
		10	5	672	34	0			
		11	14	691	11	0			
		12	3	696	22	0			
		1984	5	1	485		0		
			6	9	495	14	0		
			7	14	534	12	0		
			8	22	579	11	0		
			9	17	574	12	0		
			10	44	604	10	0		
			11	50	625	11	0		
			12	25	666	10	0		
			13	9	700	26	0		
		14	8	709	18	0			
		16	1	719		0			
		1985	5	2	479	178	0		
			6	46	463	5	0		
			7	98	500	6	0		
			8	35	555	11	0		
			9	34	577	9	0		
			10	27	596	16	0		
			11	23	614	12	0		
			12	20	631	17	0		
			13	10	688	13	0		
		14	5	681	32	0			
		15	1	744		0			
		1986	5	1	412		0		
			6	9	516	29	0		
			7	65	522	8	11	1,365	2,139
			8	91	554	7	24	1,603	1,160
			9	67	592	8	20	1,709	1,264
			10	65	621	7	18	2,073	1,722
			11	61	662	7	21	2,478	1,605
			12	36	688	9	6	2,748	7,080
		13	4	688	41	0			
		14	1	711		0			

Appendix 2.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Keweenaw Bay	1987	4	1	406		0		
		5	10	434	8	0		
		6	45	470	11	0		
		7	86	496	6	0		
		8	103	524	7	0		
		9	33	553	12	0		
		10	8	590	32	0		
		11	5	630	44	0		
	12	1	630		0			
	1993	5	27	444	11	6	654	1,416
		6	91	461	4	25	857	591
		7	206	476	4	54	972	453
		8	52	514	9	11	1,269	1,749
		9	20	531	10	3	1,299	9,428
		10	2	533	6	0		
		12	2	551	191	1	2,086	
	1994	4	1	446		0		
		5	39	457	6	11	847	954
		6	263	468	3	63	947	431
		7	62	487	9	15	1,126	1,148
		8	28	507	16	9	1,154	1,372
		9	6	543	34	1	1,552	
		10	1	515		1	1,229	
	1996	4	1	446		0		
		5	45	462	6	20	909	492
		6	132	478	6	48	1,090	429
		7	62	493	11	16	1,435	1,347
		8	40	512	13	10	1,395	1,844
		9	5	496	11	0		
		10	8	517	37	4	1,244	2,299
		11	2	589	19	0		
		12	3	624	106	1	2,471	
		14	1	766		1	3,993	
Marquette	1983	4	1	439		0		
		5	28	486	9	0		
		6	68	529	7	0		
		7	41	569	11	0		
		8	21	620	18	0		
		9	12	677	29	0		
		10	11	699	24	0		
		11	8	732	21	0		

Appendix 2.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)			
			N	Mean	± Factor	N	Mean	± Factor	
Marquette	1984	5	35	482	7	11	939	982	
		6	152	522	4	58	1,181	407	
		7	37	575	15	6	1,558	4,083	
		8	23	610	21	6	2,096	4,111	
		9	12	629	22	5	1,940	3,207	
		10	7	667	28	1	2,925		
		11	9	686	33	7	2,836	1,573	
		12	5	720	18	0			
		13	10	733	16	0			
		14	9	715	16	4	3,256	6,692	
		15	2	762	229	2	3,925	0	
		1985	4	1	434		0		
			5	90	475	4	21	878	744
			6	93	507	5	25	1,104	771
			7	121	556	6	24	1,376	1,199
	8		34	596	14	6	2,257	5,612	
	9		33	624	10	7	2,603	5,037	
	10		29	654	9	6	2,518	5,691	
	11		17	688	9	2	2,950	102,673	
	12		8	713	19	3	3,363	13,250	
	13		6	712	46	3	3,370	10,352	
	14		4	725	46	2	3,475	44,334	
	15		4	746	42	1	3,950		
	1986		5	22	474	6	4	894	3,486
			6	129	520	4	33	1,307	808
			7	57	560	9	19	1,609	1,138
		8	59	598	7	21	2,058	1,300	
		9	26	632	20	3	1,847	15,602	
		10	13	656	9	3	2,825	15,701	
		11	19	693	10	7	3,384	4,450	
		12	10	721	21	5	3,823	5,321	
		13	11	744	22	3	4,578	22,799	
		14	4	757	33	0			
		1987	4	3	449	29	0		
			5	45	467	5	0		
			6	130	499	5	0		
			7	109	526	6	0		
	8		34	557	13	0			
	9		21	597	20	0			
	10		18	629	15	0			
	11		16	645	27	0			
	12		12	669	25	0			

Appendix 2.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Marquette	1987	13	7	714	21	0		
		14	9	715	19	0		
		15	2	701	64	0		
		16	1	739		0		
	1988	4	2	460	64	0		
		5	88	469	4	0		
		6	170	489	4	0		
		7	93	518	7	0		
		8	48	551	12	0		
		9	21	620	19	0		
		10	9	617	48	0		
		11	11	685	19	0		
		12	4	692	45	0		
		13	4	686	41	0		
	1989	4	6	454	11	0		
		5	142	472	4	37	874	502
		6	106	509	5	30	1,139	693
		7	83	527	7	25	1,362	884
		8	42	565	13	8	1,557	2,897
		9	10	556	31	1	1,990	
		10	5	633	48	0		
		11	6	707	23	0		
		13	3	749	55	1	4,231	
		15	1	695		0		
	1990	4	6	466	15	0		
		5	39	495	10	10	1,085	1,402
		6	218	514	4	55	1,193	565
		7	78	545	7	23	1,460	1,010
		8	39	566	9	11	1,690	1,912
		9	14	620	21	7	2,143	2,147
		10	8	655	48	4	2,468	4,598
		11	3	685	72	0		
		12	1	684		0		
		13	3	713	82	0		
	14	1	730		0			
	1991	5	16	491	11	1	950	
		6	56	529	8	18	1,353	1,013
		7	144	551	4	54	1,550	555
		8	42	578	10	12	2,100	2,210
		9	15	591	18	8	1,848	1,566
10		11	613	23	2	1,776	48,047	

Appendix 2.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Marquette	1991	11	6	662	22	2	3,005	54,355
		12	2	738	534	1	3,900	
		13	1	701		0		
		14	1	725		0		
	1992	4	1	475		0		
		5	22	491	16	4	1,295	5,122
		6	54	531	9	6	1,503	4,898
		7	74	568	7	15	1,895	2,161
		8	130	589	5	48	2,091	813
		9	41	616	8	8	2,538	4,631
		10	26	627	14	10	2,780	2,703
		11	22	646	18	2	3,320	133,661
		12	12	682	23	2	3,900	111,270
		13	9	723	35	5	4,156	5,184
		14	4	750	30	1	5,320	
		15	1	702		0		
		16	3	785	17	0		
	1993	4	1	516		0		
		5	22	499	15	4	1,020	4,000
		6	103	524	8	27	1,103	756
		7	65	555	11	22	1,503	969
		8	46	605	11	9	1,776	2,958
		9	87	625	10	22	2,241	1,761
		10	30	651	11	4	2,495	11,689
		11	14	681	25	3	3,140	18,556
		12	13	671	39	4	2,665	7,375
		13	7	703	21	1	3,100	
		14	3	759	34	1	4,280	
		15	4	752	29	1	4,000	
		16	2	698	210	0		
	17	1	757		0			
	1994	4	1	498		0		
		5	33	480	11	9	1,010	1,348
		6	119	521	6	39	1,232	585
		7	77	561	9	26	1,626	950
		8	31	621	15	9	2,054	2,629
		9	33	646	14	6	2,470	6,088
		10	44	663	9	4	2,688	15,627
		11	31	675	14	3	2,187	20,380
		12	13	691	25	1	2,945	
		13	11	722	23	0		
		14	2	735	591	1	3,632	

Appendix 2.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)			
			N	Mean	± Factor	N	Mean	± Factor	
Marquette	1994	15	1	719		1	4,145		
		16	2	759	292	2	5,217	4,034	
	1995	5	8	464	32	1	913		
		6	17	534	24	2	1,638	56,982	
		7	71	573	8	6	1,660	6,281	
		8	107	611	6	13	2,158	3,666	
		9	56	623	13	10	2,721	4,425	
		10	38	657	12	6	2,962	7,888	
		11	67	672	7	27	2,859	1,411	
		12	52	683	7	12	2,973	3,613	
		13	35	698	13	9	3,384	4,716	
		14	26	720	9	6	3,632	7,666	
		15	15	737	13	7	3,826	4,278	
	16	6	756	47	1	5,058			
	17	4	772	70	0				
	1996	5	22	463	10	6	791	1,487	
		6	95	495	6	23	1,014	797	
		7	91	518	7	22	1,281	1,039	
		8	53	547	9	29	1,523	543	
		9	21	564	20	9	1,636	1,581	
		10	3	575	70	2	1,593	14,760	
		11	2	655	165	1	2,996		
		12	5	699	40	3	2,853	7,117	
13		1	721		1	2,794			
14		2	728	349	1	2,715			
15	1	657							
16	3	755	48	3	4,028	2,234			
Munising	1983	4	23	463	8	0			
		5	142	488	5	0			
		6	114	526	7	0			
		7	44	584	13	0			
		8	24	645	15	0			
		9	10	706	33	0			
		10	7	705	52	0			
		11	3	705	103	0			
		12	4	768	40	0			
		1984	4	1	434		0		
			5	27	481	8	0		
			6	49	516	10	0		
	7		94	567	6	0			
	8		26	606	16	0			

Appendix 2.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Munising	1984	9	37	642	9	0		
		10	24	657	16	0		
		11	6	650	41	0		
		12	4	721	20	0		
		13	3	715	54	0		
		14	11	749	24	0		
		15	6	733	49	0		
		16	6	736	21	0		
		17	1	790		0		
	18	2	760	70	0			
	1985	4	2	455	260	0		
		5	125	474	4	0		
		6	124	501	5	0		
		7	112	520	7	0		
		8	142	562	7	0		
		9	32	577	20	0		
		10	28	626	22	0		
		11	17	648	32	0		
		12	10	660	51	0		
		14	4	722	31	0		
		15	5	738	59	0		
		16	2	735	32	0		
		17	1	762		0		
	1986	4	3	445	14	0		
		5	39	472	7	10	815	1,049
		6	131	499	6	77	982	192
		7	99	513	9	50	993	291
		8	84	579	10	16	1,444	1,652
		9	80	609	10	27	2,055	1,181
		10	16	654	28	4	2,648	8,431
		11	19	666	23	6	2,619	4,539
		12	7	711	20	1	3,194	
		13	9	724	23	5	3,223	4,016
		14	6	704	31	2	3,491	62,749
		15	5	755	43	1	3,852	
		16	1	719		1	3,120	
		17	1	754		0		
	1987	4	2	443	51	0		
5		15	480	19	0			
6		130	520	5	0			
7		120	545	7	0			
8		40	575	16	0			

Appendix 2.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Munising	1987	9	48	614	13	0		
		10	23	644	19	0		
		11	12	638	33	0		
		12	11	672	47	0		
		14	1	770		0		
	1988	4	4	452	13	2	763	9,721
		5	51	469	6	12	965	1,159
		6	89	490	7	18	1,033	1,056
		7	94	519	6	20	1,316	1,220
		8	65	540	9	24	1,358	776
		9	19	571	24	6	1,379	2,352
		10	34	621	12	7	2,221	4,371
		11	19	639	20	6	2,375	4,029
		12	8	661	20	1	2,900	
		13	5	703	27	1	3,350	
		14	5	715	35	1	3,025	
		15	4	714	55	2	3,175	40,552
		16	4	760	50	1	3,150	
		20	1	779		0		
	1989	4	9	468	14	6	812	669
		5	124	471	4	38	881	447
		6	100	491	6	29	963	587
		7	45	516	10	21	1,267	647
		8	15	545	20	6	1,411	2,004
		9	6	549	65	2	1,374	25,585
		10	2	606	76	0		
		11	3	660	44	0		
		13	1	639		0		
	1990	4	7	460	13	0		
		5	47	493	7	5	1,035	4,167
		6	230	510	3	50	1,189	651
		7	65	540	10	14	1,668	1,916
		8	42	569	12	11	1,904	2,272
		9	20	592	19	10	1,890	1,437
		10	14	642	44	6	2,478	3,336
11		5	636	84	2	2,560	39,838	
12		2	671	184	1	2,367		
13		2	735	89	1	2,882		
1991	4	5	476	39	3	1,107	2,828	
	5	13	494	13	2	1,068	31,812	
	6	48	524	8	12	1,300	1,498	

Appendix 2.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Munising	1991	7	186	541	4	43	1,457	832
		8	57	555	9	11	1,512	2,194
		9	34	583	14	10	2,016	2,374
		10	29	622	22	8	2,066	3,013
		11	15	630	26	3	2,757	16,785
		12	8	642	46	2	2,555	56,823
		13	4	694	36	1	3,062	
		14	1	744		1	3,364	
		15	1	762		1	3,958	
	16	1	800		1	4,265		
	1992	4	2	463	32	2	935	826
		5	29	485	7	14	946	596
		6	59	494	10	11	1,015	1,506
		7	35	515	11	10	1,156	1,386
		8	43	553	11	20	1,455	776
		9	64	575	9	15	1,502	1,575
		10	49	586	10	17	1,808	1,337
		11	31	596	19	7	1,901	3,614
		12	20	645	28	6	2,272	4,067
		13	15	662	19	5	2,268	4,456
		14	5	705	50	0		
		15	1	671		0		
		16	2	718	159	0		
	17	2	753	292	1	3,490		
	1993	4	2	483	13	0		
		5	38	494	7	5	1,057	3,776
		6	121	526	5	25	1,375	1,140
		7	23	548	16	7	1,808	2,780
		8	27	568	15	2	1,775	79,802
		9	65	614	8	21	2,290	1,579
		10	36	639	11	10	2,529	3,092
		11	26	637	26	13	2,855	1,834
		12	36	665	14	9	3,083	4,374
		13	12	681	25	4	2,949	7,676
		14	10	695	33	2	3,643	92,608
		15	2	740	388	1	5,103	
	16	2	731	76	1	4,300		
1994	3	1	446		1	730		
	4	1	455		1	870		
	5	17	526	8	0			
	6	60	549	7	10	1,702	2,881	
	7	80	569	8	17	1,581	1,630	

Appendix 2.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Munising	1994	8	28	601	13	9	2,411	2,868
		9	32	634	12	10	2,637	2,961
		10	70	643	6	26	2,712	1,468
		11	23	655	10	7	2,856	4,332
		12	33	681	11	12	3,319	2,932
		13	19	689	17	4	3,575	12,754
		14	8	688	26	2	3,155	69,556
		15	1	701		0		
	17	1	679		1	3,070		
	1995	4	1	473		0		
		5	23	518	13	0		
		6	29	558	12	5	1,726	5,265
		7	73	584	6	17	2,004	1,937
		8	85	615	6	21	2,363	1,934
		9	32	624	11	7	2,516	4,756
		10	39	655	10	9	2,802	4,185
		11	47	660	10	18	3,010	1,968
		12	27	684	11	9	3,180	3,685
		13	13	689	21	6	3,243	4,059
		14	20	707	14	11	3,806	2,453
		15	9	714	16	4	3,887	7,992
		16	5	720	29	2	3,945	61,507
		20	1	725		1	4,272	
	1996	5	20	482	13	7	999	1,369
		6	58	492	9	20	1,060	719
		7	86	499	7	32	1,064	513
		8	72	508	10	21	1,091	806
		9	31	543	19	11	1,351	1,322
		10	22	535	25	5	1,455	3,855
		11	2	500	464	1	1,205	
		12	6	585	92	1	2,694	
	13	2	679	38	1	4,097		
	15	1	748		1	3,826		
Big Bay	1983	4	5	488	46	0		
		5	27	503	10	0		
		6	60	535	7	0		
		7	37	562	10	0		
		8	18	607	17	0		
		10	3	720	138	0		
	1984	5	4	486	15	0		
		6	30	507	12	0		

Appendix 2.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Big Bay	1984	7	58	532	6	0		
		8	60	560	7	0		
		9	33	595	12	0		
		10	51	615	12	0		
		11	44	656	11	0		
		12	18	673	16	0		
		13	1	724		0		
	14	6	730	38	0			
	1985	5	1	475		0		
		6	20	513	15	0		
		7	87	529	5	0		
		8	84	559	7	0		
		9	106	593	6	0		
		10	106	630	8	0		
		11	99	645	8	0		
		12	93	667	8	0		
		13	30	685	14	0		
		14	14	713	15	0		
		15	4	706	56	0		
	1986	5	7	495	21	1	955	
		6	48	502	6	12	1,035	1,191
		7	87	529	7	18	1,331	1,342
		8	118	570	6	28	1,497	1,065
		9	98	608	6	18	1,933	2,090
		10	59	629	8	9	2,184	4,207
		11	66	669	7	9	2,637	5,414
		12	38	687	9	4	3,079	16,497
		13	17	706	18	1	3,250	
		14	9	725	20	0		
		15	2	764	337	0		
	1987	5	10	495	23	0		
		6	126	516	5	0		
		7	87	520	7	0		
8		37	542	10	0			
9		38	605	14	0			
10		22	616	30	0			
11		7	635	40	0			
12		14	659	27	0			
13		3	671	116	0			
14	3	682	71	0				

Appendix 2.–Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)			
			N	Mean	± Factor	N	Mean	± Factor	
Big Bay	1988	4	1	452		0			
		5	46	466	5	15	801	662	
		6	123	488	5	24	916	807	
		7	138	516	6	32	1,220	821	
		8	45	531	13	16	1,147	860	
		9	12	584	28	7	1,610	1,432	
		10	3	605	24	0			
		11	6	654	30	4	2,478	3,301	
		12	7	700	26	2	3,368	67,675	
		1989	4	7	448	14	2	760	15,291
			5	108	470	5	31	850	502
			6	126	501	5	32	1,024	645
	7		92	525	6	21	1,279	1,101	
	8		36	540	12	9	1,406	2,007	
	9		14	569	25	5	2,101	4,011	
	10		8	617	30	0			
	11		6	663	26	1	2,103		
	12		5	686	45	0			
	13		1	720		0			
	15		1	672		1	2,797		
	1990		4	6	464	45	2	780	14,112
			5	60	484	9	21	886	569
			6	151	506	5	46	1,050	483
			7	39	536	13	8	1,349	2,408
		8	22	540	16	7	1,194	1,769	
		9	7	528	38	5	1,307	1,206	
		10	1	587		0			
		11	1	628		0			
		14	1	746		0			
	1991	4	3	473	63	2	1,021	9,174	
		5	31	483	9	13	964	726	
		6	84	511	7	30	1,091	561	
		7	119	538	6	35	1,286	706	
		8	28	558	16	13	1,686	1,188	
		9	13	585	14	1	1,691		
		10	7	604	17	2	1,995	40,141	
		11	7	639	41	0			
		12	2	707	152	1	3,673		
		13	2	687	597	1	4,241		
		14	1	726		1	3,378		
		15	1	726		1	4,059		
		16	1	715		0			

Appendix 2.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)				
			N	Mean	± Factor	N	Mean	± Factor		
Big Bay	1992	5	3	456	78	1	1,096			
		6	30	506	13	11	1,024	954		
		7	34	517	13	21	1,225	475		
		8	58	539	10	27	1,322	580		
		9	61	543	9	21	1,321	864		
		10	46	552	10	11	1,430	1,809		
		11	37	558	12	6	1,457	3,824		
		12	24	573	15	2	1,738	73,375		
		13	5	570	45	0				
		14	2	546	0	0				
		15	1	668		0				
		22	1	762		0				
			1993	4	11	464	20	7	810	617
				5	88	509	8	28	1,177	694
		6		111	532	7	33	1,257	708	
		7		47	562	12	20	1,851	1,073	
		8		16	610	27	4	2,008	6,466	
		9		18	632	12	4	2,499	8,628	
		10		4	628	33	3	2,193	3,885	
		11		2	670	102	1	2,712		
		12		1	688		0			
		13		2	711	254	1	4,302		
		16		1	770		0			
		1994		4	2	504	368	1	1,232	
			5	80	464	6	8	913	2,451	
			6	168	517	6	58	1,374	507	
			7	86	539	10	35	1,557	665	
			8	35	533	19	13	1,567	1,304	
			9	10	579	32	4	1,795	4,141	
			10	8	621	26	4	2,225	4,128	
			11	6	645	29	1	2,432		
			12	3	618	124	0			
			15	1	760		0			
		1996	4	1	438		1	657		
			5	30	480	10	11	945	886	
			6	79	503	8	35	1,176	474	
	7		48	530	9	27	1,369	498		
	8		31	544	12	15	1,491	900		
	9		8	574	17	7	1,798	708		
	10		1	630		0				
	11		1	578		1	1,857			

Appendix 2.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Grand Marais	1983	4	6	475	32	0		
		5	37	498	9	0		
		6	29	522	10	0		
		7	8	608	22	0		
		8	3	638	63	0		
		9	4	706	32	0		
		10	1	683		0		
		12	1	790		0		
	1984	4	22	453	4	0		
		5	57	479	6	0		
		6	46	507	9	0		
		7	44	552	11	0		
		8	16	574	22	0		
		9	3	658	52	0		
		10	1	622		0		
		12	1	732		0		
Upper Entry	1992	5	7	443	17	4	682	1,098
		6	213	464	3	91	885	216
		7	86	473	5	48	982	261
		8	47	486	9	27	1,035	374
		9	30	510	12	17	1,185	572
		10	14	543	34	8	1,548	1,273
		11	7	541	63	2	2,600	52,519
		12	4	539	56	2	1,730	22,053
	1993	4	1	447		0		
		5	48	451	6	1	754	
		6	189	468	3	49	903	445
		7	133	482	4	34	969	591
		8	18	498	9	11	1,183	673
		9	11	532	24	5	1,557	2,411
	1994	5	5	455	52	1	840	
		6	247	461	2	51	911	509
7		107	468	5	36	903	439	
8		36	487	9	9	1,047	1,482	
9		6	485	30	2	868	15,592	
1995	5	4	469	100	0			
	6	180	454	3	48	872	426	

Appendix 2.–Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Upper Entry	1995	7	175	479	5	43	942	518
		8	29	495	16	9	967	1,180
		9	11	541	26	0		
		10	2	534	273	0		
		11	1	489		0		
		13	1	586		0		
Ontonagon	1995	5	31	449	6	8	915	1,388
		6	178	466	3	33	948	720
		7	125	494	5	28	1,137	842
		8	30	519	16	6	1,339	3,096
		9	9	513	27	2	1,541	36,779
		10	8	618	52	6	2,320	1,795
		11	7	591	76	2	1,900	38,263
		12	5	716	33	3	3,751	9,518
		13	9	738	25	5	4,116	5,157
		14	7	706	47	6	3,498	1,982
		16	1	605		0		

Appendix 3.—Age frequency and size-at-age (with \pm Factor for 95% confidence interval) of lake whitefish sampled from sport fisheries in Lake Superior, and Grand Traverse Bay, Lake Michigan.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	\pm Factor	N	Mean	\pm Factor
Keweenaw Bay	1984	3	1	378		1	454	
		4	1	401		1	635	
		5	1	437		1	680	
		6	1	465		1	907	
		7	1	521		1	1,315	
		9	1	612		1	2,041	
		11	1	729		1	3,538	
	1987	1	1	241		1	181	
		2	9	309	29	9	363	110
		3	7	377	46	7	480	159
		4	14	446	7	14	784	51
		5	15	470	17	15	904	87
		6	9	522	15	9	1,280	107
		7	10	588	24	10	1,737	237
		8	10	608	17	10	2,041	165
		9	1	622		1	2,268	
		10	3	661	49	3	2,479	131
		11	2	686	165	2	2,858	4,034
		12	3	725	69	3	3,296	725
		13	2	779	172	2	4,309	2,884
	1988	3	1	376		1	408	
		4	4	453	21	4	669	246
	1989	3	6	368	53	6	378	221
		4	12	428	25	12	658	128
		5	6	477	31	6	915	179
		6	7	499	25	7	1,095	184
		7	2	524	159	2	1,202	2,020
	1991	3	1	338		1	318	
		4	6	480	64	6	1,073	405
		5	7	513	46	7	1,309	328
		6	2	516	388	2	1,339	3,170
		8	1	589		1	1,996	
		11	1	693		1	3,720	
1992	4	16	393	26	16	1,097	1,076	
	5	11	467	29	11	990	217	
	6	5	509	34	5	1,297	217	
	7	2	564	191	2	1,837	1,436	
	12	1	701		1	3,402		

Appendix 3.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Keweenaw Bay	1993	4	5	410	53	5	581	259
		5	14	481	16	14	1,047	122
		6	2	554	64	2	1,679	578
		7	1	627		1	2,404	
		9	1	663		1	2,495	
Marquette	1988	3	7	331	14	7	279	66
		4	26	387	11	26	440	43
		5	4	476	38	4	828	291
		6	4	444	43	4	624	253
	1990	2	7	255	4	7	97	16
		3	2	286	241	2	159	286
		4	8	375	33	8	408	111
		5	6	422	51	6	597	238
		6	7	490	19	7	991	162
		7	4	500	40	4	1,077	355
		1991	1	1	330		1	272
	2		8	252	9	8	108	19
	3		33	289	7	33	177	14
	4		26	354	16	26	351	47
	5		6	378	80	6	491	303
	6		3	483	120	3	953	739
	7		2	502	438	2	1,111	2,592
	1992	1	1	208		1	91	
		2	2	290	133	2	227	
		3	11	273	16	11	136	30
		4	41	339	8	41	288	32
		5	21	393	22	21	458	84
		6	3	451	177	3	726	1,075
	1993	2	1	244		1	136	
		3	17	300	9	17	213	16
		4	7	327	24	7	259	68
		5	4	388	23	4	443	37
		6	1	358		1	363	
9		1	610		1	2,177		
1994	2	1	229		1	136		
	3	8	271	8	8	164	19	
	4	11	335	25	11	281	56	
	5	8	384	31	8	471	120	

Appendix 3.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)			
			N	Mean	± Factor	N	Mean	± Factor	
Marquette	1994	6	4	376	31	4	476	138	
		7	2	490	546	2	1,089	3,462	
		9	1	686		1	3,084		
		10	1	665		1	3,856		
	1995	3	6	309	19	6	250	26	
		4	24	342	11	24	321	31	
		5	11	385	22	11	458	80	
		6	2	414	165	2	522	864	
		7	1	572		1	1,814		
		9	1	589		1	1,769		
	1996	3	3	295	23	3	197	131	
		4	7	341	25	7	311	82	
		5	10	386	26	10	454	104	
		6	1	404		1	454		
		7	1	500		1	1,043		
		16	1	780		1	4,309		
	Munising	1985	2	8	233	20	7	104	214
			3	41	253	5	36	125	75
			4	25	296	9	24	210	65
			5	23	329	12	23	278	39
			6	10	334	14	10	268	42
7			23	372	12	23	404	47	
8			8	369	16	7	350	316	
9			6	436	23	6	574	119	
11			3	447	52	3	741	172	
1987			3	13	283	23	13	175	61
			4	16	293	21	16	207	57
		5	20	318	16	20	245	63	
		6	17	355	19	16	357	131	
		7	11	403	27	11	536	141	
		8	8	393	28	8	499	154	
		9	5	403	29	5	535	108	
		10	4	450	133	4	1,032	454	
		11	2	434	0	2	635	0	
		12	1	422		1	499		
1988		3	1	345		1	363		
		4	15	378	17	14	434	160	
	5	7	390	27	7	473	130		

Appendix 3.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Munising	1988	6	3	441	200	3	801	1,194
		8	1	485		1	907	
	1991	2	2	210	210	2	45	0
		3	5	259	13	5	118	31
		4	18	283	27	18	187	81
		5	25	327	13	25	259	35
		6	21	359	22	21	378	99
		7	18	383	22	18	469	107
		8	1	452	0	1	862	0
		9	4	440	16	4	692	91
		10	2	484	1080	2	1,111	7,204
		11	5	461	63	5	771	336
		12	3	489	160	3	983	958
		1992	1	1	201		1	45
	3		1	267		1	136	
	4		8	268	14	8	136	35
	5		5	307	43	5	200	95
	6		19	347	21	19	327	77
	7		10	379	32	10	458	133
	8		6	405	73	5	662	911
	9		3	366	129	3	423	508
	10		3	432	101	3	650	568
	11		1	472		1	862	
	12		4	446	69	4	726	295
	1993		2	4	209	36	4	68
		3	9	231	14	9	81	23
		4	10	271	37	9	156	113
		5	7	291	17	7	175	38
		6	6	318	43	6	250	103
		7	6	353	31	6	333	72
		8	3	353	110	3	363	406
		9	3	369	92	3	424	131
		10	3	438	37	3	680	113
		11	3	498	267	3	1,074	1,783
		12	1	406		1	499	
		13	1	508		1	1,134	
		14	2	522	407	2	1,225	1,728
		15	1	452		1	771	
		1994	3	6	313	32	6	257
	4		4	292	50	4	193	137
5	4		325	33	4	273	84	

Appendix 3.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)			
			N	Mean	± Factor	N	Mean	± Factor	
Munising	1994	6	2	374	324	2	477	1,442	
		8	6	393	43	6	416	97	
		9	6	413	35	6	582	216	
		10	1	358		1	363		
		11	1	401		1	499		
		12	2	488	515	2	907	4,612	
		13	1	503		1	907		
		14	1	541		1	1,270		
	1995	3	2	246	146	2	182	578	
		4	30	274	11	30	205	28	
		5	32	300	7	32	254	17	
		6	9	326	28	9	318	80	
		7	6	360	40	6	431	123	
		8	4	405	108	4	601	525	
		9	7	411	39	7	641	170	
		10	3	443	9	3	680	0	
		12	1	488		1	1,134		
		1996	2	1	218		1	91	
			3	5	263	22	5	163	102
			4	8	280	20	8	221	32
	5		17	316	24	17	291	76	
	6		15	375	32	15	472	150	
	7		6	419	113	6	522	270	
	8		1	330		1	318		
9	3		398	75	3	635	406		
10	2		471	178	2	748	864		
11	4		422	60	4	624	345		
15	1		470		1	771			
Grand Traverse Bay	1986		4	4	411	18	4	612	93
			5	5	469	42	5	980	351
			6	6	492	42	6	1,142	395
		7	7	522	32	7	1,361	263	
		8	6	542	24	6	1,527	223	
		9	6	592	36	6	1,897	433	
		10	3	633	4	3	2,540	739	
		1987	3	5	305	54	5	263	201
	4		14	352	22	14	392	83	
	5		28	440	25	28	778	112	
	6		29	489	11	29	1,120	100	
	7		10	522	15	10	1,347	130	
	8		14	576	25	14	1,827	249	

Appendix 3.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Grand Traverse Bay	1987	9	8	580	24	8	1,877	310
		10	1	665		1	2,722	
		11	1	645		1	2,495	
	1988	3	1	297		1	227	
		4	10	411	24	10	581	122
		5	13	442	33	13	778	215
		6	12	501	33	12	1,157	236
		7	2	504	407	2	1,157	3,170
	1989	4	10	393	23	10	504	76
		5	25	441	18	25	775	107
		6	60	459	10	60	876	73
		7	51	484	10	51	1,039	84
		8	12	535	31	12	1,440	300
		9	3	532	23	3	1,316	299
		10	3	583	219	3	1,996	1,994
	1990	4	4	415	48	4	465	308
		5	3	417	49	3	438	234
		6	24	472	9	24	722	70
		7	20	486	8	20	887	73
		8	11	510	16	11	1,072	161
		9	4	540	42	4	1,338	292
		11	2	573	178	2	1,543	578
		13	1	602		1	1,769	
	1991	1	2	347	756	2	454	2,878
		2	6	398	78	6	491	281
		3	8	459	21	8	737	177
		4	24	491	7	24	935	75
		5	27	526	10	27	1,181	116
		6	19	568	13	19	1,545	195
		7	1	650		1	2,041	
1992	3	1	310	0	1	136	0	
	5	7	492	44	7	985	376	
	6	25	496	13	25	1,000	119	
	7	34	520	9	34	1,138	83	
	8	14	535	10	14	1,299	126	
	9	6	599	70	6	1,754	286	
	10	1	643		1	2,722		
11	1	587		1	2,359			

Appendix 3.—Continued.

Fishing area	Year	Age	Total length (mm)			Dressed weight (gm)		
			N	Mean	± Factor	N	Mean	± Factor
Grand Traverse Bay	1993	3	1	419		1	680	
		4	2	442	191	2	726	1,150
		5	2	483	95	2	839	292
		6	10	535	51	10	1,220	194
		7	21	545	10	21	1,471	114
		8	7	566	38	7	1,555	252
		9	2	583	432	2	1,747	4,326
	1994	3	8	391	23	8	442	88
		4	22	462	15	22	796	128
		5	4	507	2	4	987	69
		6	32	541	6	32	1,368	79
		7	6	561	25	6	1,376	258
		8	8	599	10	8	1,985	83
	1995	4	6	399	17	6	446	70
		5	6	424	16	6	560	126
		6	12	476	11	12	877	95
		7	4	521	17	4	1,112	209
		8	18	546	11	18	1,273	110
		9	3	629	202	3	2,147	2,158
	1996	4	4	388	22	4	431	125
		5	12	456	16	12	688	86
		6	20	487	11	20	860	87
		7	22	552	12	22	1,342	112
		8	15	580	12	15	1,554	130
		9	1	597		1	1,814	