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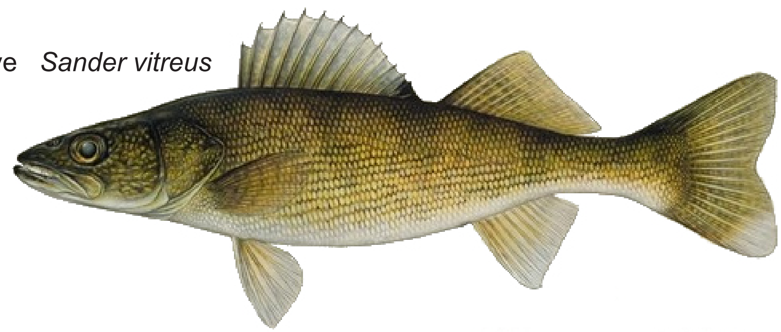
Ecology, Management, and Status of Walleye, Sauger, and Yellow Perch in Michigan

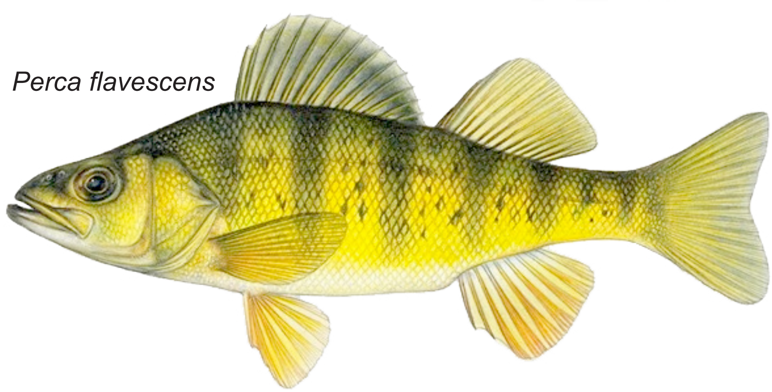
James C. Schneider,
Richard P. O'Neal
and
Richard D. Clark, Jr.

Walleye *Sander vitreus*



Sauger *Sander canadensis*

Yellow Perch *Perca flavescens*



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Ecology, Management, and Status of Walleye, Sauger, and Yellow Perch in Michigan

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Introduction

Walleye *Sander vitreus,* sauger *Sander canadensis,* and yellow perch *Perca flavescens* are related species in the fish family Percidae. Walleyes are common throughout most of Michigan and the Upper Midwest. They attain the largest size of all the species in this family and are highly valued for their food, recreation, and trophy qualities. Saugers, which are similar to but smaller than walleyes, are also potentially valuable, but they have a very limited presence in Michigan and are officially listed as "threatened" by the state. The yellow perch is a ubiquitous and very important panfish and forage fish that likewise commands a high price at fish markets when available. Also belonging to the percid family are many species of darters, small fishes that grow to only a few inches in length. The darters have no sport or commercial value and are not endangered in Michigan; they will not be discussed further in this report.

A survey of Michigan anglers in 1983 (Latta 1990), found walleyes and yellow perch were among the top three species of fish sought (47% and 65%, respectively), and were the most preferred species for eating (26% each). In 2001, an estimated $838,558,000 and 19,320,000 angler-days were spent fishing for all species in Michigan (USFWS and USBOC 2002). An estimated 8,114,000 angler-days were spent fishing for panfish (this includes yellow perch) in Michigan with an economic value of approximately $349 million. There were an estimated 3,383,000 angler-days spent fishing for walleyes, with an economic value of approximately $145 million.

Ecology

The ecology of walleye, sauger, and yellow perch has been described by Colby et al. (1979), Trautman (1981), Carlander (1997), and Scott and Crossman (1998). Here, we summarize the general information from these references and emphasize the most important aspects of their ecology in Michigan.

Walleye, sauger, and yellow perch are classified as coolwater fish, which means they thrive in waters with intermediate temperatures and grow best at 70° to 82° F. Typical waters for walleyes and saugers are larger lakes and rivers of medium to low transparency. Transparency is a factor because their eyes are adapted for low light conditions and they avoid bright light. Yellow perch are a very adaptable species and can be found in nearly every pond, bog, lake, and sluggish river in Michigan. Walleyes are not likely to be found in waters of pH less than 6 and dissolved oxygen content of less than 2 ppm. Yellow perch can tolerate a pH as low as 4.2 and a dissolved oxygen content of less than

2 ppm. Consequently, yellow perch persist in acidic and winterkill (low dissolved oxygen) waters not tolerated by most fishes. Adult walleyes and saugers are primarily fish-eating predators, and suitable habitat must contain forage fish such as yellow perch, cisco *Coregonus artedi*, or various minnows. The diet of yellow perch is more flexible and adults can thrive on either fish or invertebrates. All three species require a progression of food types from zooplankton to benthic invertebrates as they develop from larval sizes through juvenile stages.

Walleye

Distinguishing characteristics of walleyes include cloudy eyes and white tips on anal and caudal fins (Figure 1). They have canine teeth and two dorsal fins – the anterior one has spiny rays and the posterior one has soft rays.

The key feature of walleye biology in Michigan is their narrowly defined spawning habitat requirements. They can spawn in large streams connected to lakes or within a lake on clean substrates of rock, cobble, or gravel from 1 to 4 feet deep. Such habitat provides the best chances for survival of eggs and fry but is absent, of poor quality, or in limited supply in much of Michigan. Thus, the abundance and distribution of naturally reproducing walleye populations in Michigan are primarily limited by the quantity and quality of this type of spawning habitat.

However, fingerling and adult walleyes can survive and grow in a wide variety of waters and fish communities. For this reason, and because of their popularity, walleyes are widely stocked in Michigan and throughout the Midwest. Many populations were created by stocking and are maintained by stocking.

Walleyes spawn once a year, beginning when spring water temperatures reach the upper 40s °F. Females lay many small eggs (27,000 per pound of female) over a life span of many years. No parental care is given, so eggs and fry tend to have low average survival rates. For self-sustaining populations the high abundance of eggs offsets their low survival. For populations unable to sustain themselves by natural reproduction, survival of eggs and fry is so low that insufficient numbers of fingerlings and adults are produced over the long term. Typically, the Great Lakes and larger inland lakes have the largest and best walleye populations, and support the best fisheries. These waters are more likely to have a wind-swept shoal or a tributary suitable for walleye spawning, plus forage fishes of favorable types and abundance.

Walleye eggs require about 3 weeks to hatch. During that time, they are vulnerable to displacement by wave action and smothering by silt. Both eggs and fry are vulnerable to weather changes and to predation, especially where white suckers *Catostomus commersonii* and panfish such as bluegills *Lepomis macrochirus* are abundant. A supply of zooplankton of the right size and type must be available for fry within a few days of hatching because fry contain only a small amount of nutritious yolk.

For spawning, adult walleyes concentrate on specific shoals of lakes or migrate many miles up tributary rivers to specific areas, often aggregating below migration barriers like dams. Males, which on average are smaller than females, reach the spawning grounds first and may remain there for up to 3 weeks. Both males and females mate with multiple partners. The sex ratio of fish on the spawning area is skewed towards males because they remain in the area longer and mature at an earlier age (typically, age 3 and 14 inches in length) than females (typically, age 4 or older and 17 inches in length). Comparisons between walleye populations over large regions have shown that the age of first sexual maturity is inversely related to growth rate (Beverton 1987; Quist et al. 2004). That is, populations with slower average growth rates tend to mature at a later age, and visa versa. The abundance of mature females and their eggs, rather than the abundance of males and sperm, is the first population-level constraint on reproductive success. Environmental factors (above) then act to determine the survival of eggs and fry and ultimate recruitment to older ages. Food supply for fry is often weather related.

Even within a good self-sustaining walleye population, variations in weather during the reproductive stage can cause very large annual variations in spawning success, year class strength, and recruitment rate of juvenile fish to adulthood. The more age groups present in the adult population, the less these annual fluctuations in juvenile production affect the overall population abundance, but some level of annual fluctuations in adult walleye abundance and fisheries are the norm. Healthy walleye populations contain 10 or more age groups. The presence of a high proportion of older adults and the opportunity for a female to spawn more than once per lifetime are biological safety factors that help buffer a population from environmental instability and help insure perpetuity of the population.

Growth of walleyes can vary considerably across lakes, and even within a population over time, due to the abundance of food and the number of walleyes and other species competing for it. For a sample of all Michigan waters, an average length of 15 inches (the current statewide minimum size limit) is observed during the summer of age 3 (Schneider et al. 2000). Everywhere, average growth of females is faster than males, especially after sexual maturity is reached. Few males ever reach a length of 20 inches, whereas some females will grow to over 30 inches. Consequently, the largest walleyes in a population, and in a spawning run, are usually females.

Total mortality of adult walleyes is usually low compared to other sport fish. Natural mortality (all sources of mortality except fishing) tends to be low and sport-fishing mortality tends to be moderate. Walleyes are relatively difficult to catch by anglers because of their nocturnal feeding preference. Low adult mortality results in populations with many age groups, and as pointed out above, this buffers the population from irregular annual recruitment. An adult natural mortality rate of 20% per year is believed to be typical for Michigan populations (Schneider 1978). Sport fishing takes an additional 10–30% per year in most inland waters and somewhat less in Great Lakes waters. The mode of exploitation rates for North American walleye lakes is 21% (Table 1 and Baccante and Colby 1996). Thus, total adult mortality is about 30–50% per year. The most recent estimates of these vital statistics for inland lakes in Michigan are for Houghton Lake and Michigamme Reservoir: total mortality of adult walleyes was 46% and 37% and angler exploitation was 27% and 22%, respectively (Clark et al. 2004; Hanchin et al. 2005). It is likely that even waters with low accessibility are at least moderately exploited due to the high mobility of modern anglers.

Estimates of walleye population abundance have been made for 26 Michigan lakes (as used in this report, lakes include reservoirs) and 1 river by the mark-and-recapture technique using tagged or fin-clipped fish. In addition, estimates were made at two rivers using the rotenone method to collect all fish from small sections (Table 2). The estimates, for adults exceeding 13–15 inches in length, range from 0.0 to 9.2 walleyes per acre, and average 2.2 walleyes per acre. Nate et al. (2000) reported the same average of 2.2 walleyes per acre for 131 Wisconsin lakes having natural reproduction.

Fishery harvest statistics provide another measure of adult walleye population abundance. Statistics for Midwest and North American fisheries have been compiled in Table 1. However, it should be noted that these data are not directly comparable to Michigan data until the definition of "adult walleyes" is standardized. We defined "adults" as walleyes 15-inches and larger, because Michigan has a 15-inch minimum size limit (MSL) and most Michigan data are for adult fish of that size. We made adjustments to the data from outside Michigan to approximate 15-inch equivalents. We adjusted harvest by a multiple of 0.35 based on a Wisconsin estimate that 35% of the sport harvest is greater than 15 inches. We adjusted population density by a multiple of 0.20, a rough approximation based on the assumption that 20% of the out-of-state estimates were fish over 15 inches. After these rough conversions, typical angler yields for available out-of-state fisheries are approximately 0.6 walleyes per acre, 0.6 lb per acre, and 0.010 walleyes per hour (Table 1). By comparison, about 70% of the Michigan waters with fishery data exceeded one of those fishery statistics (see tables in **Status** sections). For 32 inland Michigan lakes and reservoirs, the fishery harvest averages were 1.1 walleyes per acre and 0.055 walleyes per hour. Great Lakes and connecting waters averaged 0.07 walleyes per hour (Rakoczy 2000). Note that for the Michigan fishery data, effort includes time spent angling for all species of fish, not just walleye. Also, note that many winter fisheries were not sampled, which causes an underestimate of walleye yield per acre per year. For four lakes with both winter and summer data, the winter catch was 5–40% of the yearly total.

Based on a review of North American walleye literature, we offer the following criteria to help define a "good" walleye lake and fishery. First, "good" walleye lakes have population densities of greater than three adult walleyes per acre. Of 27 Michigan lakes with walleye population estimates (Table 2), 22% achieve that level. Second, "good" walleye fisheries sustain yields of greater than 1.0 walleyes per acre with a harvest rate of greater than 0.100 walleyes per hour. Of 59 inland and Great Lakes waters for which these harvest statistics are available, 32% are in the "good" range based on at least one of these fishery statistics. Of 32 inland lakes and reservoirs with harvest statistics, 25% yielded "good" walleye harvest per acre and 16% had "good" walleye harvest per hour. Only 6% of the fisheries would be considered "good" based on both criteria (see tables in **Status** sections for statistics on individual lakes).

Some large rivers support "good" densities of resident walleyes (Table 2). In addition, some sections of rivers host dense concentrations of spawning migrants from the Great Lakes or other downstream waters. These spawning concentrations are generally protected from fishing activity by a seasonal closure. In river and impoundment systems, many walleyes move downstream through dams and may end up in the Great Lakes. There, they may roam hundreds of miles.

Walleyes can strongly affect fish communities and the population characteristics of other species through predation. Adults feed primarily on yellow perch and soft-rayed fishes such as minnows, gizzard shad *Dorosoma cepedianum*, rainbow smelt O*smerus mordax*, and alewife *Alosa pseudoharengus*. The dependence of walleyes on yellow perch as prey is especially strong in inland lakes, and on soft-rayed fish in the Great Lakes. Walleye predation can be used as a tool (e.g., by stocking) to reduce overabundance of small (stunted) perch or bluegill in lakes where this is a problem (Schneider and Lockwood 1997). However, stocking too many walleyes should be avoided because an overabundance of walleyes can exert excessive predation on some species, drive them to very low levels, and harm their fisheries. The size of prey a walleye can eat is a function of its mouth size (Schneider and Breck 1993), and because few walleyes are extremely large, prey fish become immune to walleye predation when they grow large. Large walleyes are cannibals of smaller ones, and this cannibalism can become more severe when alternative prey fishes are not available to feed adults. It can become a self-regulating mechanism limiting walleye population size by reducing recruitment of small walleyes.

Sauger

Saugers look very much like walleyes, but are smaller. Distinguishing characteristics include cloudy eyes and dark blotches along their sides (Figure 1). Like walleyes, they have canine teeth and two dorsal fins, one spiny-rayed and one soft-rayed. They can be distinguished from walleyes by the large dark spots on the spiny dorsal fin. They rarely attain lengths of greater than 16 inches and most are mature by 12 inches. Saugers compete with walleyes in places where they coexist. Walleyes generally out-compete saugers, but sauger eyes are better adapted to feeding in very turbid waters, which give them an advantage where turbidity is high. Saugers spawn about 1 week after walleyes, over the same type of coarse substrate, but sauger spawning is more likely on shoals of lakes than in rivers. Little is known about sauger biology and populations in Michigan.

The sauger is listed as a threatened species in Michigan because it is rare and has a limited distribution. It was never abundant in Michigan, and was largely limited to the Great Lakes. During the 1900s, saugers were most abundant in the most shallow and turbid waters of Lake Erie, Lake St. Clair, Saginaw Bay, and Bay de Noc. Very small numbers of saugers probably remain in those areas. In Lake Erie, saugers declined 40–50 years ago due increased water clarity and inbreeding with walleye.

The only significant inland population of saugers occurred in the connecting waters of Torch and Portage lakes (Keweenaw and Houghton counties). No saugers have been taken there since 1985, and apparently, that population has been inadvertently extirpated. The loss was most likely due to pollution control efforts that increased water clarity and enabled walleyes to out-compete saugers.

Yellow Perch

Distinguishing characteristics of yellow perch are its yellowish sides with seven blackish bars (Figure 1). Like walleyes, they have two dorsal fins, one spiny-rayed and one soft-rayed. They have no canine teeth.

The key feature of yellow perch biology is their ability to adapt to a wide variety of conditions. Unlike walleye, yellow perch have such broad spawning habitat requirements that perch abundance and distribution in Michigan are not limited by the availability of spawning habitat. Predation by other species is often the most constraining factor on yellow perch populations.

Yellow perch spawn once a year, beginning when spring water temperatures reach the 50s °F. They have a much higher reproductive capacity than walleyes. Fecundity is higher for yellow perch (approximately 41,000 eggs per pound of female) than walleyes, and survival of yellow perch eggs and fry is usually better. This gives yellow perch populations a much higher intrinsic rate of population growth than walleyes, and enables yellow perch populations to expand rapidly whenever habitat conditions permit, such as for colonizing adjacent waters and repopulating waters disrupted by fish kills. Overpopulation and stunting of yellow perch populations commonly occur when predation does not sufficiently reduce the abundance of young (Schneider 1972, 1983).

Ideal spawning substrates for yellow perch are vegetation or submerged brush, but a wide range of substrates is used successfully. The eggs are suspended off the bottom and protected from predators and weather by a gelatinous matrix. Hatching time is relatively short, about 10 days. Adults leave after spawning and do not care for their young. The most critical stage for survival of young is within a few days of hatching, when an abundance of zooplankton of the right size and type must be available for first food. Food supply is often weather related.

For spawning in inland waters, adult yellow perch usually concentrate on relatively sheltered, weedy areas of lakes, but some may migrate a few miles up tributary rivers to find preferred spawning habitat. In the Great Lakes, they spawn on rock outcroppings and on almost any other type of structure available, as well as sand. They also move into inland river mouths and lakes to spawn in their associated wetlands. Males, which on average are smaller than females, reach the spawning grounds first and may remain there for up to 3 weeks. Males and females may mate with multiple partners. The sex ratio on the spawning area is skewed towards males because they remain in the area longer and mature at a smaller size. Males typically mature by age 1 or 3–5 inches in length (Schneider 1984). Females typically mature by age 4 or 6–7 inches in length, but a few mature at only 4 inches. The probability of being mature is a function of growth and age (Schneider 1984). For perch of a given age, the larger, faster-growing fish are most likely to be mature.

The abundance of mature females and their eggs, rather than the abundance of males and sperm, is the first population-level constraint on potential reproductive success. Variations in weather during fry stages and predation during juvenile stages often cause large (factor of 100 times of more) annual variations in year class strength and recruitment rate of juvenile fish. As with walleyes, the more age groups present in the adult population the less these annual fluctuations in juvenile production affect the overall population abundance, but some level of annual fluctuations in adult yellow perch abundance and fisheries are typical.

Healthy yellow perch populations contain seven or more age groups. The presence of a high proportion of older fish and the opportunity for a female to spawn more than once per lifetime are biological characteristics that help buffer a population from environmental instability and serve to insure the perpetuity of each population. However, yellow perch populations show remarkable resiliency due to their high reproductive capacity and may persist under high stress. In a small experimental lake, as few as 1.5 mature females per acre were able to maintain adequate recruitment in the face of intensive mortality from anglers and walleye predation (Schneider 1997).

Growth of yellow perch varies considerably from lake to lake, and year to year, due to variations in the abundance of food and the number of yellow perch and other panfish species competing for it. For a sample of all Michigan waters, an average length of 7 inches is reached during the summer of age 4 (Schneider et al. 2000). Everywhere, average growth of females is faster than males, especially after sexual maturity is reached. Few males ever reach a length of 9 inches, whereas some females grow to over 11 inches. Consequently, the largest yellow perch in a population, and in a spawning run, are usually females.

Total mortality of juvenile yellow perch tends to be high (upwards of 70%) due primarily to predation, but mortality of adults is often modest, on a par with other sport fish. As pointed out above, this buffers the population from irregular reproductive success. An adult total mortality rate of about 50% per year is typical for Michigan waters unless exposed to high fishing pressure or predation by many large northern pike *Esox lucius*. Sport fishing mortality in inland waters is typically from 20–50% per year. Yellow perch are relatively easy to catch by angling and high exploitation rates are possible in small lakes. In one 13-acre lake, average total mortality increased from 22% to 87% due to angling (Schneider 1997). In a 136-acre lake, an estimated 61% of the yellow perch greater than 7.0 inches were caught in 3 days of summer fishing (Schneider 1973). In another 20-acre lake, 15–30% of the larger perch were caught by just two ice anglers in 2 days (Schneider 1993).

However, adult yellow perch populations may experience high mortality even when little or no angling occurs. The estimated total mortality rates in four lightly fished lakes were: 91% at Dead Lake (age 4 and older), 72% at Mill Lake (age 3 and older), 50% at Blueberry Pond (age 4 and older), and 22% for Jewett Lake (age 2 and older) (Schneider 1971, 1993, 1997). The high rates for the first two lakes may be attributed especially to predation by northern pike. Other predators were present also; largemouth bass *Micropterus salmoides* were abundant in the first three lakes and walleyes were abundant in the fourth lake.

The best populations of large yellow perch tend to occur in lakes with the most favorable combinations of food, temperature, and mortality factors. Such lakes tend to be either very large, to provide abundant food and cool well-oxygenated habitat in mid-summer, or to be lightly fished. Since yellow perch are usually easy to catch, it is likely that all waters accessible to anglers are exploited to a considerable degree.

Mark-and-recapture population estimates of yellow perch were available for 14 Michigan lakes (Table 3). Estimates of abundance of yellow perch greater than 7 inches long were as high as 62.8 per acre in Manistee Lake (Kalkaska County), but few lakes exceeded 20.0 per acre. Annual variation in abundance of some populations has been extreme, as high as 30-fold, due to uneven recruitment.

Fishery harvests also fluctuate considerably. The average harvest rate was 4.4 perch per acre and 0.170 perch per hour for 43 inland lakes in Michigan (see tables in **Status** sections for statistics on individual lakes) and 0.18 perch per hour in 26 areas in the Great Lakes and connecting waters (Rakoczy 2000). Note that for the harvest data, fishing effort includes time spent angling for all species of fish. Also, many winter fisheries were not sampled, which causes an underestimate of yellow perch yield per acre per year because yellow perch are readily caught by ice anglers. For five lakes with both winter and summer data, the winter catch was 1–68% (average 32%) of the yearly total.

Adult yellow perch are significant predators on fish and can affect the composition of fish communities and the population characteristics of other species. Adults also feed on a mix of benthic invertebrates, and sometimes on large zooplankton. Predation by yellow perch is restricted to smaller fishes because the size of prey they can eat is a function of mouth size and even large adult yellow perch are relatively small. In lakes containing both bluegills and yellow perch, predation by yellow perch on age-0 bluegills during winter is ecologically important and of value to the management of bluegill fisheries (Schneider and Breck 1993). It is a mechanism that tempers bluegill recruitment and may prevent bluegill overpopulation and stunting in some lakes. Predation (cannibalism) by yearlings and adult perch on their young also occurs and can be a self-regulating mechanism that limits perch population size by suppressing recruitment. However, overpopulation and stunting usually occur in waters containing only yellow perch (Schneider 1972).

Management in Michigan

General Goals and Practices

Michigan Department of Natural Resources (MDNR), Fisheries Division has expressed general goals for fisheries management in various administrative documents. The general goals for the management of all fishes include: (1) protect and maintain healthy populations and habitats, and rehabilitation of those now degraded; (2) provide diverse public fishing opportunities to maximize value of recreational fishing; and (3) permit and encourage efficient and stable commercial fisheries which accommodate tribal fishing rights and do not conflict with recreational fisheries (Fisheries Division 1997).

In addition, Fisheries Division was party to the development and adoption of goals and fish community objectives that are more specific for Great Lakes waters (e.g., Eshenroder et al. 1995) and inland watersheds (e.g., O'Neal 1997). Some fisheries management objectives have also been expressed for some inland lakes in *Fisheries Division Status of the Fishery Reports* (e.g., Tonello 2000) and for some fisheries rehabilitation efforts (Hay-Chmielewski and Whelan 1997; Fielder and Baker 2004), but specific management goals and objectives for inland fish communities, species, or populations have not been formally expressed or adopted. Habitat protection and restoration guidelines have been developed for lakes (O'Neal and Soulliere 2006) and streams (Alexander et al. 1995) in Michigan. In practice, local fisheries managers use expert judgment to attempt to maintain populations within the broader goals expressed above.

Management Objectives

Herein, we will suggest specific objectives that could be used under the broader goals to manage walleye, sauger, and yellow perch populations in Michigan. Our proposed objectives could be applied to large regions or individual water bodies. Some are overlapping and some are conflicting, so not all are applicable everywhere. Also, many of these objectives are already being used informally or implicitly by managers across the state.

More specific management objectives applicable to almost any fishery have been suggested by Colby et al. (1994). They include prevention of five types of overfishing:

1) <u>Prevent recruitment overfishing.</u> That is, prevent collapse of a population, due to excessive harvest, to the point where adequate broodstock, reproduction, and recruitment cannot be maintained. A decreasing trend in population numbers and a series of abnormally weak year classes are the usual indicators of a problem. In extreme circumstances, a population becomes extinct. The minimum sustainable size for a fish broodstock is difficult to predict because

recruitment is lake dependent, highly variable, and may change in response to water quality or invading exotic fishes. Minimum sustainable broodstock size for walleyes have been estimated for inland lakes in Indian treaty territories of Michigan and Wisconsin (treaties of 1837 and 1842). There, the minimum sustainable broodstock size is considered to be 65% of the estimated population size of adults; that is, a maximum of 35% exploitation is permitted on any one stock. Population estimates cannot be conducted in every lake every year, so additional safety factors are applied to older population estimates to account for annual population fluctuations and uncertainty (Hansen 1989). Minimum sustainable broodstock size has been directly estimated for western Lake Erie and the Bay of Quinte in Lake Ontario, but only because their walleye populations nearly collapsed while being intensively monitored. Baccante and Colby (1996) cite four other populations that collapsed under exploitation rates of 22–56%. These were relatively vulnerable because they were in relatively unproductive and cold areas of Canada (<1,400 growing degree days). By comparison, the growing degree days in Michigan range from about 1,800 to 2,600.

2) Prevent growth overfishing. That is, prevent the fishing exploitation rate from exceeding a level where yield declines because losses from mortality exceed gains from growth. For fast-growing, long-lived species such as walleye, exploitation rates causing growth overfishing can be lower than those causing recruitment overfishing. However, for many species recruitment and growth overfishing occur at similar exploitation rates. Much depends on a population's age (size) of initial harvest, age (size) of first maturity, and natural mortality rate. Mathematical models can be used to calculate what exploitation rate will cause growth overfishing for different minimum size limits and natural mortality rates. For walleye, growth overfishing typically occurs for exploitation rates exceeding 30% when minimum size of harvest is 13–16 inches. Growth overfishing is not a concern for yellow perch because at typical exploitation rates growth overfishing would not occur unless the minimum size of harvest was 4–5 inches, which is below what most anglers would want to harvest.
3) Prevent quality overfishing. That is, prevent excessive harvests of large fish from each population that cause significant declines in population abundance, size structure, age composition, and fishery characteristics. The latter includes, for sport fisheries, diminishing catch per hour and harvest rates, declines in numbers of large fish caught per hour, and the disappearance of trophy sizes (i.e., the loss of fishing quality and societal satisfaction). Some examples for Canadian walleye fisheries are cited by Post et al. (2002). All commercial and sport fisheries cause quality declines to some degree. Such changes occur gradually as fishing harvest rate increases, so it is difficult to define when a "significant" decline in quality has occurred. However, Baccante and Colby (1996) suggested that very few walleye populations can sustain quality fisheries at exploitation rates beyond 30%. They cautioned that this ill-defined threshold could be as low as 10% for fisheries in very cold and unproductive waters.
4) Prevent economic overfishing. That is, prevent loss of overall economic value to society in general and commercial and sport fisheries in particular. Usually, economic benefits are maximized by maintaining healthy and stable populations and favoring sport over commercial fisheries.
5) Prevent community overfishing. That is, prevent unfavorable changes in fish community composition that cannot be easily reversed. An example would be the depletion of predacious walleyes by fishing that may allow yellow perch or bluegill (or some exotic species such as round goby *Neogobius melanostomus*) to increase to undesirable levels, restructure community food webs, and cause walleye recruitment problems. Similarly, as mentioned above, depletion of yellow perch may contribute to bluegill stunting.

Walleye

Specific objectives for walleye management could include:

1) protect and restore essential habitat;

2) maintain abundance of adult walleyes so that optimal natural reproduction is likely to be assured in virtually all self-sustaining walleye waters in all years;
3) conservatively regulate fishing and harvest rates to avoid recruitment, growth, and quality overfishing, yet maximize opportunities for participation and distribute the harvest equitably;
4) restore depleted populations; and
5) create or maintain new walleye fishing opportunities with stocking by striking a balance among public demand and constraints imposed by environments, resources, and economics.

Objectives that are even more specific could be formulated using the following characteristics that indicate healthy, adequately-buffered, self-sustaining walleye populations:

1) stable recruitment with few missing or extremely weak year classes;
2) stable value for mean age at first maturity;
3) average total adult mortality of less than 50% per year.
4) presence of some walleyes over age 8 and 21 inches in length;
5) average total fishing mortality on all adults of less than 35% per year;
6) stable population of adults in terms of number of fish;
7) stable population in terms of growth, natural mortality, and size and age distributions;
8) stable fishery yield;
9) average catch rate when exploited within 50 to 100% of the value observed under a catch-and-release fishery;
10) mean age of catch more than 1.5 times mean age of population.

The relative importance of these specific objectives and population characteristics could be somewhat different for populations supported solely by stocking, depending on the purpose. For example, if the purpose were to restore indigenous populations, supplement natural populations, or establish new, reproducing populations, then all these objectives and characteristics would be just as important for stocked populations as for naturally reproducing ones. However, if the purpose for stocking were to create a better predator-prey balance or to produce a put-grow-take walleye fishery, then some of the objectives and characteristics listed above would be less important. One of the more important objectives for all put-grow-take fisheries is to produce a reasonable benefit-cost ratio, which means stocked fish should have reasonably good survival and the fishery should be managed to avoid growth overfishing. Other economic considerations, such as the amount of angler effort produced, could also be very important.

Sauger

The sauger, because of its threatened status, is protected in Michigan. Therefore, management objectives for sauger should be designed to minimize harvest and habitat destruction. Currently, sauger may not be harvested in Michigan unless specifically allowed by MDNR Fisheries Orders (administrative rules). One difficulty is that saugers look like walleyes and few anglers can tell them apart. Consequently, a few saugers are probably harvested by anglers as bycatch of various walleye fisheries. This is not likely a problem for the sauger because the 15-inch MSL in effect for walleyes serves to protect all but the largest saugers. No fisheries should be established anywhere in Michigan that deliberately target saugers, especially spawning aggregations.

Yellow Perch

Specific management objectives suggested for yellow perch would be the same as those listed in (1) through (4) above for walleyes, except that there would rarely be a need to create or maintain populations of yellow perch through stocking as in (5) above. Yellow perch are already widely distributed and have high reproductive potential.

Objectives that are even more specific could be formulated using the following characteristics that indicate healthy, adequately buffered, self-sustaining yellow perch populations:

1) stable recruitment with few missing or extremely weak year classes;
2) stable value for mean age at first maturity;
3) average total adult mortality less than 60% per year;
4) presence of some yellow perch over age 7 and 9 inches in length;
5) average total fishing mortality on all adults of less than 35% per year;
6) stable population of adults in terms of number of fish;
7) stable population in terms of growth, natural mortality, and size and age distributions;
8) stable fishery yield;
9) average catch rate when exploited within 50% to 100% of the value observed under a catch-and-release fishery.

Fishing Regulations

The primary tools for achieving percid management goals are regulations that limit harvest by sport and commercial fishing. The regulations may also attempt to protect spawning fish, distribute the catch fairly, and promote sportsmanship. These regulations have evolved considerably over the last 150 years in response to increases in fishing effort, real or perceived depletion of fish stocks, gains in science-based information, and a shift in societal and economic values away from harvesting toward recreation.

The majority of Michigan percid populations are managed by consistent, statewide regulations, although some exceptions do exist as described in next paragraph. In recent years, statewide regulations have been developed by consensus of MDNR fisheries biologists and citizens representing various special interests. Present statewide regulations are sufficiently conservative to protect percid stocks from recruitment overfishing. The compromises involved with quality, economic, and community overfishing were considered in their development (Schneider 1978; Fisheries Division 1996). The management goals and objectives listed above helped guide the discussion on degree of regulation required.

There have been situations in which percid fishing regulations in Michigan waters of the Great Lakes have been specifically adjusted to help solve special problems. In Lake Erie, walleye sport harvest in Michigan waters was exceeding guidelines established by the Great Lakes Fishery Commission (GLFC) Lake Committee, so minimum size and bag limits were made more restrictive to reduce harvest. In northern Lake Huron and southern Lake Michigan, yellow perch populations have declined and recruitment has been low (Schneeberger and Scott 1997; Clapp and Dettmers 2004). As a precaution, regulations in these two areas have been adjusted to provide greater protection while efforts are underway to determine the causes.

Walleye

Regulations are the primary tool for meeting many of the management objectives suggested for walleye fisheries. The degree of regulatory control needed in any fishery relates to the amount of fishing effort and the efficiency of the gears used. Sport fishing rod-and-reel gears are relatively inefficient compared commercial nets. Therefore, relatively simple sport fishing regulations based on seasonal closures, daily bag limits, and MSLs are enacted statewide, or regionally, and these are believed to be sufficiently conservative to protect virtually all walleye stocks and fisheries yet allow a safe harvest by fishers. The characteristics listed above and the amount of fishing effort expected in an area help guide the degree of regulation required. There are relatively few case histories of Michigan walleye populations that have clearly required intervention to correct recruitment overfishing. Determining the exact reason for the collapse of a fishery is often complicated by the presence of multiple stress factors, of which fishing is only one. The best examples are walleye populations in various parts of the Great Lakes, such as western Lake Erie, Saginaw Bay of Lake Huron, or Bays De Noc of Lake Michigan (Schneider and Leach 1979). Some of these fisheries came close to total collapse in the 1960s due to overfishing from commercial and sport fisheries, competition or predation from invasive exotic species, and deterioration of habitat from pollution. Restoration efforts, including regulations to restrict fishing and restocking, are either ongoing or have been successful in many of these fisheries (Schneeberger 2000; Thomas and Haas 2000; Fielder 2002).

Michigan has a long history of progressively more restrictive regulations on walleyes and other species (Borgeson 1974). Legal restrictions on fishing methods included prohibiting the obstruction of fish passage in streams (1820); banning commercial netting in certain southern (1859) and northern inland waters (1872); prohibiting the use of explosives, toxins, seines and traps (1889); and banning netting (except dip nets for suckers and common carp *Cyprinus carpio*) on all inland waters (1911). The sport fishing bag limit on walleyes was reduced from no limit to 25 per day (1903, in combination with other species), to 10 per day (1917), and to 5 per day (1929). The bag limit remains at 5 walleyes per day (in combination with largemouth bass, smallmouth bass *Micropterus dolomieu*, and northern pike). Walleye MSLs were increased from no MSL to 10 inches (1915), increased to 14 inches (1929), reduced to 13 inches (1955), and increased to 15 inches (1976), where it is today. A closed spawning season for walleyes was not enforced until 1917.

Current sport fishing regulations: (1) allow sufficient walleyes to spawn and prevent harvest of small walleyes (15-inch MSL); (2) somewhat restrict and distribute the catch (possession limit of five walleyes per angler per day); and (3) decrease the efficiency, or promote the ethics, of sport fishing (legal gear restricted to two lines and no fishing allowed during spawning concentrations). The 15-inch MSL, established statewide in 1976, is the most powerful protector from recruitment, growth, and quality overfishing. It is a compromise most suitable for the characteristics of an average walleye population (Schneider 1978; Fisheries Division 1996). Ideally, regulations should be tailored to each population, with higher MSLs most appropriate for populations with faster growth, lower natural mortality and higher fishing mortality, and vice versa. The 15-inch MSL does not assure that all females will have the chance to spawn at least once because some females do not mature until larger. However, sufficient females are protected, and populations as a whole will likely produce more than enough eggs to assure successful recruitment of young. A slightly higher MSL would slightly improve the yield from average-growing females (they grow larger than males) and fast-growing walleye populations in general, but at the cost of lost potential fishery yield from slow-growing males and females.

Great Lakes commercial walleye fisheries were initially pursued with trap nets, gill nets, seines, spears, and hooks-and-lines, but were gradually restricted to trap nets. All commercial harvest of walleyes was eventually prohibited by the state. However, commercial walleye fishing has continued at relatively low levels in some Michigan waters of the Great Lakes by Indian tribes under treaty agreements (e.g., Enslen 2000). There are gear, season, depth, size, and area restrictions on tribal commercial fishing. The tribes also pursue subsistence walleye fisheries in the state by spearing on the spawning grounds in inland lakes of the 1842 treaty territory and netting in Great Lakes waters of the 1836 treaty territory. These fisheries are controlled by a permit and quota system.

Yellow Perch

Regulations have tended to be liberal for this widespread, relatively abundant, and prolific panfish. Yellow perch, like walleye and other species, were eventually protected from the destructive methods, such as explosives and toxins. Daily possession limits were changed from unlimited to 25 (1903, in combination with many other species), retained at 25 (1915, in combination with panfish), increased to no limit (1962), then changed (1979) to the current limit of 50 per day. The MSL was increased from none to 5 inches (1903), to 6 inches (1915), to 7 inches (1929), and then back to no

MSL (1949). There have been no statewide MSLs since 1949. Research has established that yellow perch, like other panfish, require very little protection to prevent recruitment overfishing. However, for some waters there are concerns about the potential for quality overfishing and the beneficial community role yellow perch serve as predators on small bluegills.

Habitat Protection

Other important tools for percid management are habitat protection and restoration practices that benefit entire biological communities (O'Neal and Soulliere, 2006). Important habitat factors include water quality parameters related to water temperature, dissolved oxygen, turbidity, sediment, and pollution. Important parameters in lakes include protection of spawning habitat, natural submerged vegetation, and emergent vegetation along shorelines. Important physical factors in streams include maintaining natural hydrology (flow patterns), natural substrate (especially gravel-cobble), and in-stream cover (wood cover) (Alexander et al. 1995). Since walleyes have limited spawning success in Michigan waters, protecting known or potential spawning areas is a very high priority. Spawning habitat is not a limiting factor for yellow perch, except perhaps in certain Great Lakes waters.

Activities associated with habitat protection include providing recommendations on Department of Environmental Quality permit applications under PA 451 (1994) Michigan Natural Resources and Environmental Code. This occurs on a continuing basis. Other activities include watershed assessment and planning, implementation of habitat projects, and providing assistance to other agencies and the public.

Habitat enhancement has also been attempted. Rock shoals have been placed in some lakes at considerable cost to provide better substrate for walleye spawning and eliminate or reduce the need for periodic stocking. The two primary examples that have received some study are Brevoort Lake and Six Mile Lake, in the Upper Peninsula. Both artificial reefs produced some larval walleyes, but the fisheries remained modest and it was not clear that benefits exceeded costs (Wagner 1990). In Nichols Lake, Newaygo County, an artificial reef produced no benefits to walleye reproduction (MDNR, unpublished survey reports).

Habitats continue to be modified by exotic species, especially in the Great Lakes and connecting waters. A succession of invaders, including sea lamprey *Petromyzon marinus*, alewife *Alosa pseudoharengus*, white perch *Morone americana*, ruffe *Gymnocephalus cernuus,* zebra mussel *Dreissena polymorpha*, and gobies *Neogobius melanostomus* and *Proterorhinus marmoratus,* have had negative effects on walleye, yellow perch, and other species in certain areas. In addition, aquatic habitats are being modified by exotic plant species, including Eurasian water-milfoil *Myriophyllum spicatum,* curly-leaf pondweed *Potamogeton cripus, and* purple loosestrife *Lythrum hyssopifolia.* All waters are at risk, are of concern, and should be protected to the extent possible.

Stocking

Dexter and O'Neal (2004) present MDNR guidelines and procedures for stocking fish in Michigan waters. Stocking is an important management practice for walleyes. Occasionally, yellow perch may be stocked for special purposes (such as restoration of populations following fish kills) by transferring adults, juveniles, or eggs from other populations. MDNR presently stocks from 6 to 8 million walleye fingerlings annually at a cost of approximately $0.5 million (1994 dollars, O'Neal 1998). According to MDNR records for 1995 to 1999, walleye stocking occurred in 304 lakes and reservoirs, 34 Great Lakes sites, and 63 river sites (some for river fisheries, others for Great Lakes fisheries). Stocking locations may vary from year to year. Principal purposes for stocking include restoring indigenous populations, supplementing natural populations, establishing new populations for fishing, and improving slow-growing (stunted) panfish populations. Guidelines for stocking include evaluation of costs, benefits, effects on aquatic community, genetic effects on existing fish populations, biological soundness, community support, geographical need, existing regulations, and availability of fish (Dexter and O'Neal 2004). All stocking is experimental in the sense that it may be discontinued if deemed not worthwhile and other waters may be added. During the long history of walleye stocking in Michigan, nearly every potentially suitable body of water has been informally tested and many of them have been discontinued.

Genetics

Conserving the genetic integrity of fish populations is an important management objective for indigenous populations. This objective is incorporated into Michigan's fish stocking guidelines (Dexter and O'Neal 2004). The long-term health and adaptability of fish populations in Michigan is dependant on preserving genetic diversity. Fish genetics in Michigan has been influenced on a broad geographic range by glaciations and colonization, and by localized environmental influences. The greatest amount of genetic diversity within Michigan can be retained by preserving the genetic traits of individual stocks. Preserving and managing self-sustaining populations is the most economical and best way to protect genetic diversity in fish populations. Management of wild populations with stocked fish must consider the effects on genetic diversity.

Genetic principals are an integral part of Great Lakes fishery management (GLFC 2001). Fish community objectives for the Great Lakes insure management programs incorporate the genetic stock concept, along with preservation of native species and species diversity. Both walleye and yellow perch were historically widely stocked throughout Michigan, but recent studies indicate Great Lakes populations are genetically structured (Clapp and Dettmers 2004) and managers should attempt to preserve that structure.

Status in Michigan

Fisheries management by MDNR is organized by watersheds. The state is divided into four Great Lakes watersheds (or basins), and then further subdivided into management units (MUs). There are eight MUs in the state (Figure 2).

In addition, some regions of the state are managed with consideration for the harvest needs of Indian tribes who retained fishing rights from 19^{th} century treaties. Most of the Upper Peninsula west of Marquette (Figure 3) is part of the territory ceded by Indians in the Treaty of La Pointe in 1842. The Indians retained fishing rights under the treaty, including rights to issue and enforce fishing regulations pertaining to members of their tribes. Two Indian communities, Lac Vieux Desert and Keweenaw Bay, currently pursue a variety of commercial, subsistence, and sport fisheries in the 1842 territory under agreements with the states of Wisconsin and Michigan.

Most of the Upper Peninsula east of Marquette and the Lower Peninsula from the Mackinaw Bridge to Grand Haven (Figure 3) is part of the territory ceded by Indians in the Treaty of Washington in 1836. The Courts have affirmed that the tribes still have fishing rights under this treaty, but only in Great Lakes waters. The continued existence of tribal fishing rights in inland areas is still in dispute. Five Indian communities, Bay Mills, Sault Ste. Marie, Little Traverse Bay, Grand Traverse Bay, and Little River, currently pursue a variety of commercial, subsistence, and sport fisheries in the Great Lakes waters of the 1836 territory under an agreement with the state of Michigan (Enslen 2000).

Walleyes have a more limited natural distribution and abundance than most other coolwater or warmwater sport fish. Bailey et al. (2004) presented the distribution of walleyes in Michigan based on voucher specimens from the University of Michigan, Museum of Zoology and several other field survey databases from collaborating agencies, including the Michigan Department of Natural Resources (MDNR). While these records are reliable, they include only waters that were surveyed and only surveys that collected walleyes. However, walleyes are more actively managed than most species, with waters constantly added to, or subtracted from, stocking lists. We attempted to compile a nearly complete list of waters likely to contain walleyes based on MDNR stocking records from 1995 through 1999, automated MDNR biological survey records since 1980 or later, and a questionnaire sent to each MDNR fisheries MU in February 2002. The questionnaire responses (Appendices 1–4) likely contain the most important walleye lakes. Possibly excluded from these three sources of information are some small wild populations in rivers, some public or private waters that have not been surveyed recently or at all, and stockings in private lakes (lakes without public access or connecting waters are not required to obtain a stocking permit). On the other hand, some listed lakes may no longer contain walleyes if stocking was discontinued.

The questionnaire also asked the MU biologists to make judgments regarding walleye recruitment (e.g., consistent natural reproduction, recruitment from stocking only, etc.), population origin (whether or not walleyes were native to the water body), access to Great Lakes (whether or not fish migrate to Great Lakes), and fishery rank (subjective assessment of level of fishing effort).

Identifying the source and level of recruitment is one of the more helpful ways to classify walleye waters for management purposes. We classified waters according to the source and level of recruitment in their walleye populations. That is, whether walleye populations are supported by:

1) natural reproduction exclusively, which is consistent enough to produce relatively even year classes of adults;
2) natural reproduction exclusively, but is inconsistent and periodically results in missing year classes;
3) natural reproduction primarily, but stocking also occurs;
4) both natural reproduction and stocking about equally;
5) stocking primarily, but some natural reproduction occurs;
6) stocking exclusively, which is consistent enough to produce relatively even year classes of adults;
7) stocking exclusively, but population is in decline and likely to disappear due to recent termination of stocking;
8) stocking exclusively, but harvestable population has not yet developed; or
9) unknown recruitment sources.

The origin of walleye populations was coded as: (1) probably native to water body; (2) due to stocking or introduction; or (3) unknown.

Walleye population access to the Great Lakes was coded as: (1) presently has access to and migrates to Great Lakes; (2) historically migrated to Great Lakes; (3) does not have access to Great Lakes; or (4) unknown.

Walleye fishery rank was coded as: (1) excellent, used extensively by anglers; (2) moderate, used at average level by anglers; (3) fair, used at low level by anglers; or (4) poor, used rarely by anglers.

In addition, we requested ranks for yellow perch fisheries in the same walleye lakes using the same codes. The list of yellow perch lakes in the appendices and tables is far from complete, but includes many of the most important waters. Finally, we also requested published and unpublished estimates of walleye and perch populations that had been stored in MU files.

Lake Superior Basin

Michigan's part of the Lake Superior Basin (LSB) is about 160 miles north to south and 300 miles east to west. It extends south of Lake Superior to about the towns of Watersmeet on the west side and Rexton on the east side, but is very narrow in between. It only extends about 5 miles south of Lake Superior at Munising. The Basin is divided into two fisheries management units, the Western Lake Superior Management Unit (WLSMU) and the Eastern Lake Superior Management Unit (ELSMU) (Figure 2). Most of the Basin west of Marquette is part of the 1842 ceded territory, and most of the Basin east of Marquette is part of the 1836 ceded territory (Figure 3).

Walleye

Distribution.–For the LSB there were 86 sites containing walleyes based on recent stocking records, fish collections, and questionnaires (Appendix 1). The majority of sites were in the western management unit, especially in Gogebic County. Sixteen waters were classified as having adequate natural reproduction (recruitment code 1 or 2), 37 waters were classified as having a mixture of natural reproduction and stocking (coded 3, 4, or 5), and 16 waters were classified as maintained solely by stocking (coded 6, 7, or 8). Many additional waters listed in Appendix 1 have not yet been classified, but most depend on stocking.

The biological characteristics of walleyes in inland waters of the Upper Peninsula, including the LSB, may differ slightly, on average, from those described earlier for Michigan as a whole. This area of the state is more likely to have better walleye recruitment because rocky outcrops are more common and competing bluegills are less abundant. Consequently, these lakes are more likely to have regular natural recruitment and more numerous adult walleye populations. Many lakes in the western Upper Peninsula more closely resemble the classic walleyes lakes in northern Wisconsin and northeastern Minnesota. It is likely that, on average, walleye growth is somewhat slower than the Michigan state average due to the lower nutrient content of waters and shorter growing season in the western Upper Peninsula. For example in Lake Gogebic (WLSMU, Ontonagon and Gogebic counties), a length of 15 inches is not attained until age 4 or 5 instead of age 3 (Miller 2000). In addition, natural mortality may tend to be lower than the statewide norm. Few inland lakes within the Lake Superior basin contain "good" walleye populations or fisheries based on available statistics. Two lakes, Gogebic and Six Mile (WLSMU, Houghton County), had populations of adult walleyes sometimes exceeding 3.0 per acre (Table 2). Two other lakes, Cisco and Thousand Island (both in WLSMU, Gogebic County), produced good yields of greater than 1.0 walleyes per acre per year (Table 4). Only Lake Gogebic had a good catch rate, greater than 0.100 walleyes per hour, in some years. Twelve other waters were ranked by MU biologists as receiving extensive walleye fishing (Appendix 1).

Lake Gogebic is the most renowned inland walleye lake in Michigan. Eschmeyer (1950) conducted an extensive study on walleye life history and several other studies of the fishery have been made since (e.g., Norcross 1986; Miller 2000). Angling yields in this large, low-productivity lake range from 0.2 to 0.7 walleyes per acre per year, and hourly catch rates vary from 0.100 to 0.153 walleyes per hour (Table 4). These statistics are on a par with other walleye fisheries in the Midwest (Table 2).

A Lake Gogebic walleye holds the state record for longevity. A male walleye tagged during Eschmeyer's (1950) study achieved an estimated age of 26 years and a length of only 19.6 in at recapture (Schneider et al. 1977). Sport fishing exploitation and total mortality rates have increased since the 1940s (Miller 2000). Minimum angling exploitation rates based on tag returns were 4% in 1947, 6% in 1976, 7% in 1977, 20% in 1984, and 21% in 1994. Returns for the last 2 years were enhanced by rewards, so it is likely that the true exploitation rate is currently about 25%. Total mortality rates for those same years were estimated at 24%, 27%, 27%, 38%, and (for males) 37%, respectively. Natural mortality was about 18–22% per year. Estimates of number of adults (13 inches and larger) have ranged from 2.8 to 9.2 fish per acre, a three-fold variation (Table 3).

Mark-and-recapture estimates were also made at Six Mile Lake, a walleye population established in the 1970s by stocking, but partially maintained in the 1980s by reproduction on an artificial spawning reef (Wagner 1990). There, estimates averaged 1.5 walleyes per acre, with a four-fold variation (Table 2). Total mortality and exploitation were not estimated.

Lake Superior proper supports few walleyes because it is so deep and cold. However, their presence has been documented in at least 24 locations in Michigan waters (Hoff 1996), and we will mention the most significant of those here. The lower Tahquamenon River (ELSMU, Luce County) supports a small run of 2,379 wild and stocked, lake and river walleyes (MDNR 2001, unpublished data). A small population of large walleyes spawns in the Ontonagon River (WLSMU, Ontonagon County) and resides in the river and adjacent waters of Lake Superior. Sport anglers catch about 1,000 walleyes per year (Table 5). Smaller populations are associated with the Black River (WLSMU, Gogebic County), the Portage Lake waterway (WLSMU, Houghton County), and Huron Bay (shoal spawners – WLSMU, Keweenaw County). Biological data for the Lake Superior stocks is scant but most are now a mixture of stocked and naturally reproduced fish.

Special concerns.–Some common management concerns for fisheries everywhere include, but are not limited to: (1) controlling fishing effort and harvest; (2) protecting water quality and habitat from deterioration; (3) managing stocking activities; (4) protecting significant and unique spawning populations; (5) controlling spread of exotic species; and (6) dealing with toxic contaminants. The problems associated with each of these concerns vary in severity with species of fish and from one MU to another. Of those listed, the primary concerns for walleyes in LSB would be for controlling fishing, managing stocking, and dealing with contaminants. While the other problems listed are always present, they are currently of less concern than the others in LSB.

Walleye populations in LSB are generally in good condition. Overall habitat deterioration has been minimal, and there is no evidence that recruitment overfishing is occurring, with the possible exception of Parent Lake (WLSMU, Baraga County – V. Nurenburg, MDNR, personal communication). Biological surveys in Parent Lake indicated a serious decline in abundance of walleyes. As a precaution, the Keweenaw Bay Tribal Community imposed a moratorium on spearing the lake in 2002 and 2003. But overall, the present levels of fishing effort and harvest in the LSB are not of concern, except that walleye fishing effort and harvest are probably increasing. For example, sport fishing mortality rates for walleyes in Lake Gogebic increased from the 1970s to the 1990s (Miller 2000). Also, spring spearing harvest of walleyes for Lac Vieux Desert Tribal Community was 0 prior to 1989 and gradually increased to over 4,300 in 2002 (J. Krueger, Great Lakes Indian Fish and Wildlife Commission, personal communication, 2003). Much of this tribal harvest was from lakes in the 1842 ceded territory of the WLSMU. These increasing trends are a concern for LSB, and they should continue to be monitored. Further increases in either sport or subsistence harvest, or both, might require more restrictive regulations in the future.

With regard to managing stocking, walleye fry or fingerlings were stocked in 36 lakes and reservoirs, 3 Great Lakes sites, and 3 river sites in the LSB from 1995 through 1999 (Appendix 1). These fish were used to establish or maintain fisheries where walleyes were not native and to supplement native populations. Significant walleye sport fisheries have developed in some of the waters (Appendix 1). However, walleye stocking should be managed carefully (Dexter and O'Neal 2004). Even though there often is more demand for stocking than fish available, individual lakes probably still exist where too many are being stocked. It has been shown that overstocking can cause undesirable, density-dependent problems, such as reduced growth and recruitment of walleyes (Clark et al. 2004) and excessive predation on prey fish populations (see special concerns for walleyes in the Lake Erie Basin for examples). In addition, the benefit-cost ratio for stocking should be evaluated periodically to make sure it is within acceptable guidelines.

Another special concern in LSB is the presence of toxic contaminants in walleyes. It has been necessary to issue fish consumption advisories for walleyes in parts of the LSB (MDCH 2004). This includes a general advisory for mercury for all fish species from inland lakes. It states that no one should eat more than one meal of walleyes a week and women of childbearing age and children under age 15 should not eat more than one meal of walleyes a month. In addition, specific waters in LSB have more strict advisories (see list in MDCH 2004). While these advisories are of great concern from the standpoint of utilizing walleyes as food, there is no evidence that the current levels of contamination are affecting the ability of walleye populations to sustain themselves.

Yellow Perch

Distribution.–Yellow perch are distributed throughout the LSB and are likely to occur in all waters that meet their general requirements for pH and dissolved oxygen. Yellow perch are the prevalent panfish in this area, and most lakes contain important and fishable populations.

It is likely that all inland waters accessible to anglers and that contain significant populations of yellow perch are exploited to some degree. No estimates of perch exploitation rates have been made within the LSB and perch abundance has been estimated only for Cub Lake (WLSMU, Gogebic County) in the Sylvania Tract (Clady 1970). There, the number of 7-inch and larger adults varied from 1.1 to 33.1 per acre over 3 years (Table 3). Cub Lake was unexploited, but total mortality of adults was 57% and few perch lived to age 4. No commercial, but some Indian subsistence, fishing occurs for yellow perch in the LSB.

Yellow perch angling harvest rates are available for nine lakes (Table 6). They range up to 25 fish per acre and 0.711 fish per hour, but only two lakes exceeded the Michigan average of 4.4 fish per acre. Cisco, Thousand Island, and Gogebic lakes (all in WLSMU, Gogebic County), had the best perch fisheries. Sport fisheries for yellow perch in many walleye lakes were ranked by fisheries managers in Appendix 1.

Most of Lake Superior is too deep and cold for yellow perch. A modest population of them occurs in Keweenaw Bay (WLSMU, Keweenaw County) that sustains a sport harvest varying from 15 to 120,000 yellow perch per year.

Special concerns.–Yellow perch populations in the LSB are generally in good condition. Of the general fisheries problems listed earlier for walleyes, the only one that is a special concern for yellow perch in the LSB is contaminants.

There is no evidence that recruitment overfishing is occurring for yellow perch in the LSB. The general trend of increasing fishing effort and harvest mentioned earlier for walleyes is not as much of a concern for yellow perch from the standpoint of recruitment overfishing. Yellow perch populations have very high reproductive capacities. However, the potential for quality overfishing exists statewide because yellow perch are relatively easy to catch by angling at times, and the mobility of anglers and the popularity of yellow perch assure that virtually all waters will be at least moderately exploited. Regulation of yellow perch exploitation rate is made difficult by large annual fluctuations in recruitment of young and subsequent abundance of adults. This causes “boom or bust” fisheries in some lakes.

Habitat deterioration has been minimal in LSB and current programs that conserve water quality and shorelines adequately protect yellow perch habitat. Yellow perch reproduce satisfactorily and stocking is not necessary except in waters deficient in forage fish or depleted by a total fish kill.

As with walleyes, fish consumption advisories for yellow perch have been issued in parts of the LSB (MDCH 2004). The general, statewide advisory for mercury is a special concern for yellow perch. However, there is no evidence that current levels of contamination are affecting the ability of yellow perch populations to sustain themselves.

Lake Michigan Basin

The Michigan part of the Lake Michigan Basin (LMB) is about 300 miles north to south and about 200 miles east to west. It is divided into three fisheries management units, Northern Lake Michigan (NLMMU), Central Lake Michigan (CLMMU), and Southern Lake Michigan (SLMMU) (Figure 2). Most of NLMMU is part of the 1842 ceded territory. Most of CLMMU and some of SLMMU are part of the 1836 ceded territory (Figure 3).

Walleye

Distribution.–For the LMB there are 325 sites containing walleyes based on recent stocking records, fish collections, and questionnaires (Appendix 2). Of those, 24 waters were classified as adequately sustained by natural reproduction (recruitment code 1 or 2), 60 had a mixture of natural reproduction and stocking (coded 3, 4, or 5), and 104 were maintained solely by stocking (coded 6, 7, or 8). Many additional waters listed in Appendix 2 have not yet been classified, but most are dependent on stocking. About 38% of the listed sites in the LMB were stocked at least once in 1995–99.

The waters of the LMB include the complete range of types found within Michigan. The basin contains the largest (Houghton – CLMMU, Roscommon County) and the deepest (Torch – CLMMU, Antrim County) inland lakes in the state and has lakes with a wide natural range in water quality. For example, some lakes in the western Upper Peninsula are relatively acidic (low pH) whereas some marl lakes in the Lower Peninsula have a relatively high pH. Climate ranges from the coldest part of the state (Baraga County) to the warmest part (Berrien County). The lakes support the full variety of coldwater, coolwater, and warmwater fish communities. Rivers and impoundments are equally diverse. All of the waters coded with the best walleye reproduction (recruitment code 1 or 2) were in either NLMMU or CLMMU. South of the Muskegon River Watershed, the boundary between CLMMU and SLMMU, some reproduction occurs in rivers and impoundments, but walleye lake fisheries are heavily dependent on stocking.

The biological characteristics of walleyes in inland waters of NLMMU (most of southern half of the Upper Peninsula) are more similar to those in the LSB than to other waters in the LMB. Lakes in the western portion are more likely to have better walleye spawning habitat because rocky outcrops are more common. Consequently, these lakes are more likely to have regular natural recruitment and more numerous adult walleye populations. However, the large, wind-swept Manistique lakes in the eastern portion of NLMMU (Luce and Mackinac counties) also sustain good reproduction. Some lakes in the NLMMU resemble classic walleye lakes in northern Wisconsin and northeastern Minnesota. Walleye growth in the NLMMU is somewhat slower than the Michigan-wide average (Hanchin et al. 2005), probably due to fewer nutrients and a shorter growing season. Natural mortality may also tend to be lower than the statewide norm.

Population estimates of adult walleyes (>13 or 15 inches) are available for 16 lakes and 3 rivers in the LMB (Table 2). Estimates in lakes ranged from 0.4 to 5.4 walleyes per acre. Estimates for rivers, based on section sampling with rotenone, range from 0.0 to 6.0 walleyes per acre. Estimates for populations created primarily by stocking sometimes exceeded those composed predominately of naturally-reproduced fish, at least in the short term. The most recent estimates for large walleye lakes with good reproduction are 1.5 walleyes per acre for Lake Michigamme (NLMMU, Iron County) and 2.9 walleyes per acre for Houghton Lake (CLMMU, Roscommon County) (Clark et al. 2004; Hanchin et al. 2005).

Mid-1970s data for Manistee Lake (CLMMU, Kalkaska County) indicated a fishing harvest rate of about 17% per year and a total mortality rate of 42% for age-2 and older walleyes (Laarman and Schneider 1986). Very recent estimates for Houghton Lake and Lake Michigamme Reservoir were 46% and 37% for total mortality, and 27% and 22% for angler exploitation, respectively (Clark et al. 2004; Hanchin et al. 2005). These exploitation estimates were based on rewards for some tags. Other recent estimates of minimum angling exploitation rates, based on voluntary tag returns, are 26% for Maple Lake (SLMMU, Van Buren County), and 7 % for Sessions Lake (SLMMU, Ionia County) (J. Dexter and A. Herrington, MDNR, personal communications). None of these rates are excessive because they apply to fish larger than 15 inches. Also, Indian subsistence fisheries for walleyes operate on certain lakes in of the 1842 treaty territory in NLMMU.

Data accumulated since 1976 on walleye sport fishing catch and total effort at 15 sites are summarized in Table 7. Harvest rates ranged up to 13.7 walleyes per acre (Sessions Lake, a new and productive stocked impoundment) and 0.230 per hour (South Manistique, a lake with natural reproduction). Seven populations at least partially met the criteria defined earlier for "good" walleye fisheries. Based on rankings by MU biologists (Appendix 2), 13 inland lakes, 4 drowned river-mouth lakes, and 3 rivers have extensive walleye sport fisheries.

A number of populations in LMB migrate freely between inland and Great Lakes waters but have strong tendencies to return to inland waters for spawning. Lake Michigan tributaries that have migratory populations include the Muskegon, St. Joseph, Kalamazoo, Grand, White, Pentwater, Pere Marquette, and Manistee rivers. Most of these rivers contain lakes near their confluence with Lake Michigan (known as drowned-river-mouth lakes) that support the bulk of the walleye populations and fisheries and some of their walleyes are caught from Lake Michigan proper. Drowned-river-mouth lakes are unique systems that in the State of Michigan occur only in the LMB. Walleyes also occur in northern Green Bay, but those fish use various tributaries and reefs for spawning, and then move to the bay where they support very large sport fisheries.

Northern Green Bay (NLMMU, Menominee and Delta counties), including the bays de Noc, supports one of the major Great Lakes walleye populations in Michigan. This walleye population is still in the process of rehabilitation following a near-total collapse in the 1960s (Schneider et al. 1991). Fingerling walleye stocking has enhanced spawning runs in the north end of Little Bay de Noc and in tributary rivers – especially the Cedar and Menominee rivers. Natural reproduction is substantial in some years but stocking continues. The population of legal-sized walleyes is roughly 484,000 fish (Schneeberger 2000). Based on tagging data, these fast growing and large walleyes experience total mortality rates of 40% per year in Little Bay de Noc, 5% in Big Bay de Noc, 13% near Cedar River, and 59% near Menominee. Tag return rates are 5% for Little Bay de Noc and 2–6% for other areas. If it is assumed that under-reporting of unrewarded tags occurred by a factor of 2.5, then the true exploitation rate is about 12% per year. The sport fishery in 1985–96 took an average of 34,000 walleyes per year from Little Bay de Noc (with a 6-fold annual variation), 3,000 from Big Bay de Noc (16-fold variation), 250 from Cedar River area, and 12,400 from the Menominee area. Data for the year 2000 are in Table 4.

The Muskegon river-lake system (CLMMU, Muskegon County) supports a very good sport fishery (Appendix 2) and sustains the principal walleye population in CLMMU. It is one of the principal broodstock rivers used for the MDNR walleye rearing-stocking program. Marking programs have shown that Muskegon River walleyes migrate along the coast south to Indiana and north to southern Green Bay. They also move into other inland rivers within these boundaries. Spawning population levels have been estimated as follows: 1953 – 114,000; 1954 – 139,000; 1975 – 2,000; 1986 – 43,000; and 1998 – 46,479. Population levels in the 1950s were likely near the maximum for the system because walleyes exhibited substantially slower growth rates then than now. Significant declines occurred in the 1960s and 1970s associated with the dramatic changes in Lake Michigan fish communities (Schneider and Leach 1979; Eshenroder et al. 1995). A restoration program was started in 1979 by stocking pond-reared fingerling walleyes derived as eggs from the Muskegon River spawning run (Schneider et al. 1991). Population levels appear to have stabilized as indicated by the 1986 and 1998 estimates. Growth rates increased when population levels dropped, but decreased in recent years as the population was restored to moderate levels. The number of walleyes in the 1998 spawning run exceeding 15 inches in length was estimated at 45,806. Total mortality was estimated at 35%, corresponding to an instantaneous total mortality (Z) of 0.43. Poor recruitment was likely the cause of the population decline during the 1960s and 1970s (Schneider and Leach 1979), and it continues to be a problem today. Marking studies (1997–2001) have shown that fewer than 5% of juveniles in this system are from natural reproduction and the rest are stocked fish. A significant number of the walleyes in the spawning run, about two adults per acre (Table 3), reside in the Muskegon River year around. For the river section between Croton Dam and Muskegon Lake, the estimated harvest of walleyes by anglers was 731 in 1999 and 1,061 in 2000 (Table 8). The average catch rate for all types of anglers (including effort directed at trout) was 0.002 walleyes per hour for both years. In 2002-03, a year-round angler survey was conducted on Muskegon Lake. Results indicated that anglers fished 177,833 hours and caught 2006 walleyes. Studies on walleye recruitment are currently underway.

White Lake (CLMMU, Muskegon County) has a very good sport fishery for walleyes (Appendix 2) and there is a substantial spawning run of adult walleyes in the White River each year. Marking studies indicate this system is also supported by stocking. In 1999 and 2000, all juveniles collected from the lake were of stocked origin; in 2001, 75% of the young-of-the-year were of stocked origin.

Mona Lake and Black Creek (CLMMU, Muskegon County) have a fair walleye fishery, as reported by anglers. It is believed that fish from the Muskegon River supported this fishery until recently because the system was not stocked until 2001 and the creek is probably too cold for walleye reproduction.

The Pentwater (CLMMU, Oceana County) and Pere Marquette (CLMMU, Mason County) rivers generally do not support substantial spawning runs of walleyes because they are too cold. However, Pentwater and Pere Marquette lakes support fair walleye fisheries. Walleyes in Pentwater Lake may originate from stocking upstream in Hart Lake Impoundment.

The Manistee lake-river system (CLMMU, Manistee County) has small walleye fisheries. For Manistee Lake, angling catch estimates are less than 100 walleyes per year (Table 8). For the Manistee River downstream of Tippy Dam, estimated catches are 120–260 walleyes per year.

In waters of SLMMU, the Grand River has a migratory walleye population below the dam in the City of Grand Rapids. Estimates of walleye population levels and fishery statistics are not available for this system but the fishery is extensive (Appendix 2). During the 1990s, standard survey work in the Grand Rapids area during the spawning season found many adult walleyes. Sportfishing tournaments for walleyes are frequent during the open water season in the lower Grand River near Grand Haven. This system is presently stocked and natural recruitment has not been evaluated.

Lake Macatawa and the Macatawa River (SLMMU, Ottawa County) are stocked with walleyes and contain some migrants. Angler use, population levels, and natural recruitment information for this system are not available at this time. There is at least a moderate sport fishery in Lake Macatawa based on angler reports and observations (Appendix 2).

The Kalamazoo River (SLMMU, Allegan County) has a substantial population of walleyes, especially downstream of the first dam (Caulkins Dam, 26 miles from Lake Michigan). This river is stocked with walleyes and there is a limited amount of natural recruitment in the upper portions of the river based on survey data. The Black River (at South Haven) and the Galien River have very small walleye fisheries supported by stocking.

The St. Joseph River (SLMMU) supports walleyes throughout its length, but the primary fisheries are in Michigan waters of St. Joseph and Berrien counties. The St. Joseph River is a shared resource with the State of Indiana and is cooperatively managed. A fish ladder-lamprey barrier at Berrien Springs Dam prevents substantial movement of migratory walleyes into upstream areas. Based on video counting, very few walleyes move upstream during periods of the year when the fish ladder-lamprey barrier is not operational. There is some downstream movement of walleyes over the dams and through the fish ladders. Walleyes are stocked throughout this system. Survey information collected during 1990, and creel surveys in following years, indicated a limited amount of natural reproduction was occurring downstream of Berrien Springs. In 1998 and 1999, harvest estimates averaged about 4,500 walleyes per year and catch rates averaged about 0.016 walleyes per hr (Table 8).

Special concerns.–As mentioned earlier, some of the common management concerns for fisheries everywhere include: (1) controlling fishing effort and harvest; (2) protecting water quality and habitat from deterioration; (3) managing stocking activities; (4) protecting significant and unique spawning populations; (5) controlling spread of exotic species; and (6) dealing with toxic contaminants. All six of these are special concerns for walleyes in LMB.

Habitat deterioration and overfishing have harmed some walleye fisheries in LMB, such as in the Muskegon River, but recent management programs, including stocking and more restrictive fishing regulations, have been fairly successful in restoring them. These same programs have also created many walleye fisheries where none previously existed. Thus, walleye populations in the LMB are more numerous than ever and are generally in good condition.

As far as is known, recruitment overfishing is not occurring anywhere in the LMB, although there is probably a general trend of increasing sport fishing effort and harvest. There is also an increasing trend in subsistence harvest in the 1842 territory of NLMMU, as mentioned earlier. These trends should be monitored and continued increases might require more restrictive regulations in the future. Depending on how it is defined, quality overfishing might be occurring in some places in the LMB. The potential for quality overfishing always exists because it is defined differently by different people and walleyes are highly sought after by people with diverse and often conflicting interests.

The threat of water quality and habitat deterioration is directly proportional to human population size. CLMMU and SLMMU are much more heavily populated than NLMMU, and so would be of greatest concern. The aquatic resources are continuously threatened from general human land and water use, ill-advised construction projects, and pollution. The MDNR and MDEQ must try to ensure these threats are minimized or mitigated. One of the primary concerns for walleyes would be deterioration of spawning habitat, which is usually in short supply and often limits the abundance of native populations.

With regard to managing stocking, walleye fry or fingerlings were stocked in 166 lakes and reservoirs, 25 Great Lakes sites, and 35 river sites in the Lake Michigan basin from 1995 through 1999 (Appendix 2). Stocking established new fisheries in some areas where walleyes were not native and supplemented fisheries on some small native populations. In some of the waters, such as Chicagon (NLMMU, Iron County), Silver (CLMMU, Oceana County), and Sessions (SLMMU, Ionia County) lakes, the St. Joseph (SLMMU, Berrien County) and Muskegon (CLMMU, Muskegon County) rivers, and northern Green Bay waters (NLMMU, Menominee and Delta counties), significant walleye sport fisheries have developed (Tables 7 and 8). Also, stocked walleyes reproduce to a limited extent in some waters. In spite of this overall success, there is a continuous need to monitor results and refine walleye stocking. Even though there is more overall demand for stocking than fish available, individual lakes probably still exist where too many are being stocked. It has been shown that overstocking can cause undesirable, density-dependent problems, such as reduced growth and recruitment of walleyes (Clark et al. 2004) and excessive predation on prey fish populations (see special concerns for walleyes in the Lake Erie Basin for examples).

With regard to protecting significant and unique spawning populations, probably the three most important walleye populations in LMB are in Big and Little bays de Noc and the Muskegon River. These populations are in the process of restoration by heavy stocking. Exploitation should be kept minimal to buildup the broodstock and improve chances for natural reproduction. The total mortality rate for walleyes in the Menominee area, 59%, is of concern because it exceeds the upper threshold level we proposed of 50%. However, the 59% figure may not be representative (Schneeberger 2000). Some improvement has become evident in Little Bay de Noc.

Many undesirable species have been introduced to the LMB including: (1) vertebrates such as alewives, sea lamprey, and gobies; (2) invertebrates such as zebra mussels, spiny waterfleas *Bythotrephes cederstromi*, and rusty crayfish *Orconectes rusticus*; and (3) plants such as Eurasian watermilfoil *Myriophyllum spicatum*, curly-leaf pondweed *Potamogeton crispus*, and purple loosestrife *Lythrum salicaria*. Both vertebrate and invertebrate invaders can affect walleyes through predation (especially on eggs and young) and competition for food and other resources, and plant invaders can adversely affect the aquatic habitat. Alewives, in particular, have a negative effect on walleye fry in Lake Michigan (Schneider et al. 1991). Controls need to be put in place to slow or halt the spread of existing exotic species and to prevent any new ones from being introduced.

As in the LSB, fish consumption advisories for walleyes have been issued for the LMB (MDCH 2004). The general, statewide advisory for mercury is a concern for walleye fisheries. Also, walleyes are contaminated with PCBs in some lakes and rivers in the LMB (see list in MDCH 2004). However, there is no evidence that current levels of contamination are affecting the ability of walleye populations to sustain themselves.

Yellow Perch

Distribution.–Yellow perch are distributed throughout the Lake Michigan basin and are likely to occur in all significant waters meeting their general requirements for pH and dissolved oxygen. In many of the large northern lakes, yellow perch are the dominant panfish, and the lakes contain important and fishable populations of yellow perch. In more southern lakes, bluegills usually outnumber yellow perch.

It is likely that all inland waters of LMB that are accessible to anglers and contain significant populations of yellow perch are exploited to some degree. No commercial fishing and little Indian subsistence fishing occurs for yellow perch.

Within the LMB, estimates of yellow perch population size have been made for six lakes (Table 3). Estimates of adults (>7 inches) range from 1.3 to 62.8 perch per acre. The best data are for Manistee Lake (CLMMU, Kalkaska County) (Laarman and Schneider 1986). For 9 years of data, 1974–84, the average population of yellow perch 7.0 inches and longer was 27.2 perch per acre. The variation was extreme: from 0.6 to 62.8 per acre, reflecting weak and strong year classes. The average total mortality of adult perch was a modest 45% per year, indicating overexploitation was not occurring. There have been no direct measurements of yellow perch exploitation rates in inland waters of the LMB.

Yellow perch fishery data have been compiled for 25 lakes (Table 9). Estimates ranged up to 29.3 fish per acre and 0.933 fish per hour, but only eight lakes exceeded the state average of 4.4 fish per acre. Annual variations of 12-fold have been observed at Manistee Lake. Extensive yellow perch fisheries reportedly exist in four of the lakes ranked by fisheries managers (Appendix 2).

The largest yellow perch population is located in Michigan waters of Green Bay (NLMMU, Delta County). From 1985 to 1996, anglers annually harvested 226,000 yellow perch from Little Bay de Noc and 72,000 from Big Bay de Noc (Schneeberger 2000). Estimates for 2000 are in Table 10. Tribal commercial and subsistence fisheries currently take small numbers of yellow perch. Population statistics for Little Bay de Noc yellow perch are a population size of approximately 657,000 fish over 7 inches in length, a total mortality of 58%, and an adjusted exploitation rate of 10% (Schneeberger 2000). Comparable statistics have not been estimated for Big Bay de Noc yellow perch.

The other major yellow perch concentration in LMB is from Muskegon to Grand Haven (CLMMU, Muskegon and Ottawa counties) and from South Haven to St. Joseph (SLMMU, Van Buren and Berrien counties). Sport harvest from those ports totaled 183,000 yellow perch in 2000 (Table 10). This fishery has been at a reduced level for a decade, but is in better shape than yellow perch populations to the south and west. Some of these yellow perch migrate into the rivers and lakes with connecting channels to Lake Michigan. These movements can be substantial during some years, especially in the drowned-river-mouth lakes that have short, deep connecting channels to Lake Michigan. Important connecting lakes in CLMMU are Mona, Muskegon, Duck, and White (all in Muskegon County); Pentwater (Oceana County); Pere Marquette, Manistee, Portage, and Arcadia (all in Manistee County); Betsie (Benzie County); Elk (Grand Traverse County); and Charlevoix (Charlevoix County). Some juvenile perch produced in these inland waters move into Lake Michigan.

Special concerns.–Yellow perch populations in the LMB are generally in good condition. Of the general fisheries problems listed earlier for walleyes, the two that are of most concern for yellow perch are controlling exotic species and dealing with contaminants. There is no evidence that recruitment overfishing is occurring in Michigan waters. However, recruitment overfishing is a suspected problem in Indiana, Illinois, and Wisconsin waters of Lake Michigan (Clapp and Dettmers 2004). Also, the potential for quality overfishing always exists.

Habitat deterioration has been minimal for yellow perch in LMB and current programs that conserve water quality and shorelines adequately protect yellow perch habitat. Yellow perch reproduce satisfactorily and stocking is not necessary except in waters deficient in forage fish or depleted by a total fish kill.

Managers should be aware of the role of yellow perch play as a predator on small bluegills in the inland lakes where stunted bluegill populations are often a problem. This would be more of an issue in SLMMU than anywhere else in the LMB. Managers should try to maintain adequate numbers of larger, older yellow perch in such lakes, but this is difficult to achieve in practice.

Exotic species are a major concern for yellow perch in LMB, especially in the Great Lakes and connecting waters. These include the same species as mentioned earlier for walleyes. And as with walleyes, these invaders can affect yellow perch through predation, competition, and habitat alterations.

For Lake Michigan waters, the continued low abundance of yellow perch in the southern half is a concern that merits more study. The bag limit has been reduced to 35 perch per day to conserve brood stock. Possible effects of exotic species such as alewife and zebra mussels on yellow perch fry are suspected as contributing factors (Clapp and Dettmers 2004).

Fish consumption advisories for yellow perch have been issued for the LMB (MDCH 2004). The general, statewide advisory for mercury is the primary concern. However, there is no evidence that current levels of contamination are affecting the ability of yellow perch populations to sustain themselves.

Lake Huron Basin

The Michigan portion of the Lake Huron Basin (LHB) is about 280 miles long (north to south) and about 150 miles wide (east to west). It is divided into two fisheries management units, Northern Lake Huron (NLHMU) and Southern Lake Huron (SLHMU) (Figure 2). Much of NLHMU and a small part of SLHMU are part of the 1836 ceded territory (Figure 3).

Walleye

Distribution.–Over 129 waters in the Lake Huron basin contain walleyes based on recent stocking records, fish collections, and questionnaires completed by fisheries managers (Appendix 3). Twelve waters were classified as adequately sustained by natural reproduction (recruitment code 1 or 2), 32 had a mixture of natural reproduction and stocking (coded 3, 4, or 5), and 21 were maintained solely by stocking (coded 6, 7, or 8). Many additional waters listed in Appendix 3 have not yet been classified, but most are dependent on stocking.

Estimates of walleye population density have been made for only four inland lakes in the Lake Huron basin (Table 2). Densities for the three more typical lakes range from 0.7 to 1.5 adults per acre.

The highest figure, 8.4 adults per acre, is the average for an experimental fish community in Jewett Lake (SLHMU, Ogemaw County). Jewett Lake is unusual because walleyes spawned successfully there on sand and, despite the lake's small size (13 acres), anglers were able to harvest only 1.2 walleyes per acre (Schneider 1997).

The primary walleye waters are those included in the Inland Waterway, Mullett, Burt, Pickerel, and Crooked lakes (all in NLHMU, Emmet and Cheboygan counties). Walleyes migrate extensively within that system. Burt Lake is widely considered to be among the best native walleye waters in the area, yielding a walleye harvest up to 4.8 walleyes per acre (Table 11, summer data only). For Mullett Lake, 10.8% of the spawning walleyes tagged in 1998 were reportedly caught in the next 12 months (D. Borgeson, MDNR, personal communication). This is a minimal rate of exploitation based on voluntary tag returns. However, returns were enhanced by offering rewards for some tags and the presence of a census clerk on the lake. Still, it may underestimate the true angling exploitation rate by a factor of two. Voluntary tag returns from Burt Lake walleyes in the 1950s and 1970s were 7% and 18%, respectively (Schneider 1978).

The St. Marys River system (NLMMU, Chippewa County), a connecting waterway between lakes Superior and Huron, has long been known for its varied habitat and diverse fish community, including many walleyes. The St. Mary's River has a substantial migratory walleye spawning run and a year-around fishery. Spawning occurs primarily in Munuscong Bay and the Munuscong River, but also in other small tributaries in the U.S. and Canada.

Ontario and Michigan share jurisdiction over these boundary waters. The river also lies within the 1836 treaty territory and was specifically addressed in the 2000 Consent Decree (Enslen 2000). That court order closed the river to tribal commercial harvest, but permitted tribal subsistence harvest with nets and sport gears. Operating on the Ontario side, and certainly over the same populations of fish, are First Nation (Canadian Indians) and Ontario provincial commercial fisheries.

The sport fishery in Ontario plus Michigan waters of Lake Huron is very large in most years (Table 12; Fielder et al., in press). In 1999, the combined angling pressure was estimated at 556,000 hours, which was about one-third of the total sport fishing effort spent on all waters of Lake Huron. The corresponding combined angling and subsistence harvest for 1999 was 11,145 walleyes. Of those, subsistence anglers took about 2% and anglers took about 98%. The Ontario commercial fishery harvested 2,557 kg from Potagannissing Bay, or about another 5,000 walleyes. First Nation extractions in Ontario waters are unknown. The grand total harvest for 1999 was estimated to be at least 16,300 walleyes.

The total annual mortality of walleyes in the St. Marys River was high in 1995, 51% (Fielder and Waybrant 1998). Their growth rate is slow relative to other notable Great Lakes walleye populations and females do not reach sexual maturity until age 4 or 5. Walleyes older than age 5 constituted only 7.5% of the population in 1995. There are no recent estimates of walleye exploitation rate. The St. Marys River Fisheries Task Group, formed in 1997 by the Great Lakes Fishery Commission, has devised a multi-agency assessment plan and is working to provide coordination on the collection and interpretation of survey data to facilitate joint management of these fisheries (Gebhardt et al., in press).

Small walleye populations and fisheries occur in NLHMU near the mouths of the Au Sable (Oscoda County) and Thunder Bay (Alpena County) rivers. These consist of mixtures of local fish and migrants from Saginaw Bay. In the Au Sable area, some spawning occurs below the first dam and additional recruits probably originate from native populations in upstream impoundments. In the Thunder Bay area, the population includes hatchery fish stocked every other year and wild fish produced by spawning below the first dam. The dam blocks access to better spawning grounds upstream. Anglers in each area harvest about 1,000 walleyes, many very large, but the estimates may be low because a sizeable night fishery was not sampled at either site (Table 12).

The largest Lake Huron walleye population is located in Saginaw Bay (SLHMU, Bay and other counties). It is still in the process of rehabilitation following a near-total collapse in the 1940s, primarily due to water quality problems (Schneider and Leach 1979; Fielder and Baker 2004). A major spawning run has been restored in the Saginaw River system by pollution control efforts and fingerling walleye stocking (Mrozinski et al. 1991; Fielder et al. 2000). Large numbers of spawning walleyes now concentrate below the lower dams, especially in the Tittabawassee and Flint rivers. However, formerly important offshore spawning reefs are still too degraded to attract spawners or produce fry (Fielder and Baker 2004). Presently, the resident population consists of approximately 20% naturally reproduced and 80% hatchery fish. In addition, there are seasonal migrants from the Lake Erie-Lake St. Clair corridor that spend time in Saginaw Bay. The population of adults over 15 inches in length averaged 999,691 fish between 1996 and 2000 (D. G. Fielder, MDNR, personal communication). While substantial, this population is probably still short of historic levels, because the very rapid growth of walleyes indicates their numbers are well below the carrying capacity of the bay. The MDNR is actively engaged in further recovery efforts (Fielder and Baker 2004). These extremely fast growing and large walleyes experience a total mortality of approximately 35% per year, of which exploitation is estimated at 9% per year (based on voluntary tag returns corrected for non-reporting). The sport fishery, pursued in the bay and seasonally in the river, takes about 88,700 walleyes per year (Table 12).

A few thousand walleyes are also caught from southern Lake Huron along the east side of the thumb (SLHMU, ports of Harbor Beach, Port Sanilac, and Lexington; Table 12). These fish probably originate from Saginaw Bay and the St. Clair-Lake Erie corridor.

Special concerns.–All six of the general concerns listed earlier for walleyes in the LMB are also valid for the LHB. Our general discussion of these concerns would be the same, so we will not repeat it here. Two more specific concerns in the LHB would be for walleyes in Saginaw Bay and the St. Marys River system.

In Saginaw Bay and connecting waters, walleyes are being stocked to restore populations experiencing poor natural reproduction and to provide fisheries. It is anticipated that adequate natural reproduction will resume if on-going efforts to improve water quality are successful, exploitation can be kept low, sufficiently large populations of spawning adults can be reestablished, and the fish community can be restructured by walleye predation.

In the St. Marys River system, mortality of walleyes is marginally high at 51% and few fish are reaching old age. Reduction of fishing effort could be required in the future.

With regard to managing stocking, over 93 sites in the Lake Huron basin were stocked at least once in 1995–99. Of the stocking sites, 67 were on inland lakes and reservoirs, 18 sites were on the Great Lakes, and 8 were on rivers (Appendix 3).

Yellow Perch

Distribution.–Yellow perch are distributed throughout the Lake Huron basin and likely occur in all significant waters meeting the general requirements for pH and dissolved oxygen. In many of the large lakes of NLHMU, yellow perch are the dominant panfish, and the lakes contain important and fishable populations of yellow perch. In lakes of SLHMU, bluegills usually outnumber yellow perch.

Population estimates of yellow perch greater than 7 inches have been made for three small inland lakes (Table 3). The estimates range from 3.6 to 17.5 perch per acre, with the highest population in a winterkill situation at Grebe Lake (SLHMU, Ogemaw County). No estimates of typical exploitation rates have been made, but total mortality in one experimental 13-acre lake (Jewett Lake, SLHMU, Ogemaw County) increased from 22% to 87% due to angling.

Yellow perch fishery data collected since 1976 have been compiled for five inland lakes (Table 13). Harvest rates ranged up to 22.9 perch per acre and 1.690 perch per hour. However, only two lakes yielded more than the Michigan averages of 4.4 and 0.170, respectively, and two of the largest lakes in the LHB, Burt and Mullett (both in NLHMU, Cheboygan County), yielded fewer than 1.0

perch per acre. None of the yellow perch sport fisheries in LHB walleye lakes were given the highest rank by fisheries managers (Appendix 3).

Major yellow perch fisheries occur in four areas of Lake Huron: the St. Marys river-lake system (NLHMU, Chippewa County); the Les Cheneaux Islands area (NLHMU, Mackinac County); Saginaw Bay (SLHMU); and the southwest shore (SLHMU, Huron, Sanilac, and St. Clair counties).

The St. Marys River-lake system, a connecting waterway between Lakes Superior and Huron, contains many yellow perch. Ontario and Michigan share jurisdiction over these boundary waters. As with walleyes, sport and subsistence fishing occur for yellow perch on the Michigan side, and sport, subsistence, and commercial fishing occur on the Ontario side.

The combined angling fishery in Ontario and Michigan waters of the St. Marys is very large in most years (Table 14). In 1999, the combined angling pressure was estimated at 556,000 angler hours and the combined harvest by sport and subsistence anglers was estimated at 75,200 yellow perch. First Nation extractions from Ontario waters are unknown

Yellow perch total annual mortality is highest in the lower reaches of the St. Marys River and Potagannissing Bay (60%) and lowest in the upper reaches (25%), a pattern consistent with the uneven distribution of sport fishing effort (Fielder and Waybrant 1998). Yellow perch were found to grow at the state average rate in 1995. There is no up-to-date estimate of exploitation rate for yellow perch in the system.

The Les Cheneaux area, on the southeastern shore of the Upper Peninsula, once supported an extensive yellow perch fishery and resort industry. The fishery slowly declined despite intensive study and management efforts. In 1986, the estimated annual sport harvest was 439,000 yellow perch (Diana et al. 1987); by the summer of 2000, only 693 yellow perch were taken (Table 14). An Indian commercial and subsistence fishery once operated in the area, but has been reduced since 2000. Causes for the yellow perch decline are not clear, but could include relatively high angler exploitation during the 1980s (Lucchesi 1988), a dramatic increase in fish-eating cormorants in the 1990s (Ludwig and Summer 1997; Maruca 1997), and possible declines in recruitment. Total annual mortality rate for yellow perch was estimated to be 49% in 1993–95 (Schneeberger and Scott 1997). Despite some restrictions on the fisheries, total annual mortality was higher in 2001, (estimated at 67%, D. G. Fielder, MDNR, personal communication) and the fishery continues to spiral downward. The most recent estimate of exploitation rate for the sport fishery was only 2.5% (D. G. Fielder, MDNR, personal communication).

Another major yellow perch population is located in Saginaw Bay. In 1997–2001, the annual harvest was 1,076,227 yellow perch by anglers, plus another 224,000 (94,336 lbs) by commercial fishers (D. G. Fielder, MDNR, personal communication). The total annual mortality of yellow perch averaged 48% between 1997 and 2001. Population abundance and exploitation rates have not been estimated for Saginaw Bay, but the total yellow perch fishery yield remains close to the long-term average.

The southwestern shore of Lake Huron produces a fishery varying from 11,000 to 48,000 yellow perch per year (Table 14). Little is known about the biology of these perch, and they may originate from a variety of distant spawning grounds, such as Saginaw Bay or Lake St. Clair.

Special concerns.–Yellow perch populations in the LHB are generally in good condition, with the important exception of those in the Les Cheneaux Island area. The general concerns for yellow perch in the LHB are the same as those listed earlier for the LMB. In Lake Huron, the status of the yellow perch population in the Les Cheneaux area has become grave and further remedial action is needed soon. The fisheries have already been greatly curtailed, and unless other causes for weak recruitment can be quickly identified and corrected, control of cormorant predation should be considered. In Saginaw Bay, yellow perch growth and condition improved during the 1990s and is no longer of concern (Fielder et al. 2000).

Lake Erie Basin

The Michigan portion of the Lake Erie Basin (LEB) is about 130 miles (north to south) by about 80 miles (east to west). It contains one fisheries management unit, the Lake Erie Management Unit (LEMU) (Figure 2). The LEB is not part of either the 1836 or 1842 ceded territories (Figure 3).

Walleye

Distribution.–For the Lake Erie watershed there are 52 sites containing walleyes based on recent stocking records, fish collections, and questionnaires (Appendix 4). Eleven waters were classified as adequately sustained by natural reproduction (recruitment code 1 or 2), 7 had a mixture of natural reproduction and stocking (coded 3, 4, or 5), and 20 were maintained solely by stocking (coded 6, 7, or 8). Many additional waters listed in Appendix 4 have not yet been classified, but most are dependent on stocking. About 69% of the listed sites were stocked at least once in 1995–99.

The growing season is relatively long and inland waters tend to be more fertile in southeastern Michigan, both of which can aid walleye growth. Generally, few large and cool lakes are present and rocky shoals are rare. In addition, these lakes are more likely to have large bluegill populations that may further reduce walleye recruitment success. Consequently, these lakes are more likely to have irregular recruitment and sparser adult walleye populations. Successful spawning, when it occurs, is more likely to be in tributary rivers than on lake shoals. Self-sustaining walleye populations are limited to river-reservoir systems in LEB. Stocking is widespread.

Walleye population data for four inland waters in the Lake Erie basin are summarized in Table 2. Estimates range from 0.4 to 2.1 walleyes per acre. Two large and productive impoundments, Kent Lake (Oakland County) and Stoney Creek Reservoir (Macomb County), have stocked populations estimated at 1.1 to 2.1 adult walleyes per acre. In both, there is concern that walleyes have become too abundant, are not sufficiently exploited, and may have depleted once-abundant bluegill populations and eliminated important fisheries.

Walleye fishery data for eight inland waters in the Lake Erie basin are summarized in Table 15. All those waters were stocked, but Belleville Lake and other impoundments on the Huron River (Washtenaw and Wayne counties) also contained many wild walleyes. Estimated harvest rates ranged up to 1.3 walleyes per acre and 0.008 walleyes per hour. A relatively good fishery at Belleville Lake was initiated by an extensive rotenone reclamation and restocking project on the productive Huron River impoundments in the mid-1970s. Some walleyes slip downstream through the dams in the system. One walleye tagged in Belleville Lake was recaptured from the St. Clair River, 80 miles away. Minimum estimates of angling exploitation rates based on voluntary tag returns are 6.7% for Belleville Lake (Schneider and Spitler 1987) and 4.6% for Kent Lake (J. Braunscheidel, MDNR, personal communication).

The largest and most important walleye stock in Michigan resides in western Lake Erie, the Detroit River, Lake St Clair, the St Clair River, and southern Lake Huron (Thomas and Haas 2000). These walleyes migrate extensively, with some wandering as far as Saginaw Bay. Since these are boundary waters, management is shared by Michigan, Ohio, and Ontario. The fish are overwhelmingly of natural origin. Primary spawning areas are on certain offshore reefs in Ohio waters; and in the Maumee and Sandusky rivers in Ohio, the Thames River in Ontario, and probably the Detroit River in both Michigan and Ontario (Regier et al. 1969). Small spawning runs occur in Michigan's Huron River (Monroe County) and Clinton River (Macomb County). In 1992–94, the spawning run below the first dam on the lower Huron River was estimated at 3,400 to 7,800 walleyes (Leonardi and Thomas 2000).

The population in Lake Erie nearly collapsed in the 1960s, but recovered nicely when commercial harvest was greatly restricted and pollution controls were implemented. This walleye stock is intensively managed, with quotas reestablished each year to allocate harvest among sport fisheries in

Ohio, Michigan, and Ontario, and commercial fisheries in Ontario. The MSL has varied from 13 to 15 inches and the bag limit from five to six walleyes per day. First Nation tribal fishers take small numbers of walleyes from the Thames River (Ontario). The general management goal is to maintain the spawning stock well above the low level experienced during the 1960s while optimizing yield.

Annual sport harvest of walleyes from Michigan waters is 167,000 for Lake Erie (in 1998–2001) and 458,000 for the rest of the system (in 1983–84), for a total of 0.6 million walleyes (Table 16). The following estimates of walleye statistics were supplied by R. Haas (MDNR). Estimates of walleye total mortality were 35% for Lake Erie (in 2000) and 46% for Lake St Clair (in 1975–84). Estimates of exploitation were 13% for Lake Erie and approximately 10% for Lake St Clair (actual voluntary tag returns were 5.4% in 1975–84). The population of walleyes in western Lake Erie alone is approximately 35 million adults.

Special concerns.–Habitat deterioration and overfishing have harmed some walleye fisheries in LEB, such as in Lake Erie, but recent management programs, including pollution controls and more restrictive fishing regulations, have been very successful in restoring them. These same programs also created many walleye fisheries where none previously existed. Thus, walleye populations in the LEB are more numerous than ever and generally in good condition. However, all six of the concerns listed earlier for walleyes in other basins are also valid for the LEB. We covered the basics of these concerns earlier, so we will not repeat them here.

One more specific concern for LEB is that walleye recruitment has been low and brood stocks have been declining in Lake Erie and the Detroit River. There, as a precaution, the walleye season has been shortened, the bag limit has been reduced to 5 walleyes per day (from 10 per day), and the MSL has been increased from 13 to 15 inches. These adjustments are expected to be temporary.

The LEB is heavily urbanized and is by far the most densely populated area of the state. Therefore, the potential for degradation of water quality and habitat deserve special mention. One of the primary concerns for walleyes would be deterioration of spawning habitat, which is usually in short supply and often limits the abundance of native populations.

From 1995 through 1999, walleye fry or fingerlings were stocked in 32 lakes and reservoirs and 2 river sites in the LEB. These were used to establish new fisheries where walleyes were not native and to supplement small native populations. Significant walleye sport fisheries developed in some of the reservoirs (Table 15). In spite of this overall success, there is a continuous need to monitor results and refine walleye stocking. One concern is for stocking too many walleyes. In the LEB, stocked walleyes are suspected of excessively depleting once-abundant bluegill populations in Kent Lake and Stoney Creek Reservoir through predation. Also, excessive stocking of walleyes can cause undesirable, density-dependent problems within the walleye population itself, such as reduced growth or recruitment (Clark et al. 2004).

Another concern with stocking in the LEB (and elsewhere) is the possibility that stocked fish could alter gene pools of native populations (Dexter and O'Neal 2004). Of particular concern in the LEB is the preservation of important native spawning populations in lakes Erie and St. Clair and connecting rivers. These native populations should be surveyed regularly to monitor status and carefully protected from habitat degradation and overfishing. In inland waters of LEB, walleyes are native only to large rivers and impoundments and all those populations have probably already been altered genetically to some degree by widespread stocking in the past. None-the-less, in future management plans consideration should be given to the genetic strains of walleyes stocked and their potential impacts on existing native populations.

Yellow Perch

Distribution.–Yellow perch are widely distributed throughout the LEB and occur in nearly all significant waters. Yellow perch fisheries are relatively minor in most lakes because LEB lakes tend to be small to medium-sized, and bluegill rather than yellow perch are the dominant panfish. Sport fisheries for yellow perch in many LEB lakes were ranked by fisheries managers (Appendix 4)

Population estimates of larger yellow perch have been made at four relative small (<136 acres) inland lakes in the LEB (Table 3). The estimates range from 4.0 to 53.0 fish per acre. All but Cassidy Lake (Washtenaw County) were very lightly fished lakes. At Blueberry Pond (Livingston County), annual variations of five-fold have been documented for adults and eight-fold for young.

Sport fishery statistics have been collected from eight inland lakes in the LEB since 1980 (Table 17). Harvest rates were as high as 5.18 perch per acre and 0.067 perch per hour despite the dominance of bluegill in these lakes. No very large yellow perch fisheries were reported in the questionnaire for inland waters (Appendix 4).

Very large yellow perch sport fisheries do exist in LEB in Michigan waters of western Lake Erie (harvest over 400,000 perch per year), Lake St Clair (over 800,000 perch per year), and connecting waters (150,000 perch per year). The population in western Lake Erie is intensively managed, with quotas reestablished each year to allocate harvest among sport fisheries in Ohio, Michigan, and Ontario, and commercial fisheries in Ontario. Recent estimates of vital statistics indicated a population size of 48.9 million adult yellow perch with a total mortality rate for age-3 and older of 61%, of which exploitation rate is 20% (Yellow Perch Task Group 2001).

Special concerns.–Yellow perch populations in the LEB are generally in good condition. However, the common concerns listed earlier for yellow perch in other basins are also valid for the LEB. These include concerns about our ability to: (1) control future increases in fishing effort and harvest; (2) protect water quality and habitat; (3) protect significant and unique spawning populations; (4) control invasions of exotic species; and (5) deal with toxic contaminants.

For inland and Great Lakes waters of LEB, there is no specific evidence for recruitment overfishing or that characteristics of any yellow perch population are routinely unhealthy. However, depending on how it is defined, quality overfishing might be occurring in some places in the LEB. The potential for quality overfishing always exists because it is defined differently by different people and yellow perch are highly sought after by people with diverse and often conflicting interests.

Managers should be aware of the role of yellow perch as a predator on small bluegills in the inland lakes of LEB where stunted bluegill populations are often a problem. They should try to maintain adequate numbers of larger, older yellow perch in such lakes, but this is difficult to achieve in practice.

Of continued concern are the possible effects of zebra mussel, gobies, and other exotic species on yellow perch and other fish in LEB.

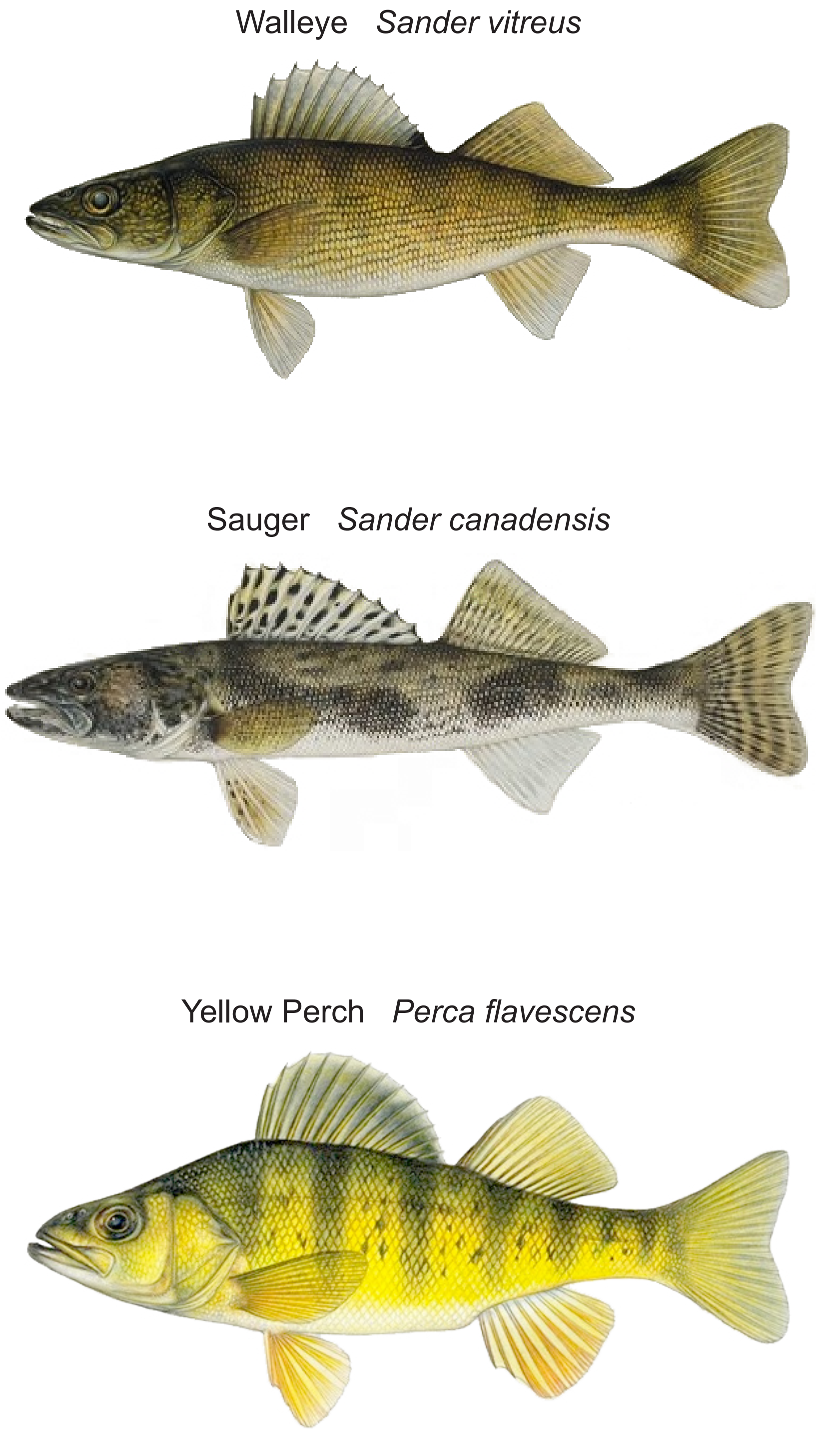

Figure 1.–Characteristics of walleye, sauger, and yellow perch as depicted by Joseph R. Tomelleri.

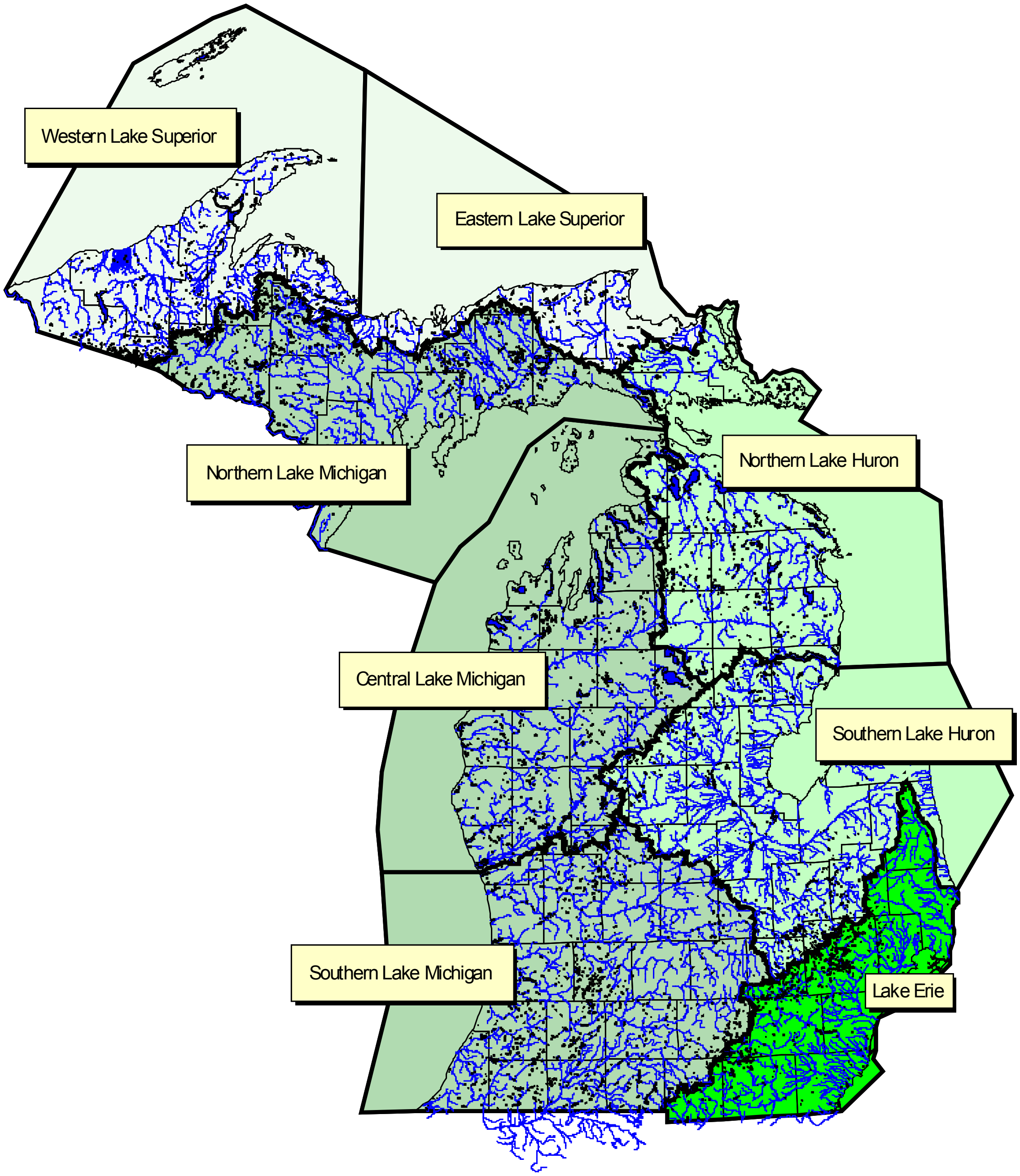

Figure 2.–Map of Michigan showing the approximate boundaries of state fisheries management units.

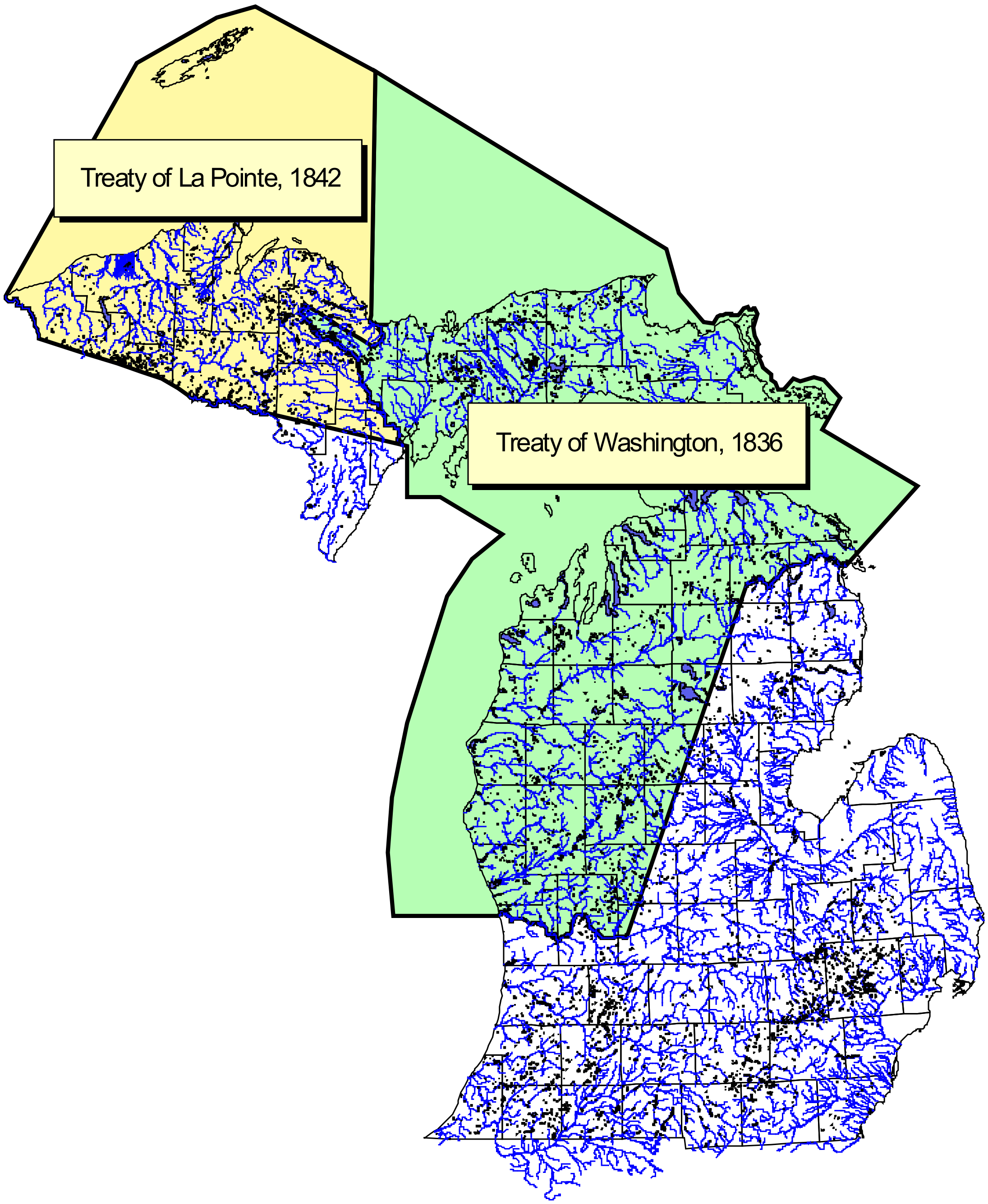

Figure 3.–Map of Michigan showing the approximate boundaries of the 1836 and 1842 treaty territories.

Table 1.–Synopsis of walleye sport fishery and population characteristics, primarily from Wisconsin, Minnesota, and Ontario sources, and adjustments to approximate levels for the 15-inch minimum size limit (MSL) used in Michigan.

		Walleye fishery statistics [a]						
		Harvested					Walleye [b]	
Location	Description	per hr (number)	per acre (number)	per acre (lbs)	Exploitation rate (%)	Fishing effort (hrs per acre)	per acre (number)	Reference
Wisconsin	Statewide mean	–	–	–	–	–	5.2	Hanson (1989)
Wisconsin	Ceded lakes mean	0.04 [c]	1.92	–	–	50	3.7	Staggs (1989)
Minnesota	Large walleye lakes	0.17–0.35	–	–	–	–	–	Payer et al. (1989)
Minnesota	Ceded territory lakes	–	–	1.63	–	–	–	MNDNR unpublished
North America	Mode of 46-168 lakes	–	1.50 [d]	1.10	21	–	6.0	Baccante and Colby (1996)
	and (range)	–	–	(0.01–44.00)	(3–56)	–	(<0.1–68.0)	
Summary	Range adjusted to 15” MSL [e]	0.01–0.12	0.53–0.67	<0.01–15.40	3–56	50	<0.1–54.4 [f]	

[a] No MSL for nearly all of these sport fisheries. This was non-targeted fishing effort.
[b] Described as “adults” – sexually mature or larger than legal size (12 inches in Wisconsin).
[c] Number of walleye harvested by anglers targeting walleye was 0.10 per hr.
[d] An approximation based on modal yield of 1.1 pounds per acre times modal weight of 1.4 pounds per walleye harvested.
[e] An approximate adjustment based on a Wisconsin figure that 35% of the sport catch is greater than 15 inches in length when no minimum size limit exists (e.g., 1.92*0.35=0.67).
[f] A rough approximation based on the assumption that 20% of the “adults” above are less than 15 inches.

Table 2.–Estimates of inland walleye population density in Michigan. For lakes, the mark-and-recapture method was used. For rivers, sample sections were blocked with nets, the toxicant rotenone was applied, and all larger fish were collected.

Water body	County	Management unit [a]	Wild or stocked [b]	Year(s)	Number per acre	Minimum fish length (in)	Reference
Lake Superior Basin							
Monacle Lake	Chippewa	ELSMU	S	2000	1.7	15	MDNR files
Lake Gogebic	Gogebic	WLSMU	W	1976, 77, 84, 94	2.8–9.2	13	Miller (2001)
Six Mile Lake	Houghton	WLSMU	W [c]	1980–87	1.5 (0.7–3.0)	13	Wagner (1990)
Lake Michigan Basin							
Brevoort Lake	Mackinac	NLMMU	S	2001	0.5	15	MDNR files
Brule Lake	Iron	NLMMU	W	1991	2.1	15	MDNR files
Chicagon Lake	Iron	NLMMU	S	1992	2.9	15	MDNR files
Hagerman Lake	Iron	NLMMU	W	1991	0.8	15	MDNR files
Indian Lake	Iron	NLMMU	S	1992	3.4	15	MDNR files
Michigamme Reservoir	Iron	NLMMU	W	2001	1.5	15	Hanchin et al. (2005)
Stanley Lake	Iron	NLMMU	W	1991	1.5	15	MDNR files
Steuben Lake	Schoolcraft	NLMMU	S	1999	1.2	14.5	MDNR files
Thunder Lake	Schoolcraft	NLMMU	S	1997	5.4	13	MDNR files
Fife Lake	Kalkaska	CLMMU	S	1964, 65, 74	1.7–2.2	13	Schneider and Lockwood (1979)
Manistee Lake	Kalkaska	CLMMU	S	1973–84	0.5–3.6	13 or 15	Laarman and Schneider (1986)
Houghton Lake	Roscommon	CLMMU	W	2001	2.9	15	Clark et al. (2004)
Muskegon River	Newaygo	CLMMU	S	1990–93	0.0–2.2	15	O'Neal (1997)
Pickerel Lake	Newaygo	CLMMU	S	1995	1.0	15	MDNR files
Silver Lake	Oceana	CLMMU	S	1997	2.3	15	MDNR files
Bills Lake	Newaygo	SLMMU	S	1995	1.1	15	MDNR files
Maple Lake	Van Buren	SLMMU	S	1993	0.4	15	MDNR files
Kalamazoo River	Kalamazoo	SLMMU	S	1982	0.0–6.0	15	Towns (1984)
Paw Paw River	Van Buren	SLMMU	S	1989	0.0–3.0	15	Dexter (1991)

Table 2.–Continued.

Water body	County	Management unit[a]	Wild or stocked[b]	Year(s)	Number per acre	Minimum fish length (in)	Reference
			Lake Huron Basin				
Mullett Lake	Cheboygan	NLHMU	W	1998	0.8	15	MDNR files
Jewett Lake	Ogemaw	SLHMU	W[d]	1987–93	8.4	14	Schneider (1997)
Holloway Reservoir	Genesee	SLHMU	S	1995	1.5	15	MDNR files
Lake Nepessing	Lapeer	SLHMU	S	1993	0.7	Adult	MDNR files
			Lake Erie Basin				
Cass Lake	Oakland	LEMU	S	1992, 96	0.4, 1.0	15	MDNR files
Kent Lake	Oakland	LEMU	S	1994–95	2.1	15	MDNR files
Pontiac Lake	Oakland	LEMU	S	1999	1.3	15	MDNR files
Stoney Creek Reservoir	Macomb	LEMU	S	1991	1.1	13	MDNR files

[a] MDNR fisheries management unit: WLSMU = Western Lake Superior; ELSMU = Eastern Lake Superior; NLMMU = Northern Lake Michigan; CLMMU = Central Lake Michigan; SLMMU = Southern Lake Michigan; NLHMU = Northern Lake Huron; SLHMU = Southern Lake Huron; and LEMU = Lake Erie.
[b] W= mostly wild walleyes; S=mostly or entirely stocked walleyes.
[c] Mostly fish produced on an artificial reef by walleye stocked prior to 1978. Estimates are for age 3 and older, approximately equivalent to 13 inches and larger.
[d] Shown is the average estimate for years when Jewett Lake contained an experimental community of walleye, bluegill, and yellow perch.

Table 3.–Mark-and-recapture population estimates for large yellow perch in Michigan.

Lake	County	Management unit [a]	Year(s)	Number per acre (range)	Minimum fish length (in)	Reference
			Lake Superior Basin			
Cub	Gogebic	WLSMU	1967–69	1.1, 1.1, 33.1	7	Clady (1970)
			Lake Michigan Basin			
Anderson	Marquette	NLMMU	1985	1.3	7	Wagner (1988)
Big Shag	Marquette	NLMMU	1985	26.9	7	Wagner (1988)
East	Schoolcraft	NLMMU	1984	3.5	7	Wagner (1988)
Stager	Iron	NLMMU	1983	15.5	7	Wagner (1988)
Tepee	Iron	NLMMU	1983	4.1	7	Wagner (1988)
Manistee	Kalkaska	CLMMU	1974–84	27.2 (0.6–62.8)	7	Laarman and Schneider (1986)
			Lake Huron Basin			
Grebe	Ogemaw	SLHMU	1960s	Up to 17.5	7	Schneider (1971)
Jewett	Ogemaw	SLHMU	1987–91	7.2	7	Schneider (1997)
			1960s	3.6, 11.3	7	Schneider (1971)
Scaup	Ogemaw	SLHMU	1960s	5.1	7	Schneider (1971)
			Lake Erie Basin			
Blueberry	Washtenaw	LEMU	1984–89	30.0 (10.0–53.0)	8	Schneider (1993)
Cassidy	Washtenaw	LEMU	1964, 87	4.0, 15.9	7	Schneeberger (1988)
Dead	Washtenaw	LEMU	1984–85	4.0	7	Schneider (1993)
Mill	Washtenaw	LEMU	1965–68	6.5 (1.7–11.8)	7	Schneider (1971)

[a] MDNR fisheries management unit: WLSMU = Western Lake Superior; ELSMU = Eastern Lake Superior; NLMMU = Northern Lake Michigan; CLMMU = Central Lake Michigan; SLMMU = Southern Lake Michigan; NLHMU = Northern Lake Huron; SLHMU = Southern Lake Huron; and LEMU = Lake Erie.

Table 4.–Estimated walleye sport fishery statistics for inland waters of the Lake Superior Basin.

Lake	County	Area (acres)	Management unit [a]	Wild or stocked [b]	Months and year	Number harvested total	Number harvested per acre	Fishing effort [c] (hrs)	Harvest per hr [c]	Reference
Beaver	Alger	765	ELSMU	S	May–Sep 1998	621	0.81	6,496	0.096	Lockwood (2000)
Bond Falls Flowage	Ontonagon	2,118	WLSMU	W	May–Sep 1994	282	0.13	7,812	0.036	Lockwood (2000)
Cisco	Gogebic	506	WLSMU	W	May–Aug 1978	595	1.18	28,171	0.021	Ryckman and Lockwood (1985)
					May–Oct 1977	372	0.74	27,085	0.014	Ryckman and Lockwood (1985)
Duck	Gogebic	622	WLSMU	S	May–Sep 1994	163	0.26	11,932	0.014	Lockwood (2000)
					May–Sep 1993	107	0.17	8,426	0.013	Lockwood (2000)
Gogebic	Ontonagon and Gogebic	12,898	WLSMU	W	Jan–Apr 1999	416	0.03	31,439	0.013	Lockwood (2000)
					May–Sep 1999	8,878	0.69	90,086	0.099	Lockwood (2000)
					May–Oct 1977	4,744	0.37	31,062	0.153	Ryckman and Lockwood (1985)
					May–Aug 1976	2,059	0.16	15,679	0.130	Ryckman and Lockwood (1985)
Pomeroy	Gogebic	317	WLSMU	W	May–Sep 1993	253	0.80	8,129	0.031	Lockwood (2000)
Tamarack	Gogebic	326	WLSMU	S	May–Sep 1993	62	0.19	2,386	0.026	Lockwood (2000)
Thousand Island	Gogebic	1,020	WLSMU	W	May–Aug 1978	1,228	1.20	37,599	0.033	Ryckman and Lockwood (1985)
					May–Oct 1977	497	0.49	35,301	0.014	Ryckman and Lockwood (1985)

[a] MDNR fisheries management unit: WLSMU = Western Lake Superior; ELSMU = Eastern Lake Superior; NLMMU = Northern Lake Michigan; CLMMU = Central Lake Michigan; SLMMU = Southern Lake Michigan; NLHMU = Northern Lake Huron; SLHMU = Southern Lake Huron; and LEMU = Lake Erie.

[b] W = mostly wild walleye; S =mostly or entirely stocked walleye

[c] Non-targeted effort directed at all species of fish.

Table 5.–Estimated walleye sport fishery statistics for Michigan waters of Lake Superior.

Location	Management unit [a]	Wild or stocked [b]	Years	Total number harvested	Fishing effort [c] (hrs)	Harvest per hr [c]	Reference
Ontonagon	WLSMU	W	1992–94	975–1,703	19,123–36,820	0.047–0.051	Rakoczy and Svoboda (1994, 1995, 1997)
Black Harbor	WLSMU	W	1992–94	0–19	4,795–24,457	0.000–0.004	Rakoczy and Svoboda (1994, 1995, 1997)
Keweenaw Bay	WLSMU	W	1992–94	0–196	13,172–15,182	0.000–0.003	Rakoczy and Svoboda (1994, 1995, 1997)

[a] MDNR fisheries management unit: WLSMU = Western Lake Superior; ELSMU = Eastern Lake Superior; NLMMU = Northern Lake Michigan; CLMMU = Central Lake Michigan; SLMMU = Southern Lake Michigan; NLHMU = Northern Lake Huron; SLHMU = Southern Lake Huron; and LEMU = Lake Erie.

[b] W = mostly wild walleye; S =mostly or entirely stocked walleye

[c] Non-targeted effort directed at all species of fish.

Table 6.–Estimated yellow perch sport fishery statistics for inland waters of the Lake Superior Basin.

Lake	County	Area (acres)	Management unit [a]	Months and year	Number harvested Total	per acre	Fishing effort [c] (hrs)	Harvest per hr [c]	Reference
Beaver	Alger	765	ELSMU	May–Sep 1998	640	0.84	6,496	0.099	Lockwood (2000)
Grand Sable	Alger	657	ELSMU	May–Sep 1998	154	0.23	5,136	0.030	Lockwood (2000)
Bond Falls Flowage	Ontonagon	2,118	WLSMU	May–Sep 1994	275	0.13	7,812	0.035	Lockwood (2000)
Cisco	Gogebic	506	WLSMU	May–Aug 1978	7,275	14.38	28,171	0.258	Ryckman and Lockwood (1985)
				May–Oct 1977	12,641	24.98	27,085	0.467	Ryckman and Lockwood (1985)
Duck	Gogebic	622	WLSMU	May–Sep 1994	455	0.73	11,932	0.038	Lockwood (2000)
				May–Sep 1993	243	0.39	8,426	0.029	Lockwood (2000)
Gogebic	Ontonagon and Gogebic	12,898	WLSMU	Jan–Apr 1999	10,208	0.79	31,439	0.324	Lockwood (2000)
				May–Sep 1999	4,741	0.37	90,086	0.053	Lockwood (2000)
				Dec–Mar 1993–94	968	3.04	1,361	0.711	Lockwood (2000)
				May–Oct 1977	5,419	0.42	31,062	0.174	Ryckman and Lockwood (1985)
				May–Aug 1976	2,059	0.16	15,679	0.131	Ryckman and Lockwood (1985)
Tamarack	Gogebic	326	WLSMU	May–Sep 1993	25	0.07	2,386	0.011	Lockwood (2000)
Tepee	Iron	121	WLSMU	May–Sep 1983	225	1.86	1,571	0.143	Wagner (1988)
Thousand Island	Gogebic	1,020	WLSMU	May–Aug 1978	7,668	7.52	37,599	0.204	Ryckman and Lockwood (1985)
				May–Oct 1977	13,946	13.67	35,301	0.395	Ryckman and Lockwood (1985)

[a] MDNR fisheries management unit: WLSMU = Western Lake Superior; ELSMU = Eastern Lake Superior; NLMMU = Northern Lake Michigan; CLMMU = Central Lake Michigan; SLMMU = Southern Lake Michigan; NLHMU = Northern Lake Huron; SLHMU = Southern Lake Huron; and LEMU = Lake Erie.

[b] Non-targeted effort directed at all species of fish.

Table 7.–Estimated walleye sport fishery statistics for inland waters of the Lake Michigan Basin.

Lake	County	Area (acres)	Management unit[a]	Wild or stocked[b]	Months and year	Number harvested total	Number harvested per acre	Fishing effort[c] (hrs)	Harvest per hr[c]	Reference
Big Manistique	Mackinac	10,130	NLMMU	W	May–Feb 1978–79	6,367	0.63	64,691	0.098	Ryckman and Lockwood (1985)
					May–Feb 1979–80	5,335	0.53	46,068	0.116	Ryckman and Lockwood (1985)
Brevoort	Mackinac	4,001	NLMMU	W	May–Aug 1996	383	0.10	26,329	0.015	Lockwood (2000)
Chicagon	Iron	1,083	NLMMU	S	May–Oct 1994	1,461	1.35	36,341	0.040	Lockwood (2000)
					Dec–Mar 1994	357	0.33	8,168	0.044	Lockwood (2000)
					May–Nov 1993	2,583	2.39	27,835	0.093	Lockwood (2000)
Hagerman	Iron	566	NLMMU	S	May–Oct 1994	–	–	10,637	–	Lockwood (2000)
					Dec–Mar 1993–94	50	0.09	382	0.131	Lockwood (2000)
Michigamme Reservoir	Iron	6,400	NLMMU	W	May–Oct 2001	2,102	0.33	34,383	0.061	Hanchin et al. (2005)
					Dec–Feb 2002	1,013	0.16	18,303	0.055	Hanchin et al. (2005)
					May–Feb 2001–02	3,115	0.48	52,686	0.059	Hanchin et al. (2005)
Petes	Schoolcraft	194	NLMMU	S	May–Sep 1993	217	1.12	3,009	0.072	Lockwood (2000)
South Manistique	Mackinac	4,001	NLMMU	W	May–Sep 1978	14,137	3.53	61,472	0.230	Ryckman and Lockwood (1985)
Stanley	Iron	318	NLMMU	W	May–Oct 1994	340	1.07	13,530	0.025	Lockwood (2000)
					Dec–Mar 1993–94	29	0.09	1,361	0.021	Lockwood (2000)
Wedge	Schoolcraft	27	NLMMU	W	May–Sep 1993	3	0.12	744	0.004	Lockwood (2000)
Houghton	Roscommon	20,075	CLMMU	W	Jan–Mar 2001	3,584	0.18	78,908	0.045	Clark et al. (2004)
					Apr–Sep 2001	13,486	0.67	278,214	0.048	Clark et al. (2004)
					Jan–Mar 2002	4,779	0.24	220,834	0.022	Clark et al. (2004)
					Apr–Mar 2001–02	18,265	0.91	499,048	0.037	Clark et al. (2004)
Manistee	Kalkaska	860	CLMMU	S	Dec–Nov 1975–76	62	0.07	12,214	0.005	Laarman (1980)
					Dec–Nov 1976–77	16	0.02	5,614	0.003	Laarman (1980)
					Dec–Nov 1977–78	713	0.83	20,884	0.034	Laarman (1980)
Missaukee	Missaukee	1,707	CLMMU	S	May–Nov 1978	130	0.08	46,772	0.003	Ryckman and Lockwood (1985)
Silver	Oceana	690	CLMMU	S	Apr–Aug 1997	3,016	4.37	14,772	0.204	Lockwood (2000)
Sessions	Ionia	135	SLMMU	S	Apr–Sep 1997	939	6.96	33,561	0.028	Lockwood (2000)
					Apr–Sep 1996	1,847	13.68	37,801	0.049	Lockwood (2000)
Grand River[d]	Ingham	–	SLMMU	S	Apr–Sep 1987	69	–	11,128	0.006	Herman (1989)

[a] MDNR fisheries management unit: WLSMU = Western Lake Superior; ELSMU = Eastern Lake Superior; NLMMU = Northern Lake Michigan; CLMMU = Central Lake Michigan; SLMMU = Southern Lake Michigan; NLHMU = Northern Lake Huron; SLHMU = Southern Lake Huron; and LEMU = Lake Erie.

[b] W = mostly wild walleye; S =mostly or entirely stocked walleye

[c] Non-targeted effort directed at all species of fish.

[d] At Moore’s Park, Lansing.

Table 8.–Estimated walleye sport fishery statistics for Michigan waters of Lake Michigan and select tributaries.

Location	Management unit [a]	Wild or stocked [b]	Year	Total number harvested	Fishing effort [c] (hrs)	Harvest per hr [c]	Reference
Little Bay de Noc	NLMMU	W	2000	31,920	544,072	0.0587	Rakoczy (2000)
Big Bay de Noc	NLMMU	S	2000	902	18,548	0.0486	Rakoczy (2000)
Cedar River	NLMMU	S	2000	953	16,974	0.0560	Rakoczy (2000)
Menominee	NLMMU	W	2000	2,374	115,321	0.0206	Rakoczy (2000)
Manistee Lake	CLMMU	W	1999	10	73,787	0.0001	Rakoczy (1999)
			2000	47		0.0008	
Manistee River	CLMMU	W	1999	120	528,766	0.0002	Rakoczy (1999)
(below Tippy Dam)			2000	260	600,247	0.0001	Rakoczy (2000)
Muskegon River	CLMMU	S	1999	731	374,895	0.0019	Rakoczy (1999)
(below Croton Dam)	CLMMU	S	2000	1,061	444,844	0.0024	Rakoczy (2000)
St Joseph River	CLMMU	S	1998	4,018	396,201	0.0101	Rakoczy (1998)
(below Berrien Springs)			1998 [d]	330	20,784	0.0159	Rakoczy (1998)
			1999	3,517	223,677	0.0160	Rakoczy (1999)
			1999 [d]	475	21,505	0.0221	Rakoczy (1999)

[a] MDNR fisheries management unit: WLSMU = Western Lake Superior; ELSMU = Eastern Lake Superior; NLMMU = Northern Lake Michigan; CLMMU = Central Lake Michigan; SLMMU = Southern Lake Michigan; NLHMU = Northern Lake Huron; SLHMU = Southern Lake Huron; and LEMU = Lake Erie.

[b] W = mostly wild walleye; S =mostly or entirely stocked walleye

[c] Non-targeted effort directed at all species of fish.

[d] Charter boat fishery only.

Table 9.–Estimated yellow perch sport fishery statistics for inland waters of the Lake Michigan Basin.

Lake	County	Area (acres)	Management unit[a]	Months and year	Number harvested total	Number harvested per acre	Fishing effort[b] (hrs)	Harvest per hr[b]	Reference
Anderson	Marquette	49	NLMMU	May–Sep 1985	15	0.31	2,752	0.009	Wagner (1988)
Bass	Schoolcraft	287	NLMMU	May–Sep 1995	3,085	10.75	3,308	0.933	Lockwood (2000)
Big Shag	Marquette	185	NLMMU	May–Sep 1985	1,086	5.87	10,726	0.101	Wagner (1988)
Big Manistique	Mackinac	10,130	NLMMU	May–Feb 1979–80	16,975	1.68	46,068	0.368	Ryckman and Lockwood (1985)
				May–Feb 1978–79	18,271	1.80	64,691	0.282	Ryckman and Lockwood (1985)
Brevoort	Mackinac	4,001	NLMMU	May–Aug 1996	7,106	1.78	26,329	0.270	Lockwood (2000)
Chicagon	Iron	1,083	NLMMU	May–Oct 1994	13,261	12.24	36,341	0.365	Lockwood (2000)
				Dec–Mar 1994	5,926	5.47	8,168	0.726	Lockwood (2000)
				May–Nov 1993	7,996	7.38	27,835	0.287	Lockwood (2000)
Hagerman	Iron	566	NLMMU	May–Dec 1993	307	0.54	11,314	0.027	Lockwood (2000)
				Dec–Mar 1993–94	1	0.00	382	0.003	Lockwood (2000)
Michigamme Reservoir	Iron	6,400	NLMMU	May–Oct 2001	3,127	0.49	34,383	0.091	Hanchin et al.(2005)
				Dec–Feb 2002	317	0.05	18,303	0.017	Hanchin et al. (2005)
				May–Feb 2001–02	3,444	0.54	52,686	0.065	Hanchin et al. (2005)
Petes	Schoolcraft	194	NLMMU	May–Sep 1993	15	0.08	3,009	0.005	Lockwood (2000)
South Manistique	Mackinac	4,001	NLMMU	May–Sep 1978	9,293	2.32	61,472	0.151	Ryckman and Lockwood (1985)
Stager	Iron	110	NLMMU	May–Sep 1983	268	2.44	3,396	0.079	Wagner (1988)
Stanley	Iron	318	NLMMU	May–Oct 1994	5,745	18.07	13,530	0.425	Lockwood (2000)
Thunder	Schoolcraft	349	NLMMU	May–Sep 1995	4,289	12.29	6,000	0.715	Lockwood (2000)
Elk	Antrim	8,088	CLMMU	Aug 1996	2,799	0.35	11,384	0.246	Lockwood (2000)
Houghton	Roscommon	20,044	CLMMU	Jan–Mar 2001	15,070	0.75	78,908	0.191	Clark et al. (2004)
				Apr–Sep 2001	29,338	1.46	278,214	0.105	Clark et al. (2004)
				Jan–Mar 2002	19,954	1.00	220,834	0.090	Clark et al. (2004)
				Apr–Mar 2001–02	49,292	2.46	499,048	0.099	Clark et al. (2004)
Missaukee	Missaukee	1,707	CLMMU	May–Nov 1978	508	0.30	46,772	0.011	Ryckman and Lockwood (1985)

Table 9.–Continued.

Lake	County	Area (acres)	Management unit [a]	Months and year	Number harvested total	Number harvested per acre	Fishing effort [b] (hrs)	Harvest per hr [b]	Reference
Manistee	Kalkaska	860	CLMMU	Dec–Nov 1975–76	3,407	3.96	12,214	0.279	Laarman (1980)
				Dec–Nov 1976–77	279	0.32	5,614	0.050	Laarman (1980)
				Dec–Nov 1977–78	2,182	2.54	20,884	0.104	Laarman (1980)
Silver	Oceana	690	CLMMU	Apr–Aug 1997	375	0.54	14,772	0.025	Lockwood (2000)
				Apr–Sep 1996	652	0.94	21,537	0.030	Lockwood (2000)
Bankson	Van Buren	217	SLMMU	Jun–Aug 1986	1,824	8.41	13,323	0.137	Duffy (1991)
Gull	Kalamazoo	2,022	SLMMU	Jan–Feb 1987	2,035	1.01	12,073	0.169	Dexter (1991b)
Lansing	Ingham	453	SLMMU	Apr–Sep 1987	194	0.42	8,959	0.022	Herman (1989)
Long	St. Joseph	297	SLMMU	Dec–Nov 1974–75	8,704	29.31	30,191	0.288	Beyerle (1984)
				Dec–Nov 1975–76	2,256	7.60	20,897	0.108	Beyerle (1984)
				Dec–Nov 1976–77	1,629	5.48	14,085	0.116	Beyerle (1984)
				Dec–Nov 1977–78	4,152	13.98	27,542	0.151	Beyerle (1984)
Osterhout	Allegan	168	SLMMU	May–Aug 1979	200	1.19	7,211	0.028	Beyerle (1984)
Round	Van Buren	187	SLMMU	May–Sep 1977–78	0	0.0	14,400	0.000	Beyerle (1984)
				May–Sep 1979	42	0.22	15,593	0.0030	Beyerle (1984)
				May–Sep 1980	902	4.82	13,470	0.067	Beyerle (1984)
Sessions	Ionia	135	SLMMU	Apr–Sep 1997	4,045	29.96	33,561	0.120	Lockwood (2000)
				Apr–Sep 1996	1,433	10.62	37,801	0.038	Lockwood (2000)
				Jun–Aug 1986	2,391	1.18	20,065	0.112	Dexter (1991a)

[a] MDNR fisheries management unit: WLSMU = Western Lake Superior; ELSMU = Eastern Lake Superior; NLMMU = Northern Lake Michigan; CLMMU = Central Lake Michigan; SLMMU = Southern Lake Michigan; NLHMU = Northern Lake Huron; SLHMU = Southern Lake Huron; and LEMU = Lake Erie.

[b] Non-targeted effort directed at all species of fish.

Table 10.–Estimated yellow perch sport fishery statistics for Michigan waters of Lake Michigan in 2000. All data were taken from Rakoczy (2000).

Location	Management unit [a]	Total number harvested	Fishing effort [b] (hrs)	Harvest per hr [b]
Little Bay de Noc	NLMMU	142,873	544,072	0.263
Big Bay de Noc	NLMMU	153	18,548	0.008
Cedar River	NLMMU	223	16,974	0.013
Menominee	NLMMU	3,450	115,321	0.030
Onekama	CLMMU	1,220	37,780	0.032
Manistee	CLMMU	2,781	187,944	0.015
White Hall	CLMMU	5,914	65,931	0.090
Muskegon	CLMMU	57,619	171,032	0.337
Grand Haven	SLMMU	35,373	199,781	0.177
Port Sheldon	SLMMU	814	49,760	0.016
Holland	SLMMU	7,153	119,901	0.060
South Haven	SLMMU	44,748 23,082 [c]	129,105 35,323 [c]	0.347 0.653 [c]
St. Joseph	SLMMU	22,000	224,000	0.120
New Buffalo	SLMMU	7,413	38,518	0.193

[a] MDNR fisheries management unit: WLSMU = Western Lake Superior; ELSMU = Eastern Lake Superior; NLMMU = Northern Lake Michigan; CLMMU = Central Lake Michigan; SLMMU = Southern Lake Michigan; NLHMU = Northern Lake Huron; SLHMU = Southern Lake Huron; and LEMU = Lake Erie.

[b] Non-targeted effort directed at all species of fish.

[c] Charter boat fishery only.

Table 11.–Estimated walleye sport fishery statistics for inland waters of the Lake Huron Basin.

Lake	County	Area (acres)	Management unit[a]	Wild or stocked[b]	Months and year	Number harvested total	Number harvested per acre	Fishing effort[c] (hrs)	Harvest per hr[c]	Reference
Big Bear	Otsego	435	NLHMU	S	May–Sep 1982	368	0.85	17,002	0.022	Ryckman and Lockwood (1985)
Burt	Cheboygan	17,120	NLHMU	W	Apr–Sep 1993	17,186	1.00	134,957	0.127	Lockwood (2000)
					May–Aug 1977	3,869	0.23	45,514	0.085	Ryckman and Lockwood (1985)
					Apr–Sep 1996	3,310	4.80	21,537	0.154	Lockwood (2000)
Mullett	Cheboygan	17,360	NLHMU	W	May–Aug 1998	3,338	0.19	87,520	0.381	Lockwood (2000)

[a] MDNR fisheries management unit: WLSMU = Western Lake Superior; ELSMU = Eastern Lake Superior; NLMMU = Northern Lake Michigan; CLMMU = Central Lake Michigan; SLMMU = Southern Lake Michigan; NLHMU = Northern Lake Huron; SLHMU = Southern Lake Huron; and LEMU = Lake Erie.

[b] W = mostly wild walleye; S =mostly or entirely stocked walleye

[c] Non-targeted effort directed at all species of fish.

Table 12.–Estimated walleye sport fishery statistics for Michigan waters of Lake Huron and the St. Marys River.

Location	Management unit [a]	Wild or stocked [b]	Year(s)	Total number harvested	Fishing effort [c] (hrs)	Harvest per hr [c]	Reference
St. Marys system [d]	NLHMU	W	1999	11,145	556,399	0.0207	Fielder et al. (in press)
Thunder Bay	NLHMU	W	1992–94	631–1,969	79,766–108,789	0.007–0.018	Rakoczy and Svoboda (1994, 1995, 1997)
Oscoda	NLHMU	W	1992–94	718–1,606	104,74–156,000	0.0052–0.0135	Rakoczy and Svoboda (1994, 1995, 1997)
Saginaw and Tittabawassee rivers	SLHMU	S	2000 winter	38,830	308,932	0.126	Rakoczy (2000)
Saginaw Bay	SLHMU	S	2000	56,598	927,925	0.0610	Rakoczy (2000)
Harbor Beach	SLHMU	W	1992–94	1,771–8,883	146,972–195,791	0.0120–0.0454	Rakoczy and Svoboda (1994, 1995, 1997)
Port Sanilac	SLHMU	W	1992–94	94–313	88,984–106,438	0.0010–0.0035	Rakoczy and Svoboda (1994, 1995, 1997)
Lexington	SLHMU	W	1992–94	154–860	76,41–98,835	0.0010–0.0086	Rakoczy and Svoboda (1994, 1995, 1997)

[a] MDNR fisheries management unit: WLSMU = Western Lake Superior; ELSMU = Eastern Lake Superior; NLMMU = Northern Lake Michigan; CLMMU = Central Lake Michigan; SLMMU = Southern Lake Michigan; NLHMU = Northern Lake Huron; SLHMU = Southern Lake Huron; and LEMU = Lake Erie.

[b] W = mostly wild walleye; S =mostly or entirely stocked walleye

[c] Non-targeted effort directed at all species of fish.

[d] For combined sport fishery in Michigan and Ontario waters, May 1999–March 2000.

Table 13.–Estimated yellow perch sport fishery statistics for inland waters of the Lake Huron Basin.

Lake	County	Area (acres)	Management unit [a]	Months and year	Number harvested total	Number harvested per acre	Fishing effort [b] (hrs)	Harvest per hr [b]	Reference
Big Bear	Otsego	435	NLHMU	May–Sep 1982	185	0.42	17,002	0.011	Ryckman and Lockwood (1985)
Burt	Cheboygan	17,120	NLHMU	Apr–Sep 1993	433	0.02	134,957	0.003	Lockwood (2000)
				May–Aug 1977	230	0.01	45,514	0.005	Ryckman and Lockwood (1985)
East Twin	Montmorency	974	NLHMU	May–Sep 1982	22,346	22.94	13,229	1.690	Ryckman and Lockwood (1985)
Mullett	Cheboygan	17,360	NLHMU	May–Aug 1998	12,286	0.71	87,520	0.140	Lockwood (2000)
Jewett [c]	Ogemaw	13	SLHMU	1987–91	81	6.23	–	–	Schneider (1997)

[a] MDNR fisheries management unit: WLSMU = Western Lake Superior; ELSMU = Eastern Lake Superior; NLMMU = Northern Lake Michigan; CLMMU = Central Lake Michigan; SLMMU = Southern Lake Michigan; NLHMU = Northern Lake Huron; SLHMU = Southern Lake Huron; and LEMU = Lake Erie.

[b] Non-targeted effort directed at all species of fish.

[c] Average estimate for years when lake contained an experimental community of walleyes, bluegills, and yellow perch.

Table 14.–Estimated yellow perch sport fishery statistics for Michigan waters of Lake Huron and the St. Marys River.

Location	Management unit [a]	Year	Total number harvested	Fishing effort [b] (hrs)	Harvest per hr [b]	Reference
St. Mary system [c]	NLHMU	1999–00	75,238	556,399	0.1350	Fielder et al. (in press)
Les Cheneaux Islands	NLHMU	2000	693	22,792	0.030	Rakoczy (2000)
Saginaw Bay	SLHMU	2000	613,583	927,925	0.662	Rakoczy (2000)
Harbor Beach	SLHMU	1992–94	6,387–24,231	146,972–195,791	0.0436–0.170	Rakoczy and Svoboda (1994, 1995, 1997)
Port Sanilac	SLHMU	1992–94	4,271–15,125	88,984–106,438	0.048–0.156	Rakoczy and Svoboda (1994, 1995, 1997)
Lexington	SLHMU	1992–94	901–8,930	76,413–90,304	0.009–0.0728	Rakoczy and Svoboda (1994, 1995, 1997)

[a] MDNR fisheries management unit: WLSMU = Western Lake Superior; ELSMU = Eastern Lake Superior; NLMMU = Northern Lake Michigan; CLMMU = Central Lake Michigan; SLMMU = Southern Lake Michigan; NLHMU = Northern Lake Huron; SLHMU = Southern Lake Huron; and LEMU = Lake Erie.

[b] Non-targeted effort directed at all species of fish.

[c] For combined sport fishery in Michigan and Ontario waters, May 1999–March 2000.

Table 15.–Estimated walleye sport fishery statistics for inland waters of the Lake Erie Basin and LEMU.

Lake	County	Area (acres)	Wild or stocked[a]	Months and year	Number harvested total	Number harvested per acre	Fishing effort[b] (hrs)	Harvest per hr[b]	Reference
Belleville	Washtenaw	1,270	S	May–Oct 1976–79	1,700	1.34	261,804	0.006	Laarman (1979); Schneider (1987)
Cass	Oakland	1,280	S	Apr–Aug 1987	65	0.05	30,703	0.002	Schneider et al. (1989)
				Jan–Nov 1986	241	0.19	39,205	0.006	Waybrant and Thomas (1988)
Devils	Lenawee	1,300	S	Apr–Sep 1987	68	0.05	42,428	0.002	Herman (1989)
Kent	Livingston	1,000	S	Jan–Oct 1986	386	0.39	231,000	0.002	Thomas (1990)
				Apr–Aug 1987	763	0.76	92,075	0.008	Schneider et al. (1989)
				May–Oct 1980	81	0.08	191,134	0.000	Ryckman and Lockwood (1985)
Maceday-Lotus	Oakland	419	S	Jan–Nov 1986	12	0.03	37,010	0.000	Waybrant and Thomas (1988)
Orchard	Oakland	788	S	Jan–Nov 1986	0	0.00	24,422	0.000	Waybrant and Thomas (1988)
Vineyard	Jackson	505	S	Apr–Sep 1987	0	0.00	28,070	0.000	Herman (1989)
White	Oakland	540	S	Jan–Oct 1987	61	0.11	40,257	0.002	Thomas (1990)

[a] W = mostly wild walleye; S =mostly or entirely stocked walleye
[b] Non-targeted effort directed at all species of fish.

Table 16.–Estimated walleye sport fishery statistics for Michigan waters of Lake St. Clair, Lake Erie, and connecting rivers.

Location	Wild or stocked [a]	Year	Total number harvested	Fishing effort [b] (hrs)	Harvest per hr [b]	Reference
St Clair River	W	1983–84	103,528	551,454	0.188	Haas et al. (1985)
Harsen's Island channels	W	1983–84	58,045	258,407	0.225	Haas et al. (1985)
Lake St. Clair	W	1983–84	132,454	1,952,694	0.068	Haas et al. (1985)
Detroit River	W	1983–84	163,830	1,409,195	0.116	Haas et al. (1985)
Lake Erie	W	1998–00	166,788	600,000	0.280	Walleye Task Group (2001)

[a] W = mostly wild walleye; S =mostly or entirely stocked walleye
[b] Non-targeted effort directed at all species of fish.

Table 17.–Estimated yellow perch sport fishery statistics for inland waters of the Lake Erie Basin and LEMU.

Lake	County	Area (acres)	Months and year	Number harvested total	Number harvested per acre	Fishing effort[a] (hrs)	Harvest per hr[a]	Reference
Cass	Oakland	1,280	Apr–Aug 1987	300	0.23	30,703	0.010	Schneider et al. (1989)
			Jan–Nov 1986	106	0.08	39,205	0.003	Waybrant and Thomas (1988)
Devils	Lenawee	1,300	Apr–Sep 1987	1,593	1.22	42,428	0.038	Herman (1989)
Kent	Livingston	1,000	Apr–Aug 1988	3,018	3.02	92,075	0.033	Schneider et al. (1989)
			Jan–Oct 1987	2,671	2.67	231,000	0.012	Thomas (1990)
			May–Oct 1980	5,176	5.18	191,134	0.027	Ryckman and Lockwood (1985)
Maceday-Lotus	Oakland	419	Jan–Nov 1986	2,121	5.06	37,010	0.057	Waybrant and Thomas (1988)
Orchard	Oakland	788	Jan–Nov 1986	191	0.24	24,422	0.008	Waybrant and Thomas (1988)
Vineyard	Jackson	505	Apr–Sep1987	684	1.35	28,070	0.024	Herman (1989)
White	Oakland	540	Jan–Oct 1987	2,691	4.98	40,257	0.067	Thomas (1990)
Whitmore	Washtenaw	677	May–Oct 1980	2,545	3.76	64,526	0.039	Ryckman and Lockwood (1985)

[a] Non-targeted effort directed at all species of fish.

Table 18.–Estimated walleye sport fishery statistics for Michigan waters of Lake St. Clair, Lake Erie, and connecting rivers.

Location	Year	Total number harvested	Fishing effort [b] (hrs)	Harvest per hr [b]	Reference
St Clair River	1983–84	8,602	551,454	0.016	Haas et al. (1985)
Harsen's Island channels	1983–84	8,290	258,407	0.032	Haas et al. (1985)
Lake St. Clair	1983–84	868,829	1,952,694	0.445	Haas et al. (1985)
Detroit River	1983–84	135,986	1,409,195	0.096	Haas et al. (1985)
Lake Erie	1997–01	411,289	600,000	0.670	Yellow Perch Task Group (2001)

[a] Non-targeted effort directed at all species of fish.

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Appendix 1.–Lake Superior Basin walleye waters based on stocking records for 1995–99, fish collected since 1980, and questionnaires completed by management unit biologists. Questionnaires asked management biologists to rank each walleye population regarding its recruitment, origin, Great Lakes (GL) access, and fishery. They were also asked to rank yellow perch fisheries, if any existed in the water body. These ranks are defined in the text at the beginning of the **Status of Percids of Michigan** section.

Management unit						Data	Walleye ranks				Yellow perch
County	Water body	Size [a]	T	R	S	source [b]	Recruitment	Origin	GL access	Fishery	fishery ramk
Eastern Lake Superior											
Alger	Au Train Lake	845	46N	20W	05	s, f	4	2	3	1	2
	Beaver Lake	783	48N	16W	08	s	3	1	2	3	3
	Cleveland Basin	1,489	45N	20W	06	s	4	3		2	3
	Deer Lake	266	47N	21W	18	s, f	5	3	3	2	2
	Kingston Lake	123	48N	15W	06	s, f					
	Little Beaver Lake	40	48N	16W	18		2	1	2	4	3
	Nawakwa Lake	442	48N	13W	19	f	1	3	3	2	4
Chippewa	Lake Superior		47N	02W	35	s					
	Lower Tahquamenon River	17	48N	06W	many		5	1	1	1	2
	Monocle Lake	172	47N	03W	14	f	5	2	3	2	3
	Tahquamenon River		48N	07W	13	s					
	Tahquamenon River		48N	06W	15	s					
	Tahquamenon River		49N	07W	32	s					
Luce	Bass Lake	144	47N	11W	17	s	4	2		3	3
	Beaverhouse Lake	33	49N	11W	33	s, f	6	2		3	3
	Belle Lake I	26	47N	12W	09	f					
	Belle Lake II	107	47N	12W	09	s, f	4	2		2	2
	Bodi Lake	275	50N	08W	29	s, f	6	2	3	2	3
	Culhane Lake	100	50N	08W	30	s, f	6	2	3	2	3
	East Lake	125	45N	11W	10	s	7	2		4	3
	Little Lake	87	50N	08W	19		3	1	1	3	3
	Marsh (South) Lake	25	47N	12W	05	f					
	Muskallonge Lake	762	49N	11W	02	s, f	5	2		3	2
	Pike Lake	286	49N	09W	14	f	3	1	2	2	4
	Pretty Lake	45	49N	11W	34	s, f	6	2		2	3
	Upper Tahquamenon River	~60	48N	08E	12		1	2		1	2

Appendix 1.–Continued.

Management unit County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks Recruitment	Origin	GL access	Fishery	Yellow perch fishery ramk
Western Lake Superior											
Baraga	Big Lake	119	49N	34W	28	s, f	7	2		4	
	Lake Superior		51N	31W	18	s					
	Lake Superior		52N	31W	27	s					
	Parent Lake	184	48N	33W	09	f	2	2		2	
	Vermilac (Worm) Lake	640	48N	33W	19	s, f	3	2		2	
	Huron Bay, Lake Superior		52N	31W	many		5	2	1	3	
Gogebic	Allen Lake	78	44N	39W	10	s	8	2		3	
	Beatons Lake	324	45N	41W	12	s, f	8	2		4	
	Big African	85	45N	41W	35		1	1		2	
	Big Lake	733	44N	41W	16, 17		1	1		2	
	Chaney Lake	496	45N	45W	many		6	2		4	
	Cisco Lake	567	45N	41W	33	s	3	1		2	
	Cloverleaf Lake	61	45N	41W	32		1	1			
	Dinner Lake	108	44N	39W	24	s, f	5	2		2	
	Duck Lake	612	44N	39W	20	s, f	5	2		2	
	East Bay Lake	277	44N	41W	many		1	1		2	
	Fishhawk Lake	77	44N	41W	10		1	1		2	
	Gaylord Lake	80	45N	43W	22		6	2		4	
	Indian Lake	129	44N	41W	13		1	1		2	
	Langford Lake	482	45N	41W	30	s	5	2		4	
	Lindsley Lake	156	44N	41W	many		1	1		2	
	Little Oxbow Lake	98	45N	43W	34	s, f	6	2		2	
	Marion Lake	297	45N	38W	29	s	5	2		2	
	Moraine Lake	90	45N	44W	many		6	2		3	
	Ormes Lake	52	45N	43W	26	f	6	2		3	
	Pomeroy Lake	314	45N	42W	20	f	5	2		2	
	Poor Lake	106	44N	41W	14		1	1		2	
	Record Lake	68	45N	41W	35		1	1		2	
	Sunday Lake	226	47N	45W	8		3	2		3	

Appendix 1.–Continued.

Management unit County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks: Recruitment	Origin	GL access	Fishery	Yellow perch fishery ramk
Western Lake Superior–continued											
Gogebic–continued	Tamarack Lake	331	44N	38W	12	f	1	2		3	
	Thousand Island	1,009	44N	41W	11	s, f	3	1		2	1
	West Bay	362	44N	41W	16		1	1		2	1
Houghton	Bob Lake	130	49N	37W	10	s, f	5	2		3	
	Lake Gerald	356	52N	36W	14		8	2		4	
	Lake Roland	258	52N	36W	22	f					
	Otter Lake	863	52N	34W	01	f	3	1	1	2	
	Pike Lake	83	51N	36W	11	s, f	5	2		3	
	Portage Lake	10,808	55N	34W	36	s, f	3	1	1	1	
	Rice Lake	656	55N	31W	17	f					
	Sandy Lake	101	52N	36W	34	s	7	2		4	
	Torch Lake	2,401	55N	32W	6	s, f	3	1	1	2	
Houghton–Baraga	Prickett Backwaters	747	50N	35W	32	f	4	2		2	
Iron	Tepee Lake	120	46N	37W	13	s					
Keweenaw	Gratiot Lake	1,452	57N	30W	03	s, f	5	1	1	1	
	Lac LeBelle	1,205	58N	29W	32	s, f	4	1	1	1	
	Lake Fanny Hooe	230	59N	28W	34	s, f	8	2		3	
	Lake Medora	690	58N	29W	04	f	5	2		3	
Marquette	Dead River Storage Basin	2,737	48N	26W	9	s	3	2		1	
	Deer Lake Basin	906	48N	27W	27	f	1	2		1	
	Forestville Basin (No Name)	90	48N	25W	08	f					
	Lake Independence	2,041	51N	27W	15	s	3	2		1	
	McClure Basin	118	48N	26W	14	f					
	Teal Lake	485	48N	27W	31	f	3	2		1	
Ontonagon–Gogebic	Lake Gogebic	13,127	48N	42W	4	f	1	2		1	1
Ontonagon–Houghton	Six Mile Lake	82	50N	37W	4	f					

Appendix 1.–Continued.

Management unit County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks: Recruitment	Origin	GL access	Fishery	Yellow perch fishery ramk
Western Lake Superior–continued											
Ontonagon	Bond Falls Flowage	2,127	46N	38W	18	s, f	3	2		2	
	Ontonagon River	39	52N	40W	25		3	1	1	1	
	Sudden Lake	35	50N	37W	10	f	5	2		3	
	Victoria Impoundment	282	50N	39W	31		3	2		3	

[a] Size is in surface acres for lakes and impoundments. Size is in length in miles for rivers.
[b] Data source is s = stocking records for 1995–99 or f = Fish Collection System of MDNR.

Appendix 2.–Lake Michigan Basin walleye waters based on stocking records for 1995–99, fish collected since 1980, and questionnaires completed by management unit biologists. Questionnaires asked management biologists to rank each walleye population regarding its recruitment, origin, Great Lakes (GL) access, and fishery. They were also asked to rank yellow perch fisheries, if any existed in the water body. These ranks are defined in the text at the beginning of the **Status of Percids of Michigan** section.

Management unit						Data	Walleye ranks				Yellow perch
County	Water body	Size [a]	T	R	S	source [b]	Recruitment	Origin	GL access	Fishery	fishery ramk
Central Lake Michigan											
Antrim	Bellaire Lake	1,789	29N	08W	1	s, f					
	Birch Lake	325	29N	09W	3	s, f	6	2		3	3
	Intermediate Lake	1,571	30N	8W	2	s, f	5	3		3	3
	Lake Skegemog	2,766	28N	09W	12	f					
Antrim–Charlevoix	Six Mile Lake	369	31N	07W	5	s	5	3		3	4
Benzie	Little Lime Lake	35	27N	13W	7	s					
	Lower Herring Lake	450	25N	16W	14	f	5	1	1	2	3
	Platte Lake	2,532	26N	15W	2	c	5	1	1	3	3
	Upper Herring Lake	572	25N	15W	13	s, f	5	1	1	2	3
Charlevoix	Lake Charlevoix	17,268	33N	06W	34	s, f	5	1	1	2	3
	Lake Geneserath	480	37N	10W	15		6	2		4	3
Clare	Long Lake	211	20N	04W	27	s, f	6	3		4	3
	Muskegon River		19N	06W	16	s					
	Muskegon River		20N	05W	10	s					
	Muskegon River		20N	06W	34	s					
Crawford	Lake Margarethe	1,922	26N	04W	15	s, f	5	2		2	4
Emmet	Paradise Lake	1,912	38N	04W	15	s	5	1	1	3	4
Grand Traverse	Boardman Lake (pond)	317	27N	11W	11		6	1	1	3	3
	Fife Lake	606	25N	09W	12	s	6	2		2	3
	Long Lake	2,911	27N	12W	34	s, f	3	2		2	3
	Silver Lake	609	27N	11W	30	s	5	2		3	3
	Spider Lake	445	26N	10W	2	f					
Grand Traverse–Antrim	Skegemog	2,766	28N	9W	24		5	1	1	4	2
Kalkaska	Cub Lake	57	27N	05W	19	s	6	2		4	4
	Manistee Lake	874	27N	06W	3	s, f	5	2		2	4
	Pickerel Lake	93	28N	06W	25	s	6	2		3	3
Lake	Big Star Lake	890	17N	14W	34	s	6	2		3	4
	Wolf Lake	407	19N	13W	26	s					

Appendix 2.–Continued.

Management unit County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks: Recruitment	Origin	GL access	Fishery	Yellow perch fishery ramk
Central Lake Michigan–continued											
Leelanau	Lake Leelanau	8,607	29N	12W	14	s	5	1		2	3
	Lake Michigan		30N	11W	28	s					
	Lake Michigan		32N	11W	34	s					
Manistee	Bear Lake	1,873	24N	15W	5	s	5	1		3	4
	Manistee Lake	1,051	21N	17W	1		1	1	1	1	3
	Manistee River (Hodenpyl)	15	22N	13W	2	s	1	1	1	2	4
	Manistee River (lower)	25	22N	15W	22		1	1	1	2	3
	Portage Lake	2,116	23N	16W	28	s	5	1	1	2	2
	Tippy Dam Backwaters	1,086	22N	13W	31		5	1	1	3	3
Mason	Gun Lake	233	20N	16W	36	s					
	Hackert (Crystal) Lake	120	18N	17W	3	s, f	6	2	2	3	4
	Hamlin Lake	4,622	19N	18W	20	s, f	5	1	1	2	3
	Long Lake	107	18N	15W	15	s					
	Pere Marquette Lake	606	18N	18W	24		5	1	1	3	3
	Pleiness Lake	98	17N	16W	20	f					
	Round Lake	542	19N	15W	28	s					
Mecosta	Horsehead Lake	443	15N	08W	22	s, f	6	2		2	3
	L. Muskegon River		13N	09W	30	s					
	Lake Mecosta	312	14N	08W	8	s, f					
	Muskegon River, upper	125	15N	10W	25		5	1	2	4	
	Rogers Impoundment	337	14N	10W	11		2	1	2	3	
	School Section Lake	122	14N	08W	16	s	6	3		4	3
Missaukee	Crooked Lake	490	22N	08W	4		7	2		4	3
	Lake Missaukee	2,035	22N	08W	12	s	5	2		2	2
	Lake Sapphire	246	22N	08W	10		6	2		4	4
	Muskegon River		21N	05W	3	s					
Missaukee–Roscommon	Deadstream (Reedsburg) Pond	567	23N	05W	25	s		1	2	0	
Montcalm	Big Whitefish Lake	502	11N	10W	20	s	7	2		4	3
	Little Whitefish Lake	180	11N	10W	08	s	8	2			3

Appendix 2.–Continued.

Management unit County	Water body	Size[a]	T	R	S	Data source[b]	Walleye ranks Recruitment	Origin	GL access	Fishery	Yellow perch fishery ramk
Central Lake Michigan–continued											
Muskegon	Big Blue Lake	336	12N	16W	3	s	6	2		3	4
	Muskegon Lake	4,232	10N	17W	34	s	5	1	1	1	1
	Muskegon River		11N	15W	34	s					
	Muskegon River (lower)	45	10N	16W	18		5	1	1	3	
	White Lake	2,535	11N	18W	2	s, f	5	1	1	1	1
	Wolf Lake	225	10N	15W	16	s	6	2		3	4
Muskegon–Oceana	White River	40	12N	17W	28		5	1	1	4	
Newaygo	Baptist Lake	80	11N	11W	24	s, f	6	2		4	4
	Croton Pond	1,129	12N	11W	7	s	2	1	2	3	3
	Fremont Lake	825	12N	14W	10	s, f	6	2	2	3	2
	Hardy Pond	2,773	13N	11W	28	f	1	1	2	3	3
	Nichols Lake	153	15N	13W	6	s	6	2		3	4
	Pickerel Lake	308	12N	13W	1	s, f	6	2		3	3
	Robinson Lake	134	13N	13W	10	s, f	6	2		4	4
Oceana	Hart Lake (impoundment)	236	15N	17W	8	s	6	1	2	3	3
	Pentwater Lake	482	16N	18W	14		9	1	1	3	2
	Pentwater River	4	16N	18W	25		9	1	1	4	
	School Section Lake	187	16N	15W	15	s	6	2		4	3
	Silver Lake	672	15N	18W	31	s, f	6	1	2	1	2
Oceana–Newaygo	White River	40	14N	15W	25			1	2		
Osceola	Big Lake	212	17N	07W	18	s	6	3		4	4
	McCoy Lake	21	19N	09W	29	s	6	2		4	4
	Muskegon River		18N	07W	16	s					
	Rose Lake	373	19N	09W	3	s	5	3		3	3
	Todd Lake	82	18N	10W	13	s	6	2		4	3
Roscommon	Higgins Lake	10,186	24N	03W	34		2	1	2	4	1
	Houghton Lake	20,075	23N	04W	10	s, f	3	1	2	2	3
	Lake James	191	22N	03W	14	s					
Wexford	Hodenpyl Dam Pond	1,530	23N	12W	17	s	4	1	1	2	2
	Lake Cadillac	1,172	21N	9W	4	f	3	1	2	3	3
	Lake Mitchell	2,649	21N	9W	6	f	3	1	2	3	4
	Pleasant Lake	130	22N	10W	13	s	6	2		3	4

Appendix 2.–Continued.

Management unit County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks: Recruitment	Walleye ranks: Origin	Walleye ranks: GL access	Walleye ranks: Fishery	Yellow perch fishery ramk
Northern Lake Michigan											
Alger	Moccasin Lake	81	44N	19W	01	s	6	2		2	3
	Skeels Lake	15	44N	19W	36	s					
	Stella Lake	332	44N	20W	26	s	6	2		2	3
Baraga	Beaufort Lake	467	48N	31W	21	f	5	2		2	3
	Craig Lake	360	49N	31W	28	f	1	2		3	3
	George Lake	158	48N	31W	17	f	2	2		3	3
	Ruth Lake	189	48N	31W	17	s, f	5	2		2	3
	Spruce Lake	70	47N	31W	34		9	2		4	4
	St. Johns Lake	126	47N	31W	36		6	2		3	3
Baraga–Marquette	Keewayden Lake	132	49N	30W	31		2	2		4	3
Delta	Boney Falls Basin	182	41N	24W	2	f					
	Escanaba River		39N	22W	7	s					
	Ford River		38N	23W	22	s					
	Gooseneck Lake	128	42N	18W	03	s	6	2		2	2
	Lake Michigan		37N	24W	34	s					
	Lake Michigan		39N	20W	4	s					
	Lake Michigan		39N	18W	5	s					
	Lake Michigan		39N	22W	7	s					
	Lake Michigan		39N	22W	29	s					
	Lake Michigan		39N	22W	35	s					
	Lake Michigan		40N	22W	10	s					
	Lake Michigan		40N	22W	16	s					
	Lake Michigan		40N	19W	20	s					
	Lake Michigan		40N	22W	22	s					
	Lake Michigan		40N	22W	28	s					
	Lake Michigan		40N	20W	28	s					
	Lake Michigan		41N	21W	29	s					
	Lake Michigan		41N	18W	33	s					
	Round Lake	442	43N	20W	1	s, f	6	2		2	2
	Square Lake	8	42N	18W	1	s					
	Sturgeon River		40N	19W	17	s					
	Sturgeon River		41N	19W	17	s					
	Sturgeon River		41N	19W	20	s					

Appendix 2.–Continued.

Management unit County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks Recruitment	Origin	GL access	Fishery	Yellow perch fishery ramk
Northern Lake Michigan–continued											
Delta–Schoolcraft	Straits, Corner, Deep, Skeels lakes	471	44N	18W	31		6	2		3	3
Dickinson	Bass Lake	60	40N	30W	13	s					
	Big Badwater Lake	308	40N	30W	1	s	1	1		2	3
	Carney Lake	115	40N	29W	06	f	6	2		2	3
	Edey Lake	80	44N	30W	21	s					
	Gene Pond	573	42N	28W	06	s, f					
	Hamilton Lake	73	39N	28W	21	s, f	6	2		3	3
	Hanbury Lake	78	39N	29W	16	s, f	6	2		3	3
	Hydraulic Falls Impoundment	40	39N	30W	7		1	1		2	3
	Island Lake (Pond 1)	175	41N	29W	6		1	2		2	4
	Kingsford Imp (Ford Dam)	408	40N	31W	13		1	1		2	3
	Lake Antoine	725	40N	30W	20	s, f	6	2		2	2
	Louise Lake	83	39N	28W	19	s	6	2		3	3
	Mary Lake	85	39N	29W	25	s	6	2		3	3
	Norway Lake	55	42N	28W	5	f					
	Pickerel Lake	68	43N	28W	33	s					
	Sawyer Lake	238	44N	30W	28	s, f	6	2		2	3
	Silver Lake	108	44N	30W	14	s, f	6	2		2	3
	Six Mile Lake	101	42N	29W	22	s					
	Solberg Lake	26	42N	29W	20	f					
Gogebic	Birch Lake	181	43N	39W	2,3		9	3			
	Lac Vieux Desert	4,370	43N	39W	4	f	3	1		1	2
Iron	Bone Lake	159	46N	32W	22	s	5	1	2	3	3
	Brule Lake	234	42N	36W	18	f	4	1	2	1	3
	Buck Lake	150	42N	33W	15	f					
	Cable Lake	331	46N	34W	29	s, f	4	2		1	4
	Camp Lake	98	42N	35W	18	s	5	2		3	3
	Caspian Pond		42N	35W	1	f					
	Chicagon Lake	1,083	42N	34W	13	s, f	5	2		1	2
	Crystal Falls Pond (Paint)	59	43N	32W	20	s					
	Deer Lake Basin	74	45N	32W	5	s, f	5	2		3	3
	Emerson Lake	15	42N	31W	1	s					

Appendix 2.–Continued.

Management unit County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks Recruitment	Origin	GL access	Fishery	Yellow perch fishery ramk
Northern Lake Michigan–continued											
Iron–continued	Emily Lake	326	43N	34W	24	s, f	6	2		1	1
	Fortune Lake, First	184	43N	33W	34	s, f					
	Fortune Lake, Second	128	43N	33W	34	s					
	Gibson Lake	95	44N	33W	21	s	6	2		3	4
	Glidden Lake	31	42N	31W	6	s, f					
	Hagerman Lake	565	42N	36W	2	f	3.5	2		1	3
	Ice Lake	87	43N	35W	25	s					
	Indian Lake	197	42N	34W	13	s, f	6	2		3	3
	Iron Lake	390	43N	35W	10	f	3.5	2		2	4
	James Lake	209	44N	37W	14	s	3.5	2		3	3
	Lake Mary	270	42N	31W	5	s	6	2		3	3
	Lake Ottawa	532	43N	36W	25	s, f					
	Lake St. Kathryn	166	46N	35W	18	s, f	5	2		2	4
	Little Smokey Lake	87	43N	37W	33	s					
	Long Lake	60	43N	33W	17	f					
	Michigamme Falls Reservoir	470	41N	31W	12	f	1	1		3	3
	Michigamme Reservoir (Way)	4,867	43N	31W	6	f	1	1		2	3
	Mitchill Lake	42	43N	31W	26	s	7	2		4	2
	Net River		45N	34W	2	s					
	Norway Lake	51	46N	35W	4	s	6	2		3	4
	Ottawa Lake	532	43N	36W	36		5	2		2	3
	Paint River Pond	708	41N	32W	12	f	1	1		1	3
	Peavy Pond	2,347	42N	31W	29	f	1	1		1	3
	Perch Lake	1,038	46N	35W	22	f	1	2		1	2
	Runkle Lake	80	43N	32W	22	s, f	6	2		3	3
	Snipe Lake	63	42N	35W	9	s, f					
	Stager Lake	109	41N	32W	5	s, f	3.5	2		2	4
	Stanley Lake	319	42N	35W	4	f	3.5	2		1	3
	Sunset Lake	531	43N	34W	7	s, f	5	2		2	3
	Swan Lake	160	43N	33W	2	s, f	6	2		1	3
	Winslow Lake	259	46N	36W	36	s					
Luce–Mackinac	Big Manistique Lake	10,346	44N	02W	2	f	1	3	3	2	2

Appendix 2.–Continued.

Management unit County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks: Recruitment	Walleye ranks: Origin	Walleye ranks: GL access	Walleye ranks: Fishery	Yellow perch fishery ramk
Northern Lake Michigan–continued											
Luce	N. Manistique Lake	1,709	45N	12W	13	s, f	6	3	3		3
Mackinac	S. Manistique Lake	4,133	44N	12W	26		1	3	3	2	2
	Brevoort Lake	4,315	42N	05W	34	s, f	5	2		3	3
	Lake Michigan		42N	07W	3	s					
	Little Brevoort Lake	163	42N	06W	24	s, f					
	Milakokia Lake	2,031	43N	12W	33	f					
	Millecoquins Lake	1,123	43N	10W	2	s, f	7	2		4	4
	Nunns Creek		42N	02W	16	s					
Marquette	Bass Lake	272	45N	25W	36	s, f	6	2		2	2
	Big Shag Lake	195	45N	26W	25	s					
	Fish Lake	152	47N	29W	5	s, f					
	Goose Lake	410	47N	26W	24	s	6	2		2	2
	Greenwood Reservoir	1,117	47N	28W	29	s	6	2		3	3
	Lake Michigamme	4,292	48N	30W	27	s	4	2		2	3
	Little Lake	460	45N	24W	20	s	6	2		2	2
	Log Lake	175	48N	29W	3	s					
	Mehl Lake	90	45N	25W	24	s					
	Peshekee River		48N	30W	24	s					
	Pike Lake	90	45N	26W	28	s, f	6	2		2	2
	Porterfield Lake	33	45N	29W	28	f					
	Schweitzer Impoundment	245	46N	27W	4	s, f	6	2		3	3
	Twin Lake	18	45N	30W	26	s					
	Witch Lk	211	45N	30W	24			2		2	3
Menominee	Cedar River	22	35N	25W	23	s	5	2		1	2
	Chalk Hills Impoundment	543	37N	28W	20		1	1		2	2
	Grand Rapids Impoundment	183	34N	27W	4		1	1		3	3
	Hermansville Pond	125	38N	27W	5		6	2		3	3
	Lake Michigan		32N	26W	5	s					
	Menominee River (lower)	3	31N	27W	11		5	2		1	2
	Menominee River (upper)	24	34N	27W	9		3	1		2	4
	White Rapids Impoundment	439	36N	28W	29		1	1		2	3

Appendix 2.–Continued.

Management unit County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks: Recruitment	Origin	GL access	Fishery	Yellow perch fishery ramk
Northern Lake Michigan–continued											
Otsego	Lake 27	105	31N	04W	27	s					
Schoolcraft	Boot Lake	106	45N	17W	29	s, f	6	2		2	2
	Gemini Lake	128	47N	16W	9	s	6	3	3		3
	Gulliver Lake	881	41N	14W	2	s, f	6	2		4	4
	Indian Lake	8,647	42N	17W	25	s	4	1		2	2
	Manistique River		42N	15W	13	s					
	Manistique River		44N	13W	30	s					
	Manistique River		45N	13W	34	s					
	Mc Donald Lake	1,441	41N	13W	05	s, f	6	2	3	3	3
	Petes Lake	194	44N	18W	07	s, f					
	Sand Lake	113	45N	17W	27		6	2		2	2
	Steuben Lake	136	44N	17W	22	s, f	5	2		2	2
	Thunder Lake	331	43N	17W	30	s, f	5	2		2	2
	Wedge Lake	26	44N	17W	18	c					
Southern Lake Michigan											
Allegan	Duck Lake	139	01N	14W	36	f					
	Kalamazoo River		02N	14W	10	s					
	Kalamazoo River (lower)	24	03N	16W	5	s	5	1	1	2	
	Kalamazoo River (upper)	42	02N	13W	20	s	5	1	2	4	
	Lake Allegan	1,785	02N	14W	15	f					
	Selkirk Lake	92	03N	11W	32	f	6	2		4	
Barry	Bristol Lake	140	01N	08W	3	s, f	8	2		4	
	Daggett Lake	17	02N	10W	1	s, f					
	Fine Lake	324	01N	08W	30	s	6	2		4	
	Fish Lake	151	02N	10W	16	f					
	Gun Lake	2,735	02N	10W	5	s, f	6	1	3	2	3
	Pleasant Lake	141	01N	09W	8	s	6	2		4	
	Thornapple Lake	415	03N	07W	19	s, f	6	1	2	2	
	Wall Lake	557	02N	09W	29	s					

Appendix 2.–Continued.

Management unit County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks: Recruitment	Walleye ranks: Origin	Walleye ranks: GL access	Walleye ranks: Fishery	Yellow perch fishery ramk
Southern Lake Michigan–continued											
Berrien	Galien River	6	08S	21W	9	s	6	1	1	2	
	Galien River		07S	20W	31	s					
	Paw Paw Lake	922	03S	17W	15	s, f	6	3	3	3	
	St. Joseph River (lower)	23	04S	19W	20		5	1	1	2	
	St. Joseph River (upper)	23	06S	17W	18	s	5	1	2	2	
Branch	Coldwater Lake	1,581	07S	06W	27	s	6	2		3	3
	East Long Lake	122	07S	06W	23	f					
	Lake of the Woods (Rose)	334	07S	06W	18	s, f	7	2		4	
	Marble Lake	741	06S	05W	29	f					
	Matteson Lake	313	06S	08W	27	s, f	6	2		3	
	Union Lake	544	05S	07W	06	s, f	6	2		4	
Calhoun	Duck Lake	596	01S	04W	16	f					
	Goguac Lake	340	02S	08W	22	f					
Cass	Barron Lake	216	07S	16W	28	s					
	Diamond Lake	1,041	06S	14W	31	s, f	5	1	3	3	3
	Fish Lake	334	05S	13W	17	s, f					
	Magician lake	522	05S	16W	03	s, f	6	2		2	
	St. Joseph River	40	08S	13W	23		6	1	2	2	
Clinton	Lake Ovid	362	06N	01W	03	f					
Eaton	Lacey Lake	55	02N	06W	25	s					
	Lake Alliance	17	03N	04W	26	f					
	Lake Delta (Erickson)	83?	04N	03W	34	s, f					
Gratiot	Rainbow Lake	304	09N	03W	20	s					
Hillsdale	Baw Beese Lake	448	07S	03W	01	f					
	Lake LeAnn	467	05S	01W	9	s					
Ingham	Grand River		04N	02W	21	s					
	Moore's River Pond	112	04N	02W	19	f	6	2			6

Appendix 2.–Continued.

Management unit County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks: Recruitment	Walleye ranks: Origin	Walleye ranks: GL access	Walleye ranks: Fishery	Yellow perch fishery ramk
Southern Lake Michigan–continued											
Ionia	Grand River		06N	08W	2	s	9	1	1	1	9
	Grand River		06N	05W	4	s					
	Grand River		06N	05W	28	s					
	Grand River		07N	06W	19	s					
	Morrison Lake	315	06N	08W	36	s, f	7	2		2	7
	Session Lake	139	07N	07W	34	s, f	6	2		1	6
	Woodard Lake	70	08N	06W	18	s, f	8	2		4	8
Jackson	Big Wolf Lake	398	03S	02E	19		6	2		3	6
	Center Lake	847	03S	01E	9	f					
	Crispell Lake	86	04S	01W	21	f					
	Grand River		02S	01W	15	s					
	Portage lake	398	01S	02E	31	s, f	6	2		4	6
Kalamazoo	Kalamazoo River		02S	10W	24	s					
	Morrow Lake	920	02S	10W	22	s, f	6	1	2	3	3
Kent	Bass Lake	188	10N	09W	12	s					
	Grand River		06N	09W	11	s					
	Grand River		07N	10W	7	s					
	Grand River		07N	10W	34	s					
	Grand River		08N	11W	23	s	5	1	2	4	
	Lincoln Lake	417	10N	09W	22	s	6	2		2	
	Long Lake	54	10N	11W	31	s, f	8	2		4	
	Versluis Lake	24?	08N	11W	23	f					
Kent–Ottawa	Grand River		05N	16W	33		5	1	1	2	
Montcalm	Clifford Lake	195	11N	07W	31	s	8	2		3	
	Crystal Lake	709	10N	05W	17	s, f	6	2		2	
	Derby Lake	114	10N	07W	10	f					
Muskegon	Mona Lake	656	09N	17W	12	f	8	3	1	4	
Newaygo	Bills Lake	200	12N	11W	31	s, f	6	2		3	
Ottawa	Crockery Lake	104	09N	13W	15	s, f	6	2		3	
	Lake Macatawa	1,881	05N	16W	33	s, f	5	1	1	1	

Appendix 2.–Continued.

Management unit County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks Recruitment	Origin	GL access	Fishery	Yellow perch fishery ramk
Southern Lake Michigan–continued											
St. Joseph	Big Pleasant Lake	256	06S	12W	10	f					
	Constantine Impoundment	206	07S	12W	23		6	1	2	3	
	Corey Lake	599	06S	12W	20	f					
	Klinger Lake	835	07S	11W	35	s, f	6	2		3	
	Long Lake	208	06S	12W	7	f					
	Long Lake (Colon Twp)	234	06S	09W	27	s					
	Mottville Impoundment	214	08S	12W	6	f	6	1	2	3	
	Palmer Lake	497	06S	09W	11	s, f	6	3	3	3	
	Pleasant Lake	256	06S	12W	16	s					
	Portage Lake	400	05S	10W	18	f					
	St. Joseph River		05S	10W	33	s					
	St. Joseph River		06S	09W	1	s					
	St. Joseph River		07S	12W	1	s					
	St. Joseph River		07S	12W	1	s					
	Sturgeon Lake	208	06S	09W	11	s, f	6	1	2	2	
	Sturgis Impoundment	574	06S	10W	5		6	1	2	3	
	Three Rivers Impoundment	491	06S	11W	17	f	6	1	2	3	
Van Buren	Black River	6	01S	17W	10	s	6	1	1	2	
	Cedar Lake	275	04S	13W	28	f	6	2	2	3	
	Lake of Woods	301	04S	15W	24	s, f	6	2	2	2	
	Maple Lake	193	03S	14W	1	s, f	6	3	3	3	

[a] Size is in surface acres for lakes and impoundments. Size is in length in miles for rivers.
[b] Data source is s = stocking records for 1995–99, f = Fish Collection System of MDNR, or c = creel survey.

Appendix 3.–Lake Huron Basin walleye waters based on stocking records for 1995–99, fish collected since 1980, and questionnaires completed by management unit biologists. Questionnaires asked management biologists to rank each walleye population regarding its recruitment, origin, Great Lakes (GL) access, and fishery. They were also asked to rank yellow perch fisheries, if any existed in the water body. These ranks are defined in the text at the beginning of the **Status of Percids of Michigan** section.

Management unit						Data	Walleye ranks				Yellow perch
County	Water body	Size [a]	T	R	S	source [b]	Recruitment	Origin	GL access	Fishery	fishery rank
Northern Lake Huron											
Alcona	Alcona Dam Pond	975	25N	05E	14	f					
	Crooked Lake	96	27N	05E	18	f					
	Hubbard Lake	8,768	27N	07E	03	f					
	Jewell Lake	184	26N	07E	04	s, f					
	Vaughn Lake	112	25N	06E	20	s, f					
	Beaver Lake	693	29N	05E	11	s, f	5	2		3	
	Four Mile Pond	93	31N	08E	07	s, f	5	2		4	
	Lake Huron		31N	08E	26	s					
	Long Lake	5,342	32N	08E	15	f	1	1		2	2
	Ninth Street Pond	366	31N	08E	22	s, f					
	Winyah Lake (7 mile)	865	31N	07E	12	s, f	5	2		3	
	Thunder Bay River		31N	05E	23	s					
Alcona–Iosco	Cedar Lake	1,057	25N	09E	15	s, f					
Cheboygan	Black Lake	10,113	36N	01E	21	f	1	1	1	1	2
	Burt Lake	17,395	35N	03W	24	f	1	1	1	1	2
	Long Lake	379	36N	01W	11	s	4	1		3	
	Mullett Lake	16,704	36N	02W	29	s	1	1	1	2	2
Chippewa	Caribou Lake	829	42N	04E	31	f					
	Carp (Trout) Lake	568	44N	06W	22	s, f					
	Frenchman's Lake	185	44N	06W	26	f					
	Lake Huron		42N	06E	03	s					
	Lake Huron		43N	03E	29	s					
	Lake Huron		44N	02E	04	s					
	St. Marys River		45N	02E	33	s					
	St. Marys River		47N	01W	01	s					
	St. Marys River		47N	01E	4	s					
	St. Marys River		47N	02E	15	s					

Appendix 3.–Continued.

Management unit County	Water body	Size[a]	T	R	S	Data source[b]	Walleye ranks Recruitment	 Origin	 GL access	 Fishery	Yellow perch fishery rank
Northern Lake Huron–continued											
Crawford	Big Creek Imp.	78	28N	01W	24	s					
	Jones Lake	40	28N	02W	30	s, f					
Emmet	Crooked Lake	2,352	35N	04W	17	s	3	1	1	2	3
	Pickerel Lake	1,082	35N	04W	26	s	3	1	1	2	3
	Round Lake	353	35N	05W	23	s	5	1		4	
Iosco	Cooke Pond	1,635	24N	07E	15	s, f					
	Five Channels Pond	223	24N	06E	23	f					
	Foote Pond	1,695	24N	08E	34	s, f					
	Loud Pond	591	24N	06E	21	f					
	Van Etten Lake	1,409	24N	09E	27	s, f					
Montmorency	Avery Lake	290	29N	02E	3	s	5	1		4	
	Crooked Lake	110	30N	02E	23	s, f					
	East Twin Lake	820	29N	01E	27	s	6	2		2	
	Ess Lake	119	31N	04E	05	s, f	2	2		3	
	Long Lake	279	32N	04E	29		2	1		3	
	West Twin Lake	1,306	29N	01E	29	s, f	8	2			
Ogemaw	Clear Lake	204	23N	01E	11	s, f					
Oscoda	Mio Dam Pond	670	26N	02E	12	f					
	Tea Lake	204	28N	01E	10	s, f					
Otsego	Big Bear Lake	344	29N	01W	01	s, f	5	2		3	
	Big Lake	124	30N	02W	08	s	6	2		3	
	Dixon Lake	78	30N	03W	14	s	6	2		3	
	Otsego Lake	2,013	30N	03W	32	s, f	6	2		2	2
Presque Isle	Grand Lake	5,822	34N	07E	23	f	1	1		2	2
	Lake Esau	319	34N	08E	28	s, f	5	1		3	
	Ocqueoc Lake	125	36N	03E	19	s, f					
	Rainy Lake	202	33N	03E	16	s					
Roscommon	Lake St. Helen	2,416	23N	01W	16	s, f	6	2		3	

Appendix 3.–Continued.

Management unit County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks Recruitment	 Origin	 GL access	 Fishery	Yellow perch fishery rank
Southern Lake Huron											
Arenac	Au Gres River	4	19N	07E	19	s	5	2	1	4	3
	Lake Huron		19N	07E	30	s					
	Pine River	3	18N	05E	10	s	5	2	1	4	2
	Rifle River	7	19N	05E			5	2	1	4	3
	Saganing Creek	4	18N	04E			5	2	1	5	4
Bay	Kawkawlin River	4	14N	05E			5	2	1	3	3
	Lake Huron		14N	05E	1	s					
	Lake Huron		14N	05E	2	s					
	Lake Huron		15N	04E	2	s					
	Lake Huron		17N	05E	30	s					
	Pinconning River		17N	04E	25	s					
	Saginaw River	21	14N	05E			5	2	1	1	2
Clare	Budd Lake	174	19N	04W	21	s, f	7	2		4	2
	Eight Point Lake	416	17N	06W	19	f					
	Shamrock Lake	62	17N	04W	35	s, f	7	2			
Genesee	Buell Lake	40	09N	07E	2	s	8	2		4	4
	Hamilton Dam Pond	49	07N	06E	16		1	2		2	4
	Holloway Reservoir	1,173	08N	08E	11	f	1	2		1	4
	Lake Fenton	867	05N	06E	14	s	6	2		4	4
	Lake Ponemah	410	05N	06E	21	s, f	6	2		3	4
	Lobdell Lake	546	05N	05E	35	s, f	6	2		4	4
	C. S. Mott Lake	596	08N	07E	21		1	2		1	4
Gladwin	Lake Four	59	20N	01W	5	s					
	Lake Lancelot	166	20N	01W	20	s	7	2		4	4
	Lake Lancer	688	20N	01W	21	s,f	6	2		3	4
	Pratt Lake	188	19N	02W	21	s, f	6	2		3	3
	Ross Lake	249	17N	02W	02	s, f	6	1	2	3	3
	Secord Lake	400	19N	01E	15	s, f	6	1	2	3	4

Appendix 3.–Continued.

Management unit County	Water body	Size[a]	T	R	S	Data source[b]	Walleye ranks Recruitment	Origin	GL access	Fishery	Yellow perch fishery rank
Southern Lake Huron–continued											
Gladwin–continued	Smallwood Lake	371	18N	01E	9	s, f	6	1	2	3	4
	Wiggins Lake	293	19N	02W	33	s, f	6	3	3	3	3
	Wixom Lake	1,142	17N	01E	25	s, f	5	1	2	2	3
Huron	Lake Huron		16N	09E	16	s					
	Sebewaing River	2	15N	09E	7	s	5	2	1	4	3
Iosco	Floyd Lake	41	22N	06E	2	s					
	Indian Lake	214	23N	06E	36		7	2			
	Lake Huron		22N	08E	34	s					
	Long Lake	486	23N	05E	05	s, f	5	2		2	3
	Loon Lake	416	23N	05E	03	s, f	5	2		2	3
	Round Lake	91	23N	06E	36	s	7	2			
	Sand Lake	245	22N	06E	3	s	7	2			
	Tawas River	2	22N	08E	19	s	5	2	1	4	4
Isabella	Chippewa River		14N	05W	22	s					
	Coldwater Lake	285	15N	05W	30	s, f	5	2		3	3
	Littlefield Lake	140	16N	05W	20	f	7	2			
Lapeer	Fish Lake	17	08N	10E	13	f					
	Lake Nepessing	427	07N	09E	14	s, f	6	2		2	3
Livingston	Lake Chemung	313	02N	05E	04	s, f	6	2		3	3
Mecosta	Chippewa Lake	791	16N	08W	29	s, f	5	2		2	3
	Pretty Lake	116	15N	08W	14	s	6	2		3	4
Midland	Chippewa River	30	14N				5	2	1	4	4
	Pine River	20	13N				5	2	1	4	4
	Sanford Lake	1,402	15N	01W	24	s, f	5	1	2	2	4
Oakland	Heron Lake	120	05N	08E	28	s, f	6	2		3	4

Appendix 3.–Continued.

Management unit County	Water body	Size[a]	T	R	S	Data source[b]	Walleye ranks: Recruitment	Origin	GL access	Fishery	Yellow perch fishery rank
Southern Lake Huron–continued											
Ogemaw	AuSable Lake	272	24N	04E	34	s, f					
	George Lake	186	23N	04E	8	s	6	2		3	4
	Jewett Lake	12	23N	3E	11	f					
	Peach Lake	234	22N	02E	22	s, f	5	2		2	4
	Rifle Lake	185	22N	02E	16	s, f	6	2		3	4
	Sage Lake	787	23N	04E	27		7	2			3
Saginaw	Cass River (lower)	15	11N	5–6E			5	2	1	2	4
	Saginaw River		12N	04E	26	s					
	Shiawassee River	20	11N	03E	13		1	1	1	2	4
	Tittabawassee River	30	11N	04E			5	2	1	1	4
Saginaw–Genesee	Flint River (lower)	40	11N	03E	13		1	1	1	1	4
Tuscola	Caro Impoundment	109	12N	09E	16	s, f	5	1	2	3	3
	Cass River (upper)	19	11N	7–9E			5	2	2	3	4
	Lake Huron		14N	07E	29	s					
	Lake Huron		15N	08E	17	s					
	Murphy Lake	183	10N	08E	01	s, f	6	2		3	3
	Quanicassee River	2	13N	17E			5	2	1	4	3
	Wiscoggin Drain		15N	08E	23	s					

[a] Size is in surface acres for lakes and impoundments. Size is in length in miles for rivers.
[b] Data source is s = stocking records for 1995–99, f = Fish Collection System of MDNR, or c = creel survey.

Appendix 4.–Lake Erie Basin (LEMU) walleye waters based on stocking records for 1995–99, fish collected since 1980, and questionnaires completed by management unit biologists. Questionnaires asked management biologists to rank each walleye population regarding its recruitment, origin, Great Lakes (GL) access, and fishery. They were also asked to rank yellow perch fisheries, if any existed in the water body. These ranks are defined in the text at the beginning of the **Status of Percids of Michigan** section.

County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks				Yellow perch fishery ramk
							Recruitment	Origin	GL access	Fishery	
Jackson	Clark Lake	576	04S	01E	17	s	6	2		3	
	Vineyard Lake	541	04S	02E	32	s, f	6	2		3	
Jackson–Lenawee	Round Lake	67	04N	02E	36		6	2		3	
	Wamplers Lake	797	05S	02E		s, f	6	2		3	
Lenawee	Devils Lake	1,312	06S	01E	4	s	6	2		3	4
	Hudson Lake	471	07S	01E	25		8	2		4	
	Lake Erin	565	05S	03E	25	s					
	Posey Lake	140	06S	01E	4	s					
	Sand Lake	546	05S	02E	12	s	6	2		3	
	Silver Lake	105	05S	01E	15	s					
Livingston	Baseline Lake	244	01N	05E	32	s	5	1	2	3	
	Huron River		01N	05E	23	s					
	Strawberry Lake	261	01N	05E	27		6	1	2	3	
	Whitmore Lake	576	01N	06E	32	s	8	2			
	Woodland Lake	258	02N	06E	19	s	8	2			
	Zukey Lake	149	01N	05E	21	s	6	1	2	3	
Livingston–Oakland	Kent Lake	1,015	01N	06E	1	s, f	5	1	2	1	4
Macomb	Clinton River (lower)	35	02N	14E		s	1	1	1	3	
	Stoney Creek Pond	584	04N	12E	31	s, f	5	2		1	
Monroe	Raisin River (lower)	2	07S	09E			1	1	1	4	
Oakland	Big Lake	213	4N	8E	28		8	2			
	Big Seven Lake	158	05N	07E	19	s, f	6	2		4	4
	Cass Lake	1,279	02N	09E	02	s, f	5	1	2	2	4
	Clinton River		03N	11E	13	s					
	Crescent Lake	91	03N	09E	27	s, f	8	2		3	
	Lakeville Lake	430	05N	11E	27	s	8	2			
	Silver Lake	94	03N	09E	12	f					

Appendix 4.–Continued.

County	Water body	Size [a]	T	R	S	Data source [b]	Walleye ranks: Recruitment	Walleye ranks: Origin	Walleye ranks: GL access	Walleye ranks: Fishery	Yellow perch fishery ramk
Oakland–continued	Long Lake	166	02N	08E	1	s, f	8	2			
	Lotus Lake	180	04N	09E	31	f					
	Maceday lake	219	03N	09E	07	s, f					
	Orion Lake	482	04N	10E	11	s, f	8	2		4	
	Oxbow Lake	268	03N	08E	23	s					
	Pontiac Lake	613	03N	08E	13	s, f	6	2		1	
	Proud Lake	90	02N	08E	20	f					
	Silver Lake	94	03N	09E	12	f					
	Union Lake	467	09E	08E	01	s, f					
	White Lake	519	03N	07E	12	s, f	6	2		2	
	Wolverine Lake	269	02N	08E	22	s, f	6	2		3	
St. Clair	Belle River (lower)	40	03N	16E	12		1	1	1	4	
	Black River (lower)	20	06N	17E			1	1	1	4	
	Pine River		05N	17E	31		1	1	1	4	
Washtenaw	Argo Pond	84	02S	06E	21		2	1	2	4	
	Barton Pond	192	02S	06E	17	f	2	1	2	3	
	Big Portage Lake	641	01S	04E	01	s, f	5	1	2	3	
	Ford Lake	958	03S	07E	24	f	1	1	2	1	4
	Geddes Pond	195	02S	06E	36	f	2	1	2	3	
	Huron River (above Barton)	17	02S	06E	7		4	1	2	4	
	South Lake	202	01S	03E	10	f					
Wayne	Belleville Lake	1,253	03S	08E	24	s, f	5	1	2	1	4
	Huron River (above Flatrock)	14	04S	09E	25		2	1	2	4	
	Huron River (below Flatrock)	12	05S	10E	25		1	1	1	2	
	Newburgh Lake	91	01S	09E	31	s					

[a] Size is in surface acres for lakes and impoundments. Size is in length in miles for rivers.
[b] Data source is s = stocking records for 1995–99, f = Fish Collection System of MDNR, or c = creel survey.