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RESEARCH REPORT

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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 Chocolay 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 artedi* 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 sign ificantly 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 $\chi^2$ 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 ($L_\infty$) 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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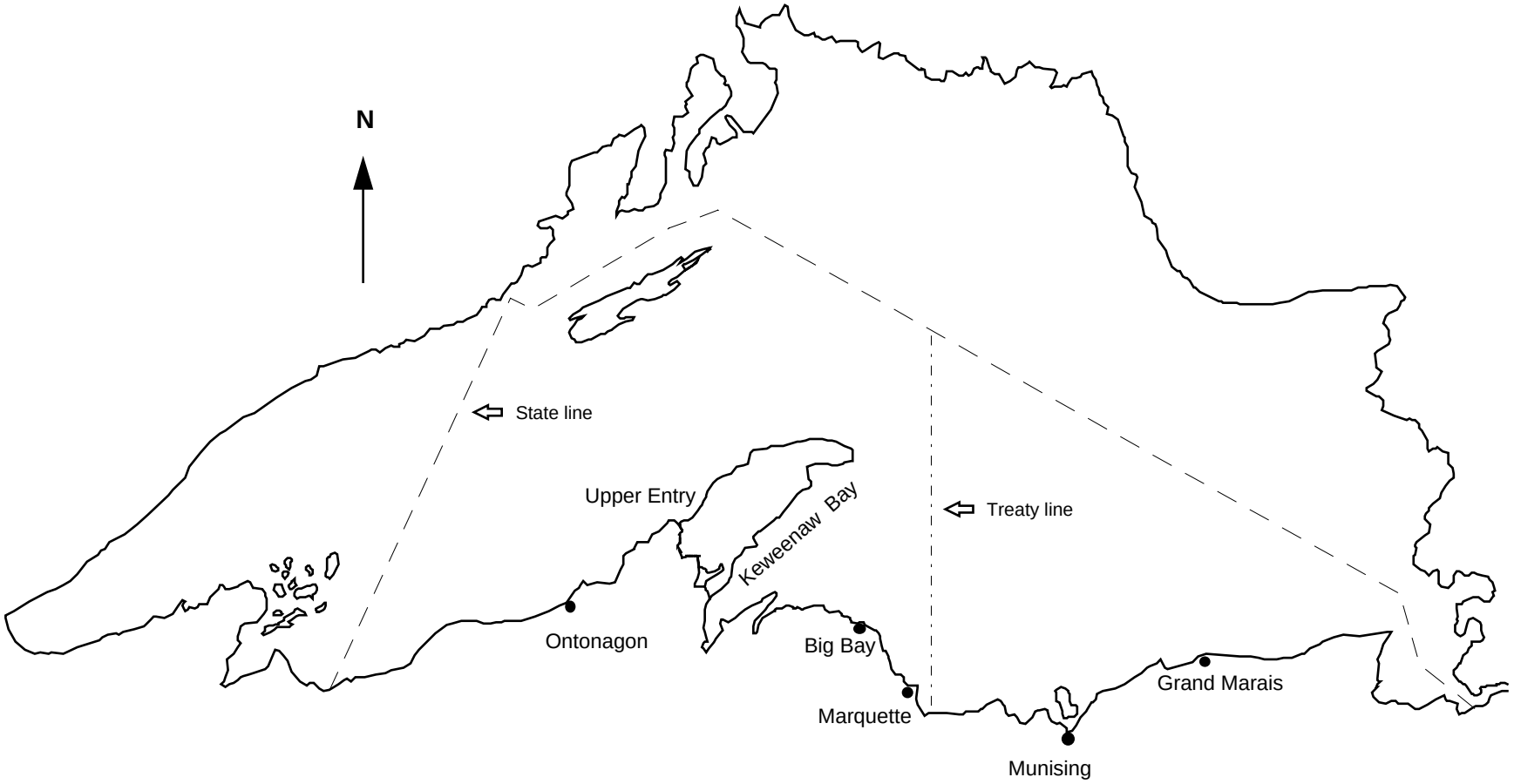


Figure 1.–Location of state-licensed commercial fisheries for lake whitefish in Michigan waters of Lake Superior.

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] Catch | Trap net[a] Effort | Trap net[a] CPE | Gill net[b] Catch | Gill net[b] Effort | Gill net[b] CPE | Total catch |
|---|---|---|---|---|---|---|---|---|
| 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 | 7-12 |
| 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 | $L_\infty$ (mm) | $t_o$ | | |
| 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 | 1983-85 | 0.13 | - | - | 0.156 | 783 | -0.004 | - | 79, 30 |
| Bay | 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 | $L_\infty$ (mm) | $t_o$ | |
| 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 ± 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.

| | | Commercial catch | | | | Sport catch | | | |
|---|---|---|---|---|---|---|---|---|---|
| Fishing area | Year | Mean length | ± Factor | Mean age | ± Factor | Mean length | ± Factor | Mean age | ± 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 | 7.0 | 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 | 10.1 | 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 | 7.5 | 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 | 566.9 | 3.7 | 8.6 | 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 | 514.6 | 5.6 | 6.7 | 0.2 | 391.2 | 14.7 | 4.1 | 0.3 |
| | 1989 | 512.6 | 5.4 | 6.3 | 0.2 | | | | |
| | 1990 | 532.4 | 4.9 | 6.6 | 0.1 | 391.7 | 33.0 | 4.5 | 0.6 |
| | 1991 | 556.7 | 5.1 | 7.2 | 0.2 | 326.4 | 15.0 | 3.6 | 0.3 |
| | 1992 | 589.0 | 6.0 | 8.1 | 0.2 | 345.3 | 12.6 | 4.1 | 0.2 |
| | 1993 | 587.7 | 7.2 | 8.0 | 0.2 | 327.4 | 23.3 | 3.7 | 0.5 |
| | 1994 | 585.0 | 7.9 | 7.8 | 0.2 | 360.9 | 33.7 | 4.6 | 0.6 |
| | 1995 | 639.6 | 5.8 | 9.9 | 0.2 | 361.8 | 18.1 | 4.4 | 0.3 |
| | 1996 | 524.4 | 6.6 | 7.2 | 0.2 | 383.1 | 42.6 | 5.0 | 1.1 |
| | All | 561.4 | 2.1 | 7.5 | 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 | 534.3 | 5.4 | 7.2 | 0.2 | 313.1 | 9.8 | 4.9 | 0.3 |
| | 1986 | 554.7 | 7.1 | 7.7 | 0.2 | | | | |
| | 1987 | 557.8 | 6.0 | 7.4 | 0.2 | 349.6 | 13.5 | 6.1 | 0.5 |
| | 1988 | 538.2 | 7.2 | 7.7 | 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 | 556.5 | 5.2 | 7.7 | 0.2 | 349.7 | 14.5 | 6.0 | 0.4 |
| | 1992 | 559.9 | 7.0 | 8.7 | 0.3 | 354.2 | 17.6 | 6.7 | 0.6 |
| | 1993 | 581.8 | 7.0 | 8.3 | 0.3 | 323.2 | 24.5 | 6.3 | 0.9 |
| | 1994 | 609.7 | 6.1 | 8.7 | 0.3 | 373.6 | 24.7 | 7.1 | 1.1 |
| | 1995 | 624.6 | 5.7 | 9.1 | 0.3 | 316.2 | 12.2 | 5.5 | 0.4 |
| | 1996 | 509.7 | 5.6 | 7.5 | 0.2 | 347.7 | 19.5 | 6.0 | 0.6 |
| | All | 555.4 | 1.9 | 7.6 | 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 | 521.4 | 7.3 | 6.0 | 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.

| | | Fishing area | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Age | 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 | | | | |
| | 12 | | | Q, M | Q, M | | | |
| 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 | | | |
| | 12 | | | 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 | | | |
| | 12 | | | 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) | Grand Marais (G) |
| 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 | | – |
| Keweenaw Bay | 5 | – | – | – | – | 94, 96 | | | – | – | – | 96 | | – | |
| | 6 | | | 83, 84, 86, 96 | | 83, 86 | – | – | – | – | – | 83, 84, 86, 96 | 83, 84, 86, 96 | – | 83, 86 |
| | 7 | | | 83, 84, 86 | 83 | 83, 84, 86 | – | – | – | – | – | 83, 84, 85, 86, 87, 96 | 83, 84, 86 | – | 83, 84, 86 |
| | 8 | | | 83, 84 | 83, 84 | 83, 84, 85, 86 | – | – | – | – | – | 83, 84, 85, 86 | 83, 84, 85, 86 | – | 83, 84, 85, 86 |
| | 9 | | 83 | 83 | 83 | 83, 85, 86 | – | – | – | – | – | 83, 84, 85, 86 | 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 | 93 | 83, 93 | | | 83, 84, 86, 87, 90, 91, 93 | – | 83, 93 |
| | 6 | | 83, 93 | | 83, 87, 93, 94 | 83, 93 | 83, 84, 85, 86, 87, 89, 90, 91, 93, 94, 96 | 83, 87, 93, 94 | 83, 93 | 83, 93 | 83, 93 | | 83, 93 | – | 83, 93 |
| | 7 | | 83, 93 | 83, 93 | 83, 93 | 83, 91, 93, 94 | 83, 84, 85, 90, 91, 93, 94 | 83, 91, 93 | 83, 93 | 83, 93 | 83, 91, 93 | | 83, 93 | – | 83, 93 |
| | 8 | | 83, 93 | 83, 93 | 83, 93 | 83, 84, 86, 93 | 83, 84, 85, 86, 93 | 83, 84, 86, 93 | 83, 86, 93 | 83, 93 | 83, 84, 85, 86, 93 | | 83, 84, 86, 93 | – | 83, 86, 93 |
| | 9 | – | 93 | 86, 93 | 93 | 93 | 93 | 86, 93 | 84, 85, 86, 87, 91, 93 | 86, 93 | 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, 90, 91, 93 | | | | | | | 83, 84, 90, 91, 92, 93 |
| | 6 | | | 83, 84, 86, 91, 92, 93, 94 | | 83, 84, 86, 90, 91, 92, 93, 94, 95 | 83, 84, 85, 86, 87, 89, 90, 91, 92, 93, 94, 95 | 83, 84, 86, 91, 92, 93, 94 | 83, 91, 92 | | | | | | 83, 84, 85, 86, 89, 90, 91, 92, 93, 94, 95 |
| | 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, 92, 95 | 83, 84, 92, 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, 91, 92, 93, 94, 95 | 83, 84, 85, 86, 92, 93, 94, 95 | 83, 84, 85, 86, 92, 93, 94, 95 | 83, 84, 86, 93, 94, 95 | 83, 94, 95 | | | | 83, 84, 85, 86, 90, 91, 92, 93, 94, 95 |
| | 9 | | | 83 | | 83, 94 | 83 | 83, 84, 85, 86, 88, 90, 92, 93, 94, 95 | 83 | 83, 85, 86, 93, 94, 95 | 83, 94 | 83 | | 83 | 83, 84, 85, 86, 88, 90, 92, 93, 94, 95 |
| | 10 | | | 83 | 83 | 83, 85, 86, 94, 95 | 83 | | | 83, 84, 85, 86, 93, 94, 95 | 83, 85, 86, 94, 95 | 83 | 83 | 83 | 83, 86, 94 |

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 | – |
| Munising | 4 | | – | | 93 | | 93 | | | | | | – | – | – |
| | 5 | 94, 95 | 94, 95 | 83, 90, 91, 93, 94, 95 | 83, 90, 91, 93, 94, 95 | 94, 95 | 83, 90, 91, 92, 93, 94, 95 | 83, 90, 91, 92, 93, 94, 95 | 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 | 94, 95 | 83, 84, 87, 90, 91, 93, 94, 95 | 83, 84, 87, 90, 91, 93, 94, 95 | 83, 87, 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, 94, 95 | 83, 84, 87, 90, 91, 93, 94, 95 | 83, 84, 87, 90, 91, 93, 94, 95 | 83, 84, 94, 95 | 83, 84, 94, 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, 94, 95 | 83, 84, 94, 95 | 83, 84, 86, 94, 95 | 83, 84, 86, 94, 95 | 83, 84, 94, 95 | 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, 86, 87, 93, 94, 95 | 83, 84 | 83 | 83 | 83, 84, 86, 87, 90, 91, 92, 93, 94, 95 |
| | 10 | | | 83 | | | 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 | | | | | | | | | | 85, 86, 88, 89, 94, 95 | | | | |
| | 12 | | | 83 | | 83 | 83, 84, 86 | – | | 83, 84, 86 | 83, 84, 86 | 83, 84, 86 | 83, 84 | 83, 84 | 83, 84, 86 |
| | 13 | – | | – | | – | | – | | | 86 | | | | |
| | 14 | – | | | | – | | – | – | – | | | 84 | 84 | – |
| Grand Marais | 5 | | 83 | – | – | – | – | – | – | – | – | – | – | – | – |
| | 7 | | 83 | – | – | – | – | – | – | – | – | – | – | – | – |

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.

| | | Fishing area | | | |
|---|---|---|---|---|---|
| Year | Age | 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 |
| | 5 | – | – | – | | – | | | 88 | 88 | 88 | 88 | 88 |
| | 6 | – | – | – | | – | | | | – | 90 | | – |
| Munising | 3 | 87, 94 | – | – | | – | – | 94 | – | 85, 87, 91, 94 | | | |
| | 4 | 88 | – | 88 | – | – | – | 88 | 85, 88 | 88 | 88 | 85, 88 | 88 |
| | 5 | 88 | – | 88 | | – | – | 88 | 88 | 85, 88, 91 | 88 | 85, 88, 91 | 88 |
| Grand Traverse Bay | 3 | – | – | 91, 94 | – | – | – | | – | – | 91 | – | – |
| | 4 | – | 91, 94 | 86, 88, 91, 94, 95 | 91, 94 | 91, 94 | 91 | | – | | 91 | 91, 94 | 91, 94 |
| | 5 | – | 91 | 91, 94 | 91, 94 | 91, 94 | 91, 94 | | | | 91 | 91, 92, 94 | 91, 94 |
| | 6 | – | 91, 94 | 91, 94 | 91, 94 | 87, 91, 92, 93, 94, 96 | 91, 92, 93, 94 | | 91, 94 | | 91 | 91, 94 | 91, 94 |
| | 7 | – | | 96 | | 87, 92, 93, 94, 95, 96 | 87, 92, 93, 94, 95, 96 | – | 93, 94, 96 | | | 96 | |
| | 8 | – | 94, 96 | | – | 94, 96 | 87, 93, 94, 95, 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-J F-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 | | | | 4 | 677 | 1,895 | 45,545 | 10,097 | 6,278 | 9,074 | 0 | 89,870 |
| | | | (0.0038) | | | | (8) | (1,126) | (8,450) | (23,124) | (6,209) | (3,878) | (5,439) | (–) | (26,279) |
| | | boat | 0.0153 | | | | 0 | 677 | 18,195 | 45,545 | 10,097 | 6,278 | 9,074 | 0 | 89,866 |
| | | | (0.0045) | | | | (–) | (1,126) | (8,450) | (23,124) | (6,209) | (3,878) | (5,439) | (–) | (26,279) |
| | | pier | <0.0001 | | | | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| | | | (<0.0001) | | | | (8) | (–) | (–) | (–) | (–) | (–) | (–) | (–) | (8) |
| | St. Joe, Benton Harbor | all | <0.0001 | | | | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| | | | (<0.0001) | | | | (8) | (–) | (–) | (–) | (–) | (–) | (–) | (–) | (8) |
| | West Traverse Bay | all | 0.1106 | | | | 0 | 546 | 5,851 | 24,273 | 522 | 0 | 76 | | 31,268 |
| | | | (0.0726) | | | | (–) | (1,108) | (6,605) | (19,237) | (548) | (–) | (160) | | (20,377) |
| | East Traverse Bay | all | 0.3189 | | | | 0 | 131 | 12,344 | 21,272 | 9,575 | 6,278 | 8,998 | | 58,598 |
| | | | (0.0936) | | | | (–) | (203) | (5,270) | (12,832) | (6,185) | (3,878) | (5,437) | | (16,593) |
| 1986 | West Grand Traverse Bay | ice | 0.0453 | | 476 | 1,343 | | | | | | | | | 1,819 |
| | | | (0.0348) | | (550) | (1,258) | | | | | | | | | (1,373) |
| | East Grand Traverse Bay | ice | 0.5554 | | 6,040 | 13,934 | | | | | | | | | 19,974 |
| | | | (0.2336) | | (2,771) | (7,099) | | | | | | | | | (7,621) |
| | Lake Michigan | all | 0.0082 | | | | 0 | 5,396 | 10,780 | 22,462 | 12,470 | 502 | 2,418 | 0 | 54,028 |
| | | | (0.0023) | | | | (–) | (4,091) | (8,074) | (9,667) | (5,566) | (1,026) | (1,742) | (–) | (14,507) |
| | | boat | 0.0095 | | | | 0 | 5,396 | 10,664 | 22,462 | 12,470 | 502 | 2,381 | 0 | 53,875 |
| | | | (0.0027) | | | | (–) | (4,094) | (8,073) | (9,667) | (5,566) | (1,026) | (1,740) | (–) | (14,506) |
| | | pier | 0.0000 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 0 | 37 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (–) | (–) | (–) | (75) | (–) | (75) |
| | | shore | 0.0007 | | | | 0 | 0 | 116 | 0 | 0 | 0 | 0 | 0 | 116 |
| | | | (0.0006) | | | | (–) | (–) | (101) | (–) | (–) | (–) | (–) | (–) | (101) |
| | Manistee | all | 0.0001 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 37 |
| | | | (0.0002) | | | | (–) | (–) | (–) | (–) | (–) | (–) | (37) | | (75) |
| | West Grand Traverse Bay | all | 0.1304 | | | | 0 | 274 | 9,431 | 5,357 | 7,803 | 0 | 75 | | 22,865 |
| | | | (0.0607) | | | | (–) | (275) | (7,982) | (4,483) | (4,830) | (–) | (–) | | (10,354) |
| | East Grand Traverse Bay | all | 0.2592 | | | | 0 | 5,122 | 1,233 | 16,359 | 4,473 | 502 | 2,381 | | 30,070 |
| | | | (0.0927) | | | | (–) | (4,082) | (1,208) | (8,417) | (2,756) | (1,026) | (1,740) | | (10,032) |
| | Elk Rapids | all | 0.0216 | | | | 0 | 0 | 0 | 746 | 194 | 0 | 0 | | 940 |
| | | | (0.0370) | | | | (–) | (–) | (–) | (1,585) | (240) | (–) | (–) | | (1,603) |
| | Charlevoix | all | 0.0012 | | | | | 0 | 116 | 0 | 0 | 0 | 0 | | 116 |
| | | | (0.0011) | | | | | (–) | (101) | (–) | (–) | (–) | (–) | | (101) |
| | Lake Huron | all | 0.0001 | | | | 0 | 0 | 0 | 572 | 0 | 0 | 0 | 0 | 572 |
| | | | (0.0001) | | | | (–) | (–) | (–) | (749) | (–) | (–) | (–) | (–) | (749) |
| | St. Ignace | boat | 0.0100 | | | | | 0 | 0 | 572 | 0 | 0 | 0 | 0 | 572 |
| | | | (0.0133) | | | | | (–) | (–) | (749) | (–) | (–) | (–) | (–) | (749) |
| | Au Sable River | all | 0.0024 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 403 | 0 | 403 |
| | | | (0.0039) | | | | (–) | (–) | (–) | (–) | (–) | (–) | (656) | (–) | (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 | | 414 | 770 | | | | | | | | | 1,184 |
| | | | (0.0643) | | (273) | (431) | | | | | | | | | (510) |
| | Munising Bay | ice | 0.2410 | | 6458 | 347 | | | | | | | | | 6805 |
| | | | (0.1208) | | (3,061) | (267) | | | | | | | | | (3,073) |
| | Lake Michigan | all | 0.0035 | | | 0 | 272 | 1,249 | 8,969 | 7,924 | 1,269 | 183 | 145 | | 20,011 |
| | | | (0.0013) | | | (–) | (304) | (961) | (5,494) | (4,819) | (894) | (228) | (158) | | (7,436) |
| | | boat | 0.0040 | | | 0 | 272 | 1,249 | 8,969 | 7,924 | 1,269 | 183 | 145 | | 20,011 |
| | | | (0.0015) | | | (–) | (304) | (961) | (5,494) | (4,819) | (894) | (228) | (158) | | (7,436) |
| | West Arm Grand Traverse Bay | all | 0.0697 | | | | 0 | 131 | 6,537 | 3,554 | 577 | 87 | 0 | | 10,886 |
| | | | (0.0369) | | | | (–) | (269) | (5,032) | (2,282) | (657) | (177) | (–) | | (5,573) |
| | East Arm Grand Traverse Bay | all | 0.0986 | | | | 0 | 1,118 | 2,432 | 3,113 | 692 | 96 | 145 | | 7,596 |
| | | | (0.0604) | | | | (–) | (923) | (2,206) | (3,864) | (606) | (144) | (158) | | (4,589) |
| | Elk Rapids | all | 0.0299 | | | | 272 | 0 | 0 | 1,257 | 0 | 0 | 0 | | 1,529 |
| | | | (0.0349) | | | | (304) | (–) | (–) | (1,755) | (–) | (–) | (–) | | (1,781) |
| | Lake Huron | all | 0.0011 | | | | 0 | 5 | 4,013 | 94 | 41 | 0 | 62 | 0 | 4,215 |
| | | | (0.0021) | | | | (–) | (10) | (8,211) | (199) | (91) | (–) | (124) | (–) | (8,215) |
| | | boat | 0.0013 | | | | 0 | 5 | 4,013 | 94 | 41 | 0 | 0 | | 4,153 |
| | | | (0.0026) | | | | (–) | (10) | (8,211) | (199) | (91) | (–) | (–) | | (8,214) |
| | Oscoda | all | 0.0004 | | | | 0 | 0 | 0 | 94 | 0 | 0 | 0 | | 94 |
| | | | (0.0009) | | | | (–) | (–) | (–) | (199) | (–) | (–) | (–) | | (199) |
| | Alpena | all | 0.0001 | | | | 0 | 5 | 0 | 0 | 0 | 0 | 0 | | 5 |
| | | | (0.0002) | | | | (–) | (10) | (–) | (–) | (–) | (–) | (–) | | (10) |
| | Rogers City | all | 0.0007 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 62 | | 62 |
| | | | (0.0014) | | | | (–) | (–) | (–) | (–) | (–) | (–) | (124) | | (124) |
| | Detour | all | 0.0011 | | | | | 0 | 0 | 0 | 41 | 0 | 0 | | 41 |
| | | | (0.0025) | | | | | (–) | (–) | (–) | (91) | (–) | (–) | | (91) |
| | Drummond Island | all | 0.0120 | | | | 0 | 0 | 4,013 | 0 | 0 | 0 | 0 | | 4,013 |
| | | | (0.0246) | | | | (–) | (–) | (8,211) | (–) | (–) | (–) | (–) | | (8,211) |
| | St. Marys River | all | 0.1473 | | | | | 5,059 | 9,561 | 5,773 | 391 | 163 | 227 | | 21,174 |
| | | | (0.0508) | | | | | (3,854) | (4,041) | (2,551) | (427) | (341) | (194) | | (6,167) |
| | Ontonagon | all | 0.0010 | | | | | 0 | 19 | 0 | 0 | 0 | 0 | | 19 |
| | | | (0.0021) | | | | | (–) | (39) | (–) | (–) | (–) | (–) | | (39) |
| | Big Bay | all | 0.0006 | | | | 0 | 0 | 2 | 0 | 0 | 0 | 0 | | 2 |
| | | | (0.0012) | | | | (–) | (–) | (4) | (–) | (–) | (–) | (–) | | (4) |
| | Munising | all | 0.0191 | | | | 239 | 48 | 119 | 0 | 0 | 0 | 0 | 0 | 406 |
| | | | (0.0154) | | | | (291) | (76) | (124) | (–) | (–) | (–) | (–) | (–) | (325) |
| 1988 | Keweenaw Bay | ice | 0.0652 | | 4,590 | 312 | | | | | | | | | 4,902 |
| | | | (0.0481) | | (3,534) | (268) | | | | | | | | | (3,544) |
| | Huron Bay | ice | 0.0881 | | 424 | 0 | | | | | | | | | 424 |
| | | | (0.1319) | | (608) | (–) | | | | | | | | | (608) |
| | Munising | ice | 0.1483 | | 4,646 | 1,260 | | | | | | | | | 5,906 |
| | | | (0.0568) | | (1,934) | (967) | | | | | | | | | (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 | 22 | 0 | 0 | | | | | | | | | 22 |
| | | | (0.0008) | (46) | (–) | (–) | | | | | | | | | (46) |
| | Lake Michigan | all | 0.0030 | | | 0 | 30 | 2,048 | 6,787 | 2,058 | 392 | 1,933 | 1,485 | 0 | 14,733 |
| | | | (0.0010) | | | (–) | (60) | (2,671) | (3,489) | (1,643) | (838) | (1,020) | (1,196) | (–) | (5,018) |
| | | boat | 0.0033 | | | 0 | 0 | 2,044 | 6,787 | 2,058 | 392 | 1,933 | 1,027 | 0 | 14,241 |
| | | | (0.0012) | | | (–) | (–) | (2,671) | (3,489) | (1,643) | (838) | (1,020) | (998) | (–) | (4,974) |
| | | pier | 0.0009 | | | 0 | 30 | 4 | 0 | 0 | 0 | 0 | 439 | 0 | 473 |
| | | | (0.0013) | | | (–) | (60) | (9) | (–) | (–) | (–) | (–) | (657) | (–) | (660) |
| | | shore | 0.0002 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 19 |
| | | | (0.0005) | | | | (–) | (–) | (–) | (–) | (–) | (–) | (44) | (–) | (44) |
| | St. Joe | all | 0.0004 | | | 0 | 0 | 171 | 0 | 0 | 0 | 0 | 0 | | 171 |
| | | | (0.0008) | | | (–) | (–) | (353) | (–) | (–) | (–) | (–) | (–) | | (353) |
| | Frankfort | all | 0.0018 | | | | 30 | 4 | 0 | 0 | 0 | 0 | 439 | | 473 |
| | | | (0.0025) | | | | (60) | (9) | (–) | (–) | (–) | (–) | (657) | | (660) |
| | Platte Bay | all | 0.0052 | | | | 0 | 6 | 85 | 63 | 0 | 0 | 0 | | 154 |
| | | | (0.0059) | | | | (–) | (13) | (130) | (113) | (–) | (–) | (–) | | (173) |
| | Leland | all | 0.0020 | | | | | | 299 | 0 | 0 | | | | 299 |
| | | | (0.0045) | | | | | | (669) | (–) | (–) | | | | (669) |
| | West Grand Traverse Bay | all | 0.0056 | | | | 0 | 96 | 0 | 714 | 0 | 0 | 0 | | 810 |
| | | | (0.0052) | | | | (–) | (197) | (–) | (720) | (–) | (–) | (–) | | (746) |
| | East Grand Traverse Bay | all | 0.1441 | | | | 0 | 159 | 6,403 | 1,281 | 0 | 1,933 | 1,046 | | 10,822 |
| | | | (0.0550) | | | | (–) | (170) | (3,422) | (1,473) | (–) | (1,020) | (999) | | (3,993) |
| | Elk Rapids | all | 0.0457 | | | | 0 | 1,612 | 0 | 0 | 392 | 0 | 0 | | 2,004 |
| | | | (0.0632) | | | | (–) | (2,635) | (–) | (–) | (838) | (–) | (–) | | (2,765) |
| | Lake Huron | all | 0.0001 | | | | 0 | 0 | 0 | 312 | 35 | 0 | 0 | | 347 |
| | | | (0.0001) | | | | (–) | (–) | (–) | (299) | (73) | (–) | (–) | | (308) |
| | | boat | 0.0001 | | | | 0 | 0 | 0 | 312 | 35 | 0 | 0 | | 347 |
| | | | (0.0001) | | | | (–) | (–) | (–) | (299) | (73) | (–) | (–) | | (308) |
| | Eagle Bay | all | 0.0001 | | | | 0 | 0 | 0 | 0 | 35 | 0 | | | 35 |
| | | | (0.0002) | | | | (–) | (–) | (–) | (–) | (73) | (–) | | | (73) |
| | Harrisville | all | 0.0008 | | | | | 0 | 0 | 133 | 0 | 0 | 0 | | 133 |
| | | | (0.0013) | | | | | (–) | (–) | (216) | (–) | (–) | (–) | | (216) |
| | Alpena | all | 0.0001 | | | | 0 | 0 | 0 | 7 | 0 | 0 | | | 7 |
| | | | (0.0001) | | | | (–) | (–) | (–) | (9) | (–) | (–) | | | (9) |
| | St. Ignace | boat | 0.0056 | | | | | 0 | 0 | 172 | 0 | 0 | | | 172 |
| | | | (0.0068) | | | | | (–) | (–) | (206) | (–) | (–) | | | (206) |
| | Lake Superior | all | 0.0135 | | | 0 | 626 | 809 | 978 | 15 | 0 | 0 | | | 2,428 |
| | | | (0.0071) | | | (–) | (476) | (605) | (1,008) | (29) | (–) | (–) | | | (1,269) |
| | Ontonagon | all | 0.0025 | | | | | 0 | 53 | 0 | 0 | 0 | | | 53 |
| | | | (0.0036) | | | | | (–) | (77) | (–) | (–) | (–) | | | (77) |
| | Huron Bay | boat | 0.0191 | | | | | 258 | 0 | 0 | 0 | 0 | | | 258 |
| | | | (0.0239) | | | | | (319) | (–) | (–) | (–) | (–) | | | (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 | 0 | 388 | 778 | 0 | 0 | 0 | | | 1,166 |
| | | | (0.0240) | | | (–) | (–) | (471) | (976) | (–) | (–) | (–) | | | (1,084) |
| | Munising | all | 0.0296 | | | | 626 | 163 | 147 | 15 | 0 | 0 | | | 951 |
| | | | (0.0179) | | | | (476) | (206) | (239) | (29) | (–) | (–) | | | (572) |
| 1989 | Keweenaw Bay | ice | 0.0385 | | 3,188 | 0 | | | | | | | | | 3,188 |
| | | | (0.0441) | | (3,572) | (–) | | | | | | | | | (3,572) |
| | Huron Bay | ice | 0.1116 | | 227 | 551 | | | | | | | | | 778 |
| | | | (0.0755) | | (257) | (417) | | | | | | | | | (490) |
| | West Arm Grand Traverse Bay | ice | 0.1045 | | | | | 2,509 | | | | | | | 2,509 |
| | | | (0.1243) | | | | | (2,607) | | | | | | | (2,607) |
| | East Arm Grand Traverse Bay | ice | 0.1993 | | | | | 3,562 | | | | | | | 3,562 |
| | | | (0.1594) | | | | | (2,356) | | | | | | | (2,356) |
| | Lake Michigan | all | 0.0049 | | | 0 | 241 | 2,007 | 297 | 6,200 | 2,682 | 391 | 1,988 | 0 | 13,806 |
| | | | (0.0019) | | | (–) | (508) | (1,777) | (287) | (4,138) | (2,269) | (445) | (756) | (–) | (5,158) |
| | | boat | 0.0058 | | | 0 | 241 | 2,007 | 297 | 6,200 | 2,682 | 391 | 1,988 | 0 | 13,806 |
| | | | (0.0022) | | | (–) | (508) | (1,777) | (387) | (4,138) | (2,269) | (445) | (756) | (–) | (5,158) |
| | Elk Rapids | all | 0.0733 | | | | 0 | 1,767 | 0 | 0 | 574 | 0 | 924 | | 3,265 |
| | | | (0.0496) | | | | (–) | (1,760) | (–) | (–) | (1,235) | (–) | (341) | | (2,177) |
| | East Grand Traverse Bay | all | 0.1279 | | | | 241 | 168 | 297 | 5,509 | 1,551 | 391 | 1,064 | | 9,221 |
| | | | (0.0646) | | | | (508) | (219) | (387) | (4,055) | (1,813) | (445) | (675) | | (4,565) |
| | West Grand Traverse Bay | all | 0.0103 | | | | 0 | 72 | 0 | 691 | 557 | 0 | 0 | | 1,320 |
| | | | (0.0080) | | | | (–) | (105) | (–) | (824) | (581) | (–) | (–) | | (1,014) |
| | Traverse Bay | boat | 0.0024 | | | | | 0 | 20 | 0 | 0 | 0 | | | 20 |
| | | | (0.0050) | | | | | (–) | (41) | (–) | (–) | (–) | | | (41) |
| | Huron Bay | boat | 0.1174 | | | | | 1,435 | 0 | 0 | 0 | 0 | | | 1,435 |
| | | | (0.1099) | | | | | (1,318) | (–) | (–) | (–) | (–) | | | (1,318) |
| 1990 | Little Bay de Noc | ice | 0.0000 | 0 | 0 | 9 | | | | | | | | | 9 |
| | | | (0.0000) | (–) | (–) | (19) | | | | | | | | | (19) |
| | Keweenaw Bay | ice | 0.0096 | | | 106 | | | | | | | | | 106 |
| | | | (0.0194) | | | (212) | | | | | | | | | (212) |
| | Lake Michigan | all | 0.0060 | | | 0 | 0 | 1,207 | 1,209 | 1,356 | 4,429 | 32 | 3,875 | 0 | 12,108 |
| | | | (0.0025) | | | (–) | (–) | (998) | (1,552) | (971) | (3,036) | (66) | (3,220) | (–) | (4,893) |
| | | boat | 0.0071 | | | 0 | 0 | 1,207 | 1,120 | 1,356 | 4,429 | 32 | 3,875 | | 12,019 |
| | | | (0.0029) | | | (–) | (–) | (998) | (1,541) | (971) | (3,036) | (66) | (3,220) | | (4,889) |
| | | shore | 0.0015 | | | | 0 | 0 | 89 | 0 | 0 | 0 | 0 | 0 | 89 |
| | | | (0.0031) | | | | (–) | (–) | (181) | (–) | (–) | (–) | (–) | (–) | (181) |
| | Elk Rapids | all | 0.0634 | | | | | 191 | 89 | 0 | 0 | 0 | 2,219 | | 2,499 |
| | | | (0.0790) | | | | | (104) | (181) | (–) | (–) | (–) | (3,095) | | (3,102) |
| | East Arm Grand Traverse Bay | all | 0.1824 | | | | | 985 | 1,114 | 883 | 4,264 | 32 | 1,656 | | 8,934 |
| | | | (0.0793) | | | | | (991) | (1,541) | (767) | (3,021) | (66) | (887) | | (3,723) |
| | West Arm Grand Traverse Bay | all | 0.0074 | | | | 0 | 31 | 0 | 473 | 165 | 0 | 0 | | 669 |
| | | | (0.0074) | | | | (–) | (63) | (–) | (596) | (297) | (–) | (–) | | (669) |

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 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | | 6 |
| | | | (0.0000) | | | (–) | (–) | (–) | (14) | (–) | (–) | (–) | (–) | | (14) |
| | Lake Superior | all | 0.0062 | | | | | 85 | 200 | 83 | 0 | 0 | 348 | | 716 |
| | | | (0.0049) | | | | | (102) | (365) | (162) | (–) | (–) | (390) | | (567) |
| | Black River Harbor | all | 0.0003 | | | | 0 | 0 | 0 | 3 | 0 | 0 | 0 | | 3 |
| | | | (0.0006) | | | | 0 | (–) | (–) | (6) | (–) | (–) | (–) | | (6) |
| | Traverse Bay | boat | 0.0013 | | | | | 15 | 0 | 0 | 0 | | | | 15 |
| | | | (0.0018) | | | | | (21) | (–) | (–) | (–) | | | | (21) |
| | Presque Isle Harbor | all | 0.0103 | | | | | 70 | 200 | 80 | 0 | 0 | 17 | | 367 |
| | | | (0.0116) | | | | | (100) | (365) | (162) | (–) | (–) | (34) | | (413) |
| | Marquette Lower Harbor | all | 0.0261 | | | | | 0 | 0 | 0 | 0 | 0 | 331 | | 331 |
| | | | (0.0311) | | | | | (–) | (–) | (–) | (–) | (–) | (389) | | (389) |
| | Rogers City | all | 0.0001 | | | | | | 0 | 12 | 0 | 0 | | | 12 |
| | | | (0.0002) | | | | | | (–) | (25) | (–) | (–) | | | (25) |
| 1991 | Keweenaw Bay | ice | 0.0029 | | 218 | 49 | | | | | | | | | 267 |
| | | | (0.0026) | | (223) | (70) | | | | | | | | | (234) |
| | Marquette | ice | 0.0080 | | | 44 | | | | | | | | | 44 |
| | | | (0.0070) | | | (38) | | | | | | | | | (38) |
| | Munising | ice | 0.1283 | | 1,738 | 886 | | | | | | | | | 2,624 |
| | | | (0.0682) | | (1,207) | (652) | | | | | | | | | (1,372) |
| | Lake Michigan | all | 0.0046 | | | 38 | 13 | 1,272 | 201 | 2,187 | 5,356 | 726 | 991 | 0 | 10,784 |
| | | | (0.0017) | | | (59) | (26) | (902) | (257) | (1,494) | (3,502) | (481) | (503) | (–) | (3,983) |
| | | boat | 0.0054 | | | 5 | 13 | 1,272 | 201 | 2,187 | 5,356 | 726 | 991 | | 10,751 |
| | | | (0.0020) | | | (15) | (26) | (902) | (257) | (1,494) | (3,502) | (481) | (503) | | (3,983) |
| | | pier | 0.0001 | | | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 |
| | | | (0.0002) | | | (57) | (–) | (–) | (–) | (–) | (–) | (–) | (–) | (–) | (57) |
| | New Buffalo | all | 0.0000 | | | 5 | 0 | 0 | 0 | 0 | 0 | 0 | | | 5 |
| | | | (0.0000) | | | (15) | (–) | (–) | (–) | (–) | (–) | (–) | | | (15) |
| | St. Joe | all | 0.0001 | | | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 33 |
| | | | (0.0002) | | | (57) | (–) | (–) | (–) | (–) | (–) | (–) | (–) | | (57) |
| | West Arm Grand Traverse Bay | all | 0.0058 | | | | 13 | 0 | 174 | 452 | 16 | 0 | 0 | | 655 |
| | | | (0.0063) | | | | (26) | (–) | (251) | (668) | (31) | (–) | (–) | | (715) |
| | East Arm Grand Traverse Bay | all | 0.1253 | | | | 0 | 103 | 27 | 1,735 | 5,340 | 174 | 942 | | 8,321 |
| | | | (0.0587) | | | | (–) | (212) | (54) | (1,336) | (3,502) | (273) | (490) | | (3,796) |
| | Elk Rapids | all | 0.0529 | | | | 0 | 1,169 | 0 | 0 | 0 | 552 | 49 | | 1,770 |
| | | | (0.0294) | | | | (–) | (877) | (–) | (–) | (–) | (396) | (112) | | (969) |
| | Lake Huron | all | 0.0000 | | | | 0 | 0 | 0 | 67 | 11 | 8 | 0 | | 86 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (74) | (25) | (17) | (–) | | (80) |
| | | boat | 0.0000 | | | | 0 | 0 | 0 | 67 | 11 | 8 | 0 | | 86 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (74) | (25) | (17) | (–) | | (80) |
| | Rogers City | boat | 0.0001 | | | | | | 0 | 9 | 0 | 0 | | | 9 |
| | | | (0.0002) | | | | | | (–) | (19) | (–) | (–) | | | (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 | 0 | 3 | 0 | 0 | 0 | | 3 |
| | | | (0.0000) | | | | | (–) | (–) | (7) | (–) | (–) | (–) | | (7) |
| | Alpena | all | 0.0000 | | | | 0 | 0 | 0 | 2 | 0 | 0 | 0 | | 2 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (5) | (–) | (–) | (–) | | (5) |
| | Harrisville | boat | 0.0002 | | | | | 0 | 0 | 15 | 0 | 0 | 0 | | 15 |
| | | | (0.0005) | | | | | (–) | (–) | (34) | (–) | (–) | (–) | | (34) |
| | Oscoda | all | 0.0003 | | | | | 0 | 0 | 38 | 0 | 8 | 0 | | 46 |
| | | | (0.0004) | | | | | (–) | (–) | (62) | (–) | (17) | (–) | | (64) |
| | Eagle Bay to Harbor Beach | all | 0.0001 | | | | 0 | 0 | 0 | 0 | 11 | 0 | 0 | | 11 |
| | | | (0.0002) | | | | (–) | (–) | (–) | (–) | (25) | (–) | (–) | | (25) |
| | St. Marys River | all | 0.0003 | | | | | 0 | 0 | 191 | 13 | 0 | 0 | | 204 |
| | | | (0.0006) | | | | | (–) | (–) | (394) | (27) | (–) | (–) | | (395) |
| | Sault Ste. Marie to Neebish Isl. | All | 0.0027 | | | | | 0 | 0 | 191 | 13 | 0 | 0 | | 204 |
| | | | (0.0053) | | | | | (–) | (–) | (394) | (27) | (–) | (–) | | (395) |
| | Lake Superior | all | 0.0074 | | | | 267 | 516 | 291 | 17 | 0 | 43 | 395 | | 1,529 |
| | | | (0.0034) | | | | (207) | (511) | (367) | (35) | (–) | (85) | (219) | | (704) |
| | Keweenaw Bay | boat | 0.0353 | | | | | 115 | | | | | | | 115 |
| | | | (0.0319) | | | | | (102) | | | | | | | (102) |
| | Marquette | all | 0.0083 | | | | 103 | 165 | 0 | 17 | 0 | 43 | 395 | | 723 |
| | | | (0.0039) | | | | (99) | (212) | (–) | (35) | (–) | (85) | (219) | | (333) |
| | Munising | all | 0.0216 | | | | 164 | 236 | 291 | 0 | 0 | 0 | | | 691 |
| | | | (0.0192) | | | | (182) | (454) | (367) | (–) | (–) | (–) | | | (611) |
| | Dead River | shore | 0.0061 | | | | | 0 | 0 | 0 | 0 | 0 | 51 | | 51 |
| | | | (0.0123) | | | | | (–) | (–) | (–) | (–) | (–) | (103) | | (103) |
| 1992 | Keweenaw Bay | ice | 0.0100 | | 235 | 110 | | | | | | | | | 345 |
| | | | (0.0115) | | (322) | (226) | | | | | | | | | (393) |
| | Marquette | winter boat | 0.0352 | | | 278 | | | | | | | | | 278 |
| | | | (0.0289) | | | (225) | | | | | | | | | (225) |
| | Munising | ice | 0.1709 | | 4,755 | 1,107 | | | | | | | | | 5,862 |
| | | | (0.0658) | | (1,906) | (964) | | | | | | | | | (2,136) |
| | Lake Michigan | all | 0.0022 | | | 23 | 123 | 307 | 137 | 565 | 3,613 | 13 | 220 | | 5,001 |
| | | | (0.0013) | | | (34) | (111) | (418) | (161) | (674) | (2,895) | (26) | (237) | | (3,018) |
| | | boat | 0.0026 | | | 9 | 123 | 307 | 137 | 565 | 3,613 | 13 | 220 | | 4,987 |
| | | | (0.0016) | | | (19) | (111) | (418) | (161) | (674) | (2,895) | (26) | (237) | | (3,018) |
| | | pier | 0.0000 | | | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 14 |
| | | | (0.0000) | | | (28) | (–) | (–) | (–) | (–) | (–) | (–) | (–) | | (28) |
| | Elk Rapids | all | 0.0065 | | | | 0 | 0 | 0 | 0 | 240 | 0 | 0 | | 240 |
| | | | (0.0136) | | | | (–) | (–) | (–) | (–) | (500) | (–) | (–) | | (500) |
| | East Arm Grand Traverse Bay | all | 0.0849 | | | | 123 | 56 | 97 | 523 | 3,373 | 0 | 220 | | 4,392 |
| | | | (0.0575) | | | | (111) | (88) | (139) | (669) | (2,851) | (–) | (237) | | (2,945) |
| | West Arm Grand Traverse Bay | all | 0.0037 | | | | 0 | 251 | 40 | 42 | 0 | 13 | 0 | | 346 |
| | | | (0.0046) | | | | (–) | (409) | (81) | (84) | (–) | (26) | (–) | | (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 | | | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 23 |
| | | | (0.0001) | | | (34) | (–) | (–) | (–) | (–) | (–) | (–) | (–) | | (34) |
| | Lake Huron | all | 0.0000 | | | | 0 | 0 | 0 | 25 | 36 | 0 | 0 | | 61 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (55) | (76) | (–) | (–) | | (94) |
| | | boat | 0.0000 | | | | 0 | 0 | 0 | 25 | 36 | 0 | 0 | | 61 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (55) | (76) | (–) | (–) | | (94) |
| | Oscoda | all | 0.0004 | | | | | 0 | 0 | 25 | 36 | 0 | 0 | | 61 |
| | | | (0.0006) | | | | | (–) | (–) | (55) | (76) | (–) | (–) | | (94) |
| | Lake Superior | all | 0.0055 | | | | 306 | 279 | 375 | 12 | 0 | 37 | 90 | | 1,099 |
| | | | (0.0033) | | | | (293) | (323) | (457) | (24) | (–) | (59) | (123) | | (647) |
| | Ontonagon | boat | 0.0060 | | | | | 26 | 177 | 12 | 0 | 0 | | | 215 |
| | | | (0.0101) | | | | | (53) | (356) | (24) | (–) | (–) | | | (361) |
| | Keweenaw Bay | all | 0.0014 | | | | | 19 | 0 | 0 | 0 | 0 | 0 | | 19 |
| | | | (0.0015) | | | | | (20) | (–) | (–) | (–) | (–) | (–) | | (20) |
| | Marquette | all | 0.0070 | | | | 243 | 234 | 0 | 0 | 0 | 0 | 90 | | 567 |
| | | | (0.0055) | | | | (282) | (318) | (–) | (–) | (–) | (–) | (123) | | (442) |
| | Munising Bay | all | 0.0113 | | | | 63 | 0 | 198 | 0 | 0 | 37 | | | 298 |
| | | | (0.0116) | | | | (80) | (–) | (286) | (–) | (–) | (59) | | | (303) |
| 1993 | Keweenaw Bay | ice | 0.0063 | | 358 | 46 | | | | | | | | | 404 |
| | | | (0.0038) | | (227) | (74) | | | | | | | | | (239) |
| | Marquette | winter | 0.0032 | | | 11 | | | | | | | | | 11 |
| | | | (0.0056) | | | (19) | | | | | | | | | (19) |
| | Munising Bay | ice | 0.0805 | | 1,343 | 419 | 311 | | | | | | | | 2,073 |
| | | | (0.0580) | | (1,227) | (339) | (331) | | | | | | | | (1,315) |
| | Quanicassee to Sebewaing | | 0.0002 | 0 | 0 | 6 | | | | | | | | | 6 |
| | | | (0.0004) | (–) | (–) | (11) | | | | | | | | | (11) |
| | Lake Michigan | all | 0.0010 | | | | 0 | 641 | 975 | 624 | 95 | 18 | 185 | | 2,538 |
| | | | (0.0005) | | | | (–) | (675) | (550) | (826) | (137) | (36) | (196) | | (1,224) |
| | | boat | 0.0011 | | | | 0 | 641 | 975 | 624 | 95 | 18 | 185 | | 2,538 |
| | | | (0.0005) | | | | (–) | (675) | (550) | (826) | (137) | (36) | (196) | | (1,224) |
| | Manistee | all | 0.0002 | | | | 0 | 0 | 0 | 58 | 0 | 0 | 0 | | 58 |
| | | | (0.0004) | | | | (–) | (–) | (–) | (118) | (–) | (–) | (–) | | (118) |
| | West Grand Traverse Bay | all | 0.0085 | | | | 0 | 0 | 691 | 27 | 0 | 0 | 0 | | 718 |
| | | | (0.0059) | | | | (–) | (–) | (491) | (55) | (–) | (–) | (–) | | (494) |
| | East Grand Traverse Bay | all | 0.0212 | | | | 0 | 405 | 217 | 0 | 95 | 18 | 126 | | 861 |
| | | | (0.0144) | | | | (–) | (490) | (207) | (–) | (137) | (36) | (175) | | (578) |
| | Elk Rapids | all | 0.0190 | | | | 0 | 236 | 67 | 539 | 0 | 0 | 59 | | 901 |
| | | | (0.0202) | | | | (–) | (464) | (137) | (816) | (–) | (–) | (89) | | (953) |
| | Lake Huron | all | 0.0000 | | | | 0 | 0 | 0 | 5 | 3 | 0 | 0 | | 8 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (10) | (7) | (–) | (–) | | (12) |
| | | boat | 0.0000 | | | | 0 | 0 | 0 | 5 | 3 | 0 | 0 | | 8 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (10) | (7) | (–) | (–) | | (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 | 0 | 0 | 5 | 0 | 0 | 0 | | 5 |
| | | | (0.0002) | | | | (–) | (–) | (–) | (10) | (–) | (–) | (–) | | (10) |
| | Harrisville | all | 0.0000 | | | | | | 0 | 0 | 3 | 0 | 0 | | 3 |
| | | | (0.0000) | | | | | | (–) | (–) | (7) | (–) | (–) | | (7) |
| | Lake Superior | all | 0.0084 | | | | 135 | 50 | 157 | 67 | 0 | 67 | 1,242 | | 1,718 |
| | | | (0.0040) | | | | (158) | (73) | (192) | (156) | (–) | (133) | (754) | | (823) |
| | Ontonagon | boat | 0.0019 | | | | | 20 | 40 | 0 | 0 | 0 | | | 60 |
| | | | (0.0024) | | | | | (41) | (65) | (–) | (–) | (–) | | | (77) |
| | Traverse Bay | all | 0.0067 | | | | | 0 | 0 | 67 | 0 | 0 | 23 | | 67 |
| | | | (0.0159) | | | | | (–) | (–) | (156) | (–) | (–) | (52) | | (156) |
| | Marquette | all | 0.0182 | | | | 63 | 30 | 29 | 0 | 0 | 0 | 1,242 | | 1,364 |
| | | | (0.0103) | | | | (128) | (60) | (43) | (–) | (–) | (–) | (754) | | (768) |
| | Munising Bay | all | 0.0062 | | | | 72 | 0 | 88 | 0 | 0 | 67 | | | 227 |
| | | | (0.0065) | | | | (93) | (–) | (176) | (–) | (–) | (133) | | | (239) |
| 1994 | Keweenaw Bay | ice | 0.0042 | 348 | 53 | 7 | 0 | | | | | | | | 408 |
| | | | (0.0033) | (301) | (107) | (14) | (–) | | | | | | | | (320) |
| | Marquette | ice | 0.0030 | | | 10 | | | | | | | | | 10 |
| | | | (0.0054) | | | (18) | | | | | | | | | (18) |
| | Munising Bay | ice | 0.0175 | | 282 | 128 | | | | | | | | | 410 |
| | | | (0.0132) | | (225) | (206) | | | | | | | | | (305) |
| | Lake Michigan | all | 0.0018 | | | 0 | 34 | 1,674 | 1,164 | 68 | 169 | 0 | 1,082 | | 4,191 |
| | | | (0.0006) | | | (–) | (51) | (822) | (958) | (108) | (197) | (–) | (531) | | (1,389) |
| | Grand Haven | all | 0.0000 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 5 | | 5 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (–) | (–) | (–) | (11) | | (11) |
| | Muskegon | all | 0.0002 | | | | 16 | 0 | 0 | 0 | 0 | 0 | 0 | | 16 |
| | | | (0.0004) | | | | (35) | (–) | (–) | (–) | (–) | (–) | (–) | | (35) |
| | Manistee | all | 0.0001 | | | | 18 | 0 | 0 | 0 | 0 | 0 | 0 | | 18 |
| | | | (0.0002) | | | | (37) | (–) | (–) | (–) | (–) | (–) | (–) | | (37) |
| | West Arm Grand Traverse Bay | all | 0.0040 | | | | 0 | 253 | 0 | 51 | 0 | 0 | 0 | | 304 |
| | | | (0.0048) | | | | (–) | (350) | (–) | (103) | (–) | (–) | (–) | | (365) |
| | East Arm Grand Traverse Bay | all | 0.0633 | | | | 0 | 1,298 | 1,079 | 17 | 169 | 0 | 1,077 | | 3,640 |
| | | | (0.0232) | | | | (–) | (700) | (941) | (34) | (197) | (–) | (531) | | (1,303) |
| | Elk Rapids | all | 0.0049 | | | | 0 | 123 | 85 | 0 | 0 | 0 | 0 | | 208 |
| | | | (0.0073) | | | | (–) | (252) | (178) | (–) | (–) | (–) | (–) | | (309) |
| | Lake Huron | all | 0.0000 | | | | 28 | 0 | 0 | 0 | 4 | 0 | 0 | | 32 |
| | | | (0.0000) | | | | (42) | (–) | (–) | (–) | (9) | (–) | (–) | | (43) |
| | Alpena | all | 0.0000 | | | | 2 | 0 | 0 | 0 | 0 | 0 | 0 | | 2 |
| | | | (0.0000) | | | | (5) | (–) | (–) | (–) | (–) | (–) | (–) | | (5) |
| | Harrisville | all | 0.0000 | | | | | | 0 | 0 | 4 | 0 | 0 | | 4 |
| | | | (0.0000) | | | | | | (–) | (–) | (9) | (–) | (–) | | (9) |
| | Tawas | all | 0.0001 | | | | 6 | 0 | 0 | 0 | 0 | 0 | 0 | | 6 |
| | | | (0.0002) | | | | (13) | (–) | (–) | (–) | (–) | (–) | (–) | | (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 | | | | 20 | 0 | 0 | 0 | 0 | 0 | 0 | | 20 |
| | | | (0.0002) | | | | (40) | (–) | (–) | (–) | (–) | (–) | (–) | | (40) |
| | Lake Superior | all | 0.0068 | | | | 286 | 543 | 2 | 0 | 0 | 0 | 104 | | 935 |
| | | | (0.0036) | | | | (205) | (442) | (5) | (–) | (–) | (–) | (73) | | (493) |
| | Black River Harbor | all | 0.0035 | | | | 0 | 17 | 0 | 0 | 0 | 0 | 0 | | 17 |
| | | | (0.0072) | | | | (–) | (35) | (–) | (–) | (–) | (–) | (–) | | (35) |
| | Marquette | all | 0.0129 | | | | 174 | 408 | 2 | 0 | 0 | 0 | 104 | | 688 |
| | | | (0.0083) | | | | (154) | (408) | (5) | (–) | (–) | (–) | (73) | | (442) |
| | Munising | all | 0.0123 | | | | 112 | 118 | 0 | 0 | 0 | 0 | | | 230 |
| | | | (0.0116) | | | | (136) | (166) | (–) | (–) | (–) | (–) | | | (215) |
| 1995 | Keweenaw Bay | ice | 0.0003 | 0 | 10 | 0 | | | | | | | | | 10 |
| | | | (0.0006) | (–) | (21) | (–) | | | | | | | | | (21) |
| | Munising Bay | ice | 0.2355 | | 2,371 | 379 | 0 | 2,750 | | | | | | | 2,750 |
| | | | (0.1536) | | (1,688) | (328) | (–) | (1,720) | | | | | | | (1,720) |
| | Lake Michigan | all | 0.0022 | | | 167 | 482 | 2,001 | 295 | 1,507 | 113 | 17 | 31 | | 4,613 |
| | | | (0.0009) | | | (190) | (598) | (1,167) | (288) | (1,185) | (126) | (34) | (39) | | (1,806) |
| | St. Joeseph-Benton Harbor | all | 0.0008 | | | 167 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 167 |
| | | | (0.0009) | | | (190) | (–) | (–) | (–) | (–) | (–) | (–) | (–) | | (190) |
| | South Haven | all | 0.0000 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 8 | | 8 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (–) | (–) | (–) | (16) | | (16) |
| | West Arm Grand Traverse Bay | all | 0.0076 | | | | 426 | 0 | 0 | 243 | 53 | 0 | 0 | | 722 |
| | | | (0.0082) | | | | (590) | (–) | (–) | (490) | (107) | (–) | (–) | | (774) |
| | East Arm Grand Traverse Bay | all | 0.0515 | | | | 56 | 2,001 | 292 | 370 | 53 | 17 | 23 | | 2,812 |
| | | | (0.0245) | | | | (94) | (1,167) | (288) | (518) | (65) | (34) | (36) | | (1,315) |
| | Elk Rapids | all | 0.0243 | | | | 0 | 0 | 0 | 894 | 0 | 0 | 0 | | 894 |
| | | | (0.0259) | | | | (–) | (–) | (–) | (946) | (–) | (–) | (–) | | (946) |
| | Petoskey | all | 0.0004 | | | | | 0 | 3 | 0 | 7 | 0 | | | 10 |
| | | | (0.0006) | | | | | (–) | (6) | (–) | (14) | (–) | | | (15) |
| | Lake Huron | all | 0.0000 | | | | 0 | 19 | 0 | 24 | 17 | 17 | 0 | | 77 |
| | | | (0.0000) | | | | (–) | (39) | (–) | (32) | (29) | (27) | (–) | | (64) |
| | Rogers City | all | 0.0001 | | | | | 0 | 0 | 13 | 2 | 0 | | | 15 |
| | | | (0.0002) | | | | | (–) | (–) | (26) | (4) | (–) | | | (26) |
| | Rockport | all | 0.0002 | | | | | 0 | 0 | 0 | 15 | 0 | | | 15 |
| | | | (0.0004) | | | | | (–) | (–) | (–) | (29) | (–) | | | (29) |
| | Alpena | all | 0.0000 | | | | 0 | 0 | 0 | 2 | 0 | 0 | 0 | | 2 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (4) | (–) | (–) | (–) | | (4) |
| | Harrisville | all | 0.0001 | | | | | 0 | 0 | 9 | 0 | 0 | 0 | | 9 |
| | | | (0.0002) | | | | | (–) | (–) | (19) | (–) | (–) | (–) | | (19) |
| | Oscoda | all | 0.0002 | | | | | 19 | 0 | 0 | 0 | 17 | 0 | | 36 |
| | | | (0.0003) | | | | | (39) | (–) | (–) | (–) | (27) | (–) | | (47) |
| | Lake Superior | all | 0.0111 | | | | 376 | 273 | 0 | 0 | 0 | 6 | 820 | | 1,475 |
| | | | (0.0041) | | | | (298) | (294) | (–) | (–) | (–) | (11) | (333) | | (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 | | | | 376 | 189 | 0 | 0 | 0 | 0 | 820 | | 1,385 |
| | | | (0.0105) | | | | (298) | (239) | (–) | (–) | (–) | (–) | (333) | | (507) |
| | Munising Bay | all | 0.0059 | | | | 0 | 84 | 0 | 0 | 0 | 6 | | | 90 |
| | | | (0.0112) | | | | (–) | (171) | (–) | (–) | (–) | (11) | | | (171) |
| 1996 | Little Bay de Noc | ice | 0.0002 | 0 | 0 | 27 | | | | | | | | | 27 |
| | | | (0.0003) | (–) | (–) | (41) | | | | | | | | | (41) |
| | Keweenaw Bay | ice | 0.0016 | 97 | 0 | 0 | | | | | | | | | 97 |
| | | | (0.0023) | (137) | (–) | (–) | | | | | | | | | (137) |
| | Marquette | ice | 0.0009 | | | 2 | | | | | | | | | 2 |
| | | | (0.0018) | | | (4) | | | | | | | | | (4) |
| | Munising Bay | ice | 0.0356 | | 379 | 324 | | | | | | | | | 703 |
| | | | (0.0197) | | (291) | (249) | | | | | | | | | (383) |
| | Lake Michigan | all | 0.0049 | | | 251 | 339 | 474 | 4,996 | 1,243 | 0 | 0 | 3,860 | | 11,163 |
| | | | (0.0019) | | | (165) | (219) | (427) | (3,559) | (1,548) | (–) | (–) | (1,529) | | (4,202) |
| | St. Joseph-Benton Harbor | all | 0.0032 | | | 251 | 326 | 0 | 0 | 0 | 0 | 0 | 0 | | 577 |
| | | | (0.0016) | | | (165) | (217) | (–) | (–) | (–) | (–) | (–) | (–) | | (273) |
| | Grand Haven | all | 0.0000 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 3 | | 3 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (–) | (–) | (–) | (7) | | (7) |
| | Ludington | all | 0.0004 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 93 | | 93 |
| | | | (0.0008) | | | | (–) | (–) | (–) | (–) | (–) | (–) | (190) | | (190) |
| | Elk Rapids | all | 0.1213 | | | | 0 | 0 | 0 | 1,133 | 0 | 0 | 3,764 | | 4,897 |
| | | | (0.0547) | | | | (–) | (–) | (–) | (1,539) | (–) | (–) | (1,517) | | (2,161) |
| | East Grand Traverse Bay | all | 0.1234 | | | | 0 | 435 | 4,996 | 35 | 0 | 0 | 0 | | 5,466 |
| | | | (0.0822) | | | | (–) | (420) | (3,559) | (72) | (–) | (–) | (–) | | (3,584) |
| | West Grand Traverse Bay | all | 0.0013 | | | | 13 | 39 | 0 | 75 | 0 | 0 | 0 | | 127 |
| | | | (0.0018) | | | | (27) | (79) | (–) | (152) | (–) | (–) | (–) | | (173) |
| | Lake Superior | all | 0.0032 | | | | 52 | 76 | 132 | 26 | 0 | 0 | 213 | | 499 |
| | | | (0.0020) | | | | (41) | (86) | (265) | (56) | (–) | (–) | (123) | | (312) |
| | Marquette | all | 0.0051 | | | | 27 | 22 | 0 | 26 | 0 | 0 | 213 | | 288 |
| | | | (0.0026) | | | | (30) | (38) | (–) | (56) | (–) | (–) | (123) | | (144) |
| | Munising | all | 0.0098 | | | | 25 | 54 | 132 | 0 | 0 | 0 | | | 211 |
| | | | (0.0129) | | | | (28) | (77) | (265) | (–) | (–) | (–) | | | (277) |
| | Lake Huron | all | 0.0001 | | | | 2 | 0 | 16 | 48 | 81 | 20 | 18 | | 185 |
| | | | (0.0001) | | | | (4) | (–) | (25) | (61) | (159) | (41) | (37) | | (181) |
| | Harbor Beach | all | 0.0002 | | | | | 0 | 0 | 0 | 0 | 20 | 0 | | 20 |
| | | | (0.0004) | | | | | (–) | (–) | (–) | (–) | (41) | (–) | | (41) |
| | Saginaw Bay | all | 0.0000 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 18 | | 18 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (–) | (–) | (–) | (37) | | (37) |
| | Au Gres | all | 0.0000 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 18 | | 18 |
| | | | (0.0000) | | | | (–) | (–) | (–) | (–) | (–) | (–) | (37) | | (37) |
| | Oscoda | all | 0.0007 | | | | | 0 | 0 | 36 | 81 | 0 | 0 | | 117 |
| | | | (0.0010) | | | | | (–) | (–) | (58) | (159) | (–) | (–) | | (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 | | | | 2 | 0 | 16 | 3 | 0 | 0 | 0 | | 21 |
| | | | (0.0002) | | | | (4) | (–) | (25) | (7) | (–) | (–) | (–) | | (26) |
| | Rockport | all | 0.0001 | | | | | 0 | 0 | 9 | 0 | 0 | | | 9 |
| | | | (0.0002) | | | | | (–) | (–) | (18) | (–) | (–) | | | (18) |

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

| | | | Total length (mm) | | | Dressed weight (gm) | | |
|---|---|---|---|---|---|---|---|---|
| Fishing area | Year | Age | N | Mean | ± Factor | N | Mean | ± 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) N | Total length (mm) Mean | Total length (mm) ± Factor | Dressed weight (gm) N | Dressed weight (gm) Mean | Dressed weight (gm) ± 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) N | Total length (mm) Mean | Total length (mm) ± Factor | Dressed weight (gm) N | Dressed weight (gm) Mean | Dressed weight (gm) ± 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) N | Total length (mm) Mean | Total length (mm) ± Factor | Dressed weight (gm) N | Dressed weight (gm) Mean | Dressed weight (gm) ± 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) N | Total length (mm) Mean | Total length (mm) ± Factor | Dressed weight (gm) N | Dressed weight (gm) Mean | Dressed weight (gm) ± 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 | | |
| | | 16 | 1 | 739 | | 0 | | |
| | | 17 | 1 | 643 | | 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) N | Total length (mm) Mean | Total length (mm) ± Factor | Dressed weight (gm) N | Dressed weight (gm) Mean | Dressed weight (gm) ± 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) N | Total length (mm) Mean | Total length (mm) ± Factor | Dressed weight (gm) N | Dressed weight (gm) Mean | Dressed weight (gm) ± 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 | | |
| | | 13 | 3 | 729 | 54 | 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 |
| | | 16 | 1 | 690 | | 1 | 2,810 | |
| | 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 ± Factor for 95% confidence interval) of lake whitefish sampled from sport fisheries in Lake Superior, and Grand Traverse Bay, Lake Michigan.

| | | | Total length (mm) | | | Dressed weight (gm) | | |
|---|---|---|---|---|---|---|---|---|
| Fishing area | Year | Age | N | Mean | ± Factor | N | Mean | ± 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) N | Total length (mm) Mean | Total length (mm) ± Factor | Dressed weight (gm) N | Dressed weight (gm) Mean | Dressed weight (gm) ± 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) N | Total length (mm) Mean | Total length (mm) ± Factor | Dressed weight (gm) N | Dressed weight (gm) Mean | Dressed weight (gm) ± 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 | |
| | | 13 | 1 | 511 | | 1 | 1,134 | |
| | | 14 | 2 | 510 | 400 | 2 | 1,089 | 2,878 |
| | 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) N | Total length (mm) Mean | Total length (mm) ± Factor | Dressed weight (gm) N | Dressed weight (gm) Mean | Dressed weight (gm) ± 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 | 42 |
| | | 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 | 78 |
| | | 4 | 4 | 292 | 50 | 4 | 193 | 137 |
| | | 5 | 4 | 325 | 33 | 4 | 273 | 84 |

Appendix 3.–Continued.

| Fishing area | Year | Age | Total length (mm) N | Total length (mm) Mean | Total length (mm) ± Factor | Dressed weight (gm) N | Dressed weight (gm) Mean | Dressed weight (gm) ± 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) N | Total length (mm) Mean | Total length (mm) ± Factor | Dressed weight (gm) N | Dressed weight (gm) Mean | Dressed weight (gm) ± 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 | 1181 | 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 | |