Lake Mitchell
Wexford County
Last surveyed 2012, Clam River Subwatershed, Muskegon River Watershed

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Environment

Lake Mitchell (Fig. 1) is a 2,580-acre natural lake located just west of the city of Cadillac, MI, in southeastern Wexford County. Lake Mitchell is in the Muskegon River watershed, as the creeks flowing into Lake Mitchell are the extreme headwaters of the Clam River subwatershed. Lake Mitchell flows into Lake Cadillac via a ¼ mile long dredged channel which is navigable by most small boats. The maximum depth of Lake Mitchell is 22 feet, with approximately 90% of the lake shallower than 15 feet. According to Fusilier and Fusilier (2010), the size of the Lake Mitchell watershed is approximately 28,593 acres, and the lake flushes about once every 1.06 years. One report (Anonymous 1991) classifies Lake Mitchell as a borderline meso-eutrophic lake. Another report (Jermalowicz-Jones (2012) classifies Lake Mitchell as eutrophic, although some of the parameters in that report rank as mesotrophic. Substrates in the lake are primarily sand and organic matter, with a few areas of cobble and gravel. Although there is no dam or lake level control structure on Lake Mitchell, there is a structure on Lake Cadillac that influences the level of Lake Mitchell. The legal lake level for Lake Cadillac was established in 1967. The annual maximum level is 1290.0 feet above sea level, the minimum winter level is 1288.9 feet, and the minimum summer level is 1289.7 feet.

Most of the Lake Mitchell shoreline is heavily developed with permanent residences. Because of this, most of the shoreline of the lake has been altered with seawalls, riprap, docks, boat hoists, etc. The largest remaining area of natural shoreline is in Big Cove, where the riparian wetland remains intact. That land is owned primarily by the United States Forest Service (USFS) as part of the Manistee National Forest. There are three public boat launches on Lake Mitchell (Fig. 1). One is at William Mitchell State Park, another at Hemlock Campground (operated by the USFS) on Big Cove, and another at Selma Township Park on the western shore of the lake. Mitchell State Park offers excellent access for shore anglers, including a fishing platform at the juncture of Lake Mitchell and the canal connecting to Lake Cadillac. The canal itself is also very popular with shore anglers and is fished heavily. William Mitchell State Park also offers a very popular swimming beach.

Much of the terrain surrounding Lake Mitchell is low and swampy. The area to the west is locally known as the Mitchell Swamp. Four small streams flow from these swamps into Lake Mitchell, including Black Creek, Brandy Creek, Gyttja Creek, and Mitchell Creek (Fig. 1). The largest of these is Mitchell Creek, which enters Lake Mitchell in Big Cove off USFS land. These streams are tannin-colored, warmwater streams that are affected dramatically by surface runoff. Because they are fed by wetlands, the runoff events are more protracted in nature, as the wetlands store and slowly release water over time.

The zebra mussel, an exotic invasive species, was first documented in Lake Cadillac in the fall of 2010. They were then documented for the first time in Lake Mitchell in the fall of 2011, near the outlet canal that connects the two lakes. As of the fall of 2012, while a few zebra mussels can still be found

in the canal area, they do not seem to have colonized the entire lake yet. They are much more widespread on Lake Cadillac than on Lake Mitchell.

The Lake Mitchell Improvement Board (LMIB) is the primary citizen-based group that serves Lake Mitchell. It was formed in 1993. Per State of Michigan law, the LMIB is comprised of appointed members who oversee the distribution of assessment money collected from lakefront or lake access property owners. One of the main points of focus for the LMIB has been aquatic nuisance weed control. Lake Mitchell has had a Eurasian milfoil infestation for many years, requiring treatment (typically chemical 2,4-D treatments) on an annual basis. Another citizen-based group on Lake Mitchell is the Lake Mitchell Property Owner's Association.

History

Lake Mitchell was originally known as "Big Clam Lake", and Lake Cadillac was called "Little Clam Lake". The names were changed to Lake Mitchell and Lake Cadillac in 1903. Lake Mitchell was named after William Mitchell, who was an early lumber baron in the Cadillac area and one of the founders of the City of Cadillac. The two lakes were originally connected by Black Creek, which was a slow, meandering stream that flowed through a large marsh located between the two lakes, south of what is now Division Road. The canal was dug in 1873 so that logs could be floated into Lake Cadillac to the lumber mills on the eastern shores of Lake Cadillac. When the canal was finished, the water level of Lake Mitchell reportedly dropped by one foot. Although it does not carry the flow it did before the canal was dug, Black Creek still exists, and it still carries flow during periods of high water. Probably due to modifications made to the marsh by humans over time, Black Creek actually flows in both directions now. During periods of high water, it drains the eastern portion of the marsh back under M-115 and into Lake Mitchell, while the western portion of the marsh drains into Lake Cadillac.

The first documented fish stocking of Lake Mitchell took place in 1874, when lake whitefish were stocked (Table 1). Other species stocked in the 1800s included Chinook salmon, lake trout, smallmouth bass, walleye, and common carp. Due to the shallow, warm nature of Lake Mitchell, it is not possible for coldwater species like lake whitefish, lake trout, and Chinook salmon to survive for any length of time. Only 40 common carp were stocked, and they have not been documented in Lake Mitchell since then. Walleye and smallmouth bass were again stocked in 1909 and 1910. Although Table 1 displays the known stocking records for Lake Mitchell, there is some evidence that other fish stocking events occurred as well. The period from 1929-1940 saw intensive stocking of multiple species including bluegill, yellow perch, and emerald shiners (called "Great Lakes shiners" at that time). After 1940, no stocking took place until 2004, when walleye were again stocked. Since then, walleye have also been stocked in 2006, 2008, 2011, and 2012.

The first known fisheries report on Lake Mitchell was written in 1931 (Krull 1931). It documented a fish kill event in June of that year. Species affected included adult walleye and yellow perch. The author concluded that the fish kill was a natural event, and that the numbers of fish that perished would not affect the overall fishery in Lake Mitchell.

The first fisheries survey of Lake Mitchell was a creel survey conducted by MDOC (Michigan Department of Conservation, the predecessor to today's Department of Natural Resources or DNR) from 1928-1940 (Funk 1942). Creel surveys were also conducted on Lake Cadillac during the same

years. Netting with seines and gill nets was also conducted in 1941. A total of 24 species were identified through these efforts (Table 2). Funk (1942) concluded that yellow perch stocking should be discontinued, and that no walleye should be stocked in 1942 or 1943, and that attempts should be made to determine whether or not walleye natural reproduction occurs in those years. Follow up reports by Carbine and Washburn (1944, 1945) and Carbine (1947) confirmed that walleye natural reproduction was indeed occurring, and that walleye stocking should be permanently discontinued. Minimal efforts of gill netting and seining were conducted as a part of these surveys.

The next fisheries survey of Lake Mitchell was conducted in 1961 and consisted of several large seine hauls. Yellow perch were the most abundant species in this survey, but a number of other species were caught as well (Table 2).

Another fisheries survey of Lake Mitchell was conducted by MDNR in May of 1980. The survey consisted of one night of electrofishing and one night of fyke netting, with most of the survey effort taking place in Big Cove. A total of 745 fish weighing 579.2 lbs and representing 11 species (Table 2) were caught. Of those, nearly half were bullhead. Other well-represented species included walleye, bluegill, pumpkinseed sunfish, and rock bass. Age and growth analysis from the 1980 survey indicated that all Lake Mitchell fish species, with the exception of walleye, were growing faster than the state average (Table 3).

A four-day fyke net survey was conducted by MDNR from April 12-15, 1988. A total of 1,326 fish representing 13 different species were caught in the survey (Table 2). Nearly half of the fish captured (587) were brown bullhead. In particular, the researchers were targeting walleye, which were likely spawning at that time. A total of 215 walleye were caught, representing 10 different age groups. One species observed was brook trout, represented by one 8 inch individual. This is the only known brook trout to have ever been captured in a fisheries survey of Lake Mitchell. Age and growth analysis from the 1988 survey showed that as in 1980, most species were growing faster than the state average (Table 3). The exceptions were northern pike, walleye, and yellow perch.

Another major survey was conducted from April 26-30, 1993, this one utilizing both large-mesh and small-mesh fyke nets. While data was collected from all species, the primary goal of this survey was to tag as many walleye as possible with metal jaw tags. A similar survey was conducted on Lake Cadillac during the following week. In the two surveys, a total of 543 walleye greater than 15 inches were tagged. For the next several years, anglers were asked to return tags from walleye they caught via sportfishing. Using the Schumacher method, population sizes of walleye greater than 15" were estimated at 13,271 (5.14/acre) for Lake Mitchell and 5,980 (5.20/acre) for Lake Cadillac. The vast majority of tag returns from anglers occurred in May, June, and July (likely early July). Also, the study documented 14 walleye that were caught in Lake Cadillac but had been tagged in Lake Mitchell. Conversely, no migration from Lake Cadillac to Lake Mitchell was documented in the study. Not surprisingly, 1993 saw the most tag returns from anglers, with 110 tags turned in. This resulted in an annual exploitation rate of over 20% for walleye in the Lake Mitchell/Cadillac system.

Although walleye tagging was the main impetus behind the 1993 survey, other species were collected as well. A total of 2,670 fish were collected, representing 18 species (Table 2). Brown bullhead were the most numerous, with 1,233 collected. Other species collected in large numbers included walleye (413), northern pike (220), pumpkinseed (138), black crappie (111), and bluegill (109). Age and

growth analysis from the 1993 survey showed a shift from the 1980 and 1988 surveys (Table 3). In 1980 and 1988, most species were growing faster than the state average. However, in 1993 most species were growing slower than the state average, although not dramatically. Walleye in particular were growing very slowly, at 2.7 inches slower than the state average.

Starting in 1994, MDNR began conducting fall electrofishing surveys on Lake Mitchell, utilizing the methods from Serns (1982, 1983). These surveys are conducted after dark and are designed to target shallow, sandy flats where juvenile walleye are typically found. These surveys were conducted in 1994, 1995, and 2002-2006 (Table 4). While the 1994 and 1995 surveys were successful in capturing modest numbers of juvenile walleye, the 2002-2006 surveys were not, even with heavy stocking occurring in 2004 and 2006. Anglers were reporting catching juvenile walleye even though only one walleye from the 2004 year class was caught in the 2004-2006 surveys. There have been some lakes where Serns-style sampling was not successful in the fall, but efforts conducted in the following spring were successful in documenting the presence of juvenile walleye (Rich O'Neal, MDNR, personal communication). Therefore, in 2007, 2008, and 2010, the surveys were conducted according to the same Serns protocol, only in the spring instead of in the fall (Tonello 2007; 2010). The 2007, 2008, and 2010 spring surveys were more successful than the 2002-2006 surveys in documenting survival of stocked juvenile walleye (Table 4).

The next comprehensive fisheries survey of Lake Mitchell was conducted in the spring of 2003. The 2003 survey consisted of six large-mesh fyke nets and two small-mesh fyke nets, and was conducted from April 28-May 2. In this survey, a total of 1,994 fish were caught, representing 18 different species (Tables 2, 5, and 6). Most of the fish were caught in the large-mesh fyke nets. Well represented species in the survey included, brown bullhead, yellow bullhead, black crappie, bluegill, pumpkinseed sunfish, and largemouth bass. The trend of slower growth for most fish species that was evident in the 1993 survey was also present in the 2003 survey (Tables 3 and 7).

While a total of 67 walleye were caught in the 2003 survey, the large-mesh fyke net catch per effort (CPE) for walleye was dramatically lower than in 1988 and 1993. In both of those surveys, the CPE was 11.3 walleye per net lift, while in 2003 it had dropped to 2.9 walleye per net lift. Also, no walleye smaller than 16 inches or younger than age 5 were caught in the 2003 survey. Smaller and younger walleye were present in both the 1988 and 1993 surveys. The most common walleye age classes caught in the 2003 survey were ages 8 and 9, which would have been the 1994 and 1995 year classes (Table 7).

A creel survey was conducted by MDNR on Lakes Mitchell and Cadillac in the summer of 2006 and winter of 2007 (Anonymous 2007a; Anonymous 2007b). Catch estimates were generated for both fish harvested and for fish released. The open-water creel program of 2006 ran from April 29 to October 31. In that time, an estimated 8,154 angler trips were taken on Lake Mitchell, equating to 32,627 angler hours generated (Table 8). An estimated total of 53,854 fish were caught, with 41,422 of those released. Bluegill was the most commonly kept and the most commonly released species. The ice fishing creel season ran from January 19 through March 24. In that time, an estimated 4,874 ice fishing angler trips were taken on Lake Mitchell, equating to 16,674 angler hours generated (Table 9). An estimated 21,798 fish were caught by ice anglers on Lake Mitchell, with 14,800 of those released. While yellow perch was the most commonly caught and released species, black crappie was the most commonly kept species for ice anglers on Lake Mitchell. Combined, the summer and winter effort on

Lake Mitchell was 13,028 angler trips, equating to 49,301 angler hours. When that effort total is combined with the angler effort from Lake Cadillac, the two lakes generated a total of 37,540 angler trips and 117,567 angler hours of fishing effort in the 2006/2007 fishing season.

Lake Mitchell has produced 123 entries into the MDNR Master Angler program since 1994 (Table 10). The most common species entered include bowfin (45 entries) and bullhead (26 entries). Other species with more than ten entries include bluegill, rock bass, and pumpkinseed.

Current Status

The most recent comprehensive fisheries survey of Lake Mitchell was conducted in the spring and summer of 2012. Status and trends netting protocols (Wehrly et al. 2009) were used for the survey. The netting portion of the survey took place from May 7 through May 11. Gear used included eight trap nets (30 net-nights) and 2 experimental graded-mesh inland gill nets (4 net-nights). Electrofishing was conducted on July 9, 2012, with three ten-minute electrofishing transects conducted with an 18-foot boomshocking boat. Seining was conducted on August 6 and 7, with a total of five seine hauls completed. Age and growth analysis on fish captured was conducted by counting growth rings on scales (panfish and smaller gamefish) and spines (larger gamefish). The purpose of this survey was to assess the entire fish community in Lake Mitchell as well as evaluate the walleye population.

During the May netting portion of the 2012 survey of Lake Mitchell, a total of 2,550 fish were caught, representing 13 different species (Table 11). Brown bullhead were the most abundant species collected, with a total of 1,453 caught (from 8-14 inches) representing 57% of the total catch by number and 46.3% by weight. Panfish species present in the 2012 netting catch included black crappie (394 fish caught ranging from 4-13 inches), bluegill (88 from 4-8 inches), pumpkinseed sunfish (58 from 4-8 inches), rock bass (14 from 6-10 inches), and yellow perch (14 from 5-9 inches). The most abundant game fish species caught in the netting portion of the 2012 survey was northern pike, with 128 caught ranging from 11-32 inches in length. Other game species present in the 2012 netting catch included largemouth bass (121 from 8-18 inches), walleye (65 from 13-27 inches), and smallmouth bass (17 from 9-19 inches). Other species caught in the netting portion of the 2012 survey included bowfin, white sucker, and yellow bullhead.

During the electrofishing and seining portions of the 2012 survey of Lake Mitchell, a total of 628 fish were caught, representing 16 different species (Table 12). Species most frequently collected while seining and electrofishing were spottail shiner (303 from 1-4 inches), bluegill (123 from 1-6 inches), and pumpkinseed sunfish (87 from 1-6 inches). Other panfish species present in the seining and electrofishing catch included black crappie (9 from 4-5 inches), rock bass (2 from 3-6 inches), and yellow perch (45 from 2-7 inches). Game species present in the seining and electrofishing catch included largemouth bass (37 from 1-17 inches), northern pike (2 from 17-24 inches), smallmouth bass (3 from 1-3 inches), and walleye (3 from 9-16 inches). Other nongame species present in the seining and electrofishing catch included bluntnose minnow, bowfin, common shiner, and white sucker.

In the 2012 survey, most species caught showed growth rates that were below the state average (Tables 3, 13 and 14). Black crappie, bluegill, largemouth bass, northern pike, and yellow perch were all growing at least one inch slower than the State average. The two exceptions were smallmouth bass and walleye, which were growing 1.3 and 0.2 inches faster than the state average, respectively. Walleye as

old as 17 were present in the 2012 survey. These are some of the oldest walleye ever aged in a northwestern lower peninsula fish survey.

Previously recorded fish species that were not present in the 2012 survey of Lake Mitchell included banded killifish, black bullhead, blacknose dace, brook trout, central mudminnow, creek chub, fathead minnow, golden shiner, hornyhead chub, Iowa darter, Johnny darter, logperch, and mimic shiner (Table 2). Species caught in the 2012 survey that had not been identified in previous surveys of Lake Mitchell included sand shiner.

Shoreline data were collected on Lake Mitchell by DNR Fisheries personnel on July 9, 2012 according to protocols outlined in Wehrly et al. (2009). Data collected included the number of docks, submerged trees, and houses observed per kilometer of shoreline, as well as how much of the shoreline is armored or hardened with a structure to prevent erosion. Lake Mitchell averaged 28.1 docks, 3.0 submerged trees and 31.9 houses per kilometer of shoreline. Armoring structures and materials were present along 75.0% of the lake shoreline.

Analysis and Discussion

The Lake Mitchell fish community has undergone major changes in the past three decades since comprehensive fisheries surveys were first conducted. In particular, largemouth bass have become very abundant in Lake Mitchell, while the once self-sustaining walleye population has diminished to the point where stocking is now required to maintain the fishery. No walleye were stocked between 1940 and 2004 (Table 1), and for most of those years, Lake Mitchell provided an excellent walleye fishery. However, in the late 1990s, walleye reproduction began to diminish. The 2012 survey did not document any recent walleye natural reproduction (Table 13), as the most recent fish from an "unstocked" year class was from 2003, and that was only one fish. The strongest walleye year classes represented in the 2012 survey and recent Serns surveys were 2008, 2006, and 2004, all of which were stocked year classes (Tables 4 and 13). Although walleye densities observed in these surveys were all "poor" year classes according to the standards outlined by Ziegler and Schneider (2000), the fishery they have created on Lake Mitchell disputes that. Clearly, stocking is playing a major role in the current Lake Mitchell walleye fishery. However, even with stocking, the walleye population in Lake Mitchell is likely smaller than it was in the 1980s and early 1990s.

While the exact reason for the lack of walleye natural reproduction in Lake Mitchell in recent years is unknown, it may have something to do with the recent increase in largemouth bass abundance. In the 1980, 1988, and 1993 fyke netting surveys of Lake Mitchell, largemouth bass catch per effort (cpe) was relatively low at 1.4, 0.4, and 1.0 largemouth bass per net lift, respectively. In the 2003 survey, the largemouth bass catch rate was 6.9 per net lift. Largemouth bass were also very abundant in the 2012 survey, although catch rates are not directly comparable because trap nets were used. According to Fayram et al. (2005), largemouth bass can negatively affect juvenile walleye year classes by preying on juvenile walleye. Therefore it is possible that the lack of natural reproduction of walleye in Lake Mitchell in the last 15 years or so is related to the elevated population levels of largemouth bass. Exactly why the largemouth bass population has expanded in recent years is unknown, although several hypotheses have been suggested. One is that warmer temperatures in recent years might favor largemouth bass over other species like walleye or smallmouth bass. Another is the ethics change that

occurred among bass anglers in recent decades. In the 1980s, catch and release angling for bass became very popular. This continues at present, with few anglers harvesting bass on a regular basis.

Another parameter that has changed over time in Lake Mitchell is fish growth. In 1980 and 1988, most fish species in Lake Mitchell were growing faster than the state average (Table 3). However, starting in 1993, growth rates began to diminish to the point where in 2012 only two species (walleye and smallmouth bass) were growing faster than the state average. The cause of this growth shift in Lake Mitchell is unknown, although there are several possible explanations. One possible cause of reduced growth in some species could be reduced walleye abundance. Walleye are known to be effective predators on many panfish species, and their reduced abundance in recent years could be allowing more intraspecific competition in panfish species, leading to slower growth. Another plausible explanation is the loss of mayflies that has occurred on both Lakes Cadillac and Mitchell in recent years. Mayflies are known to be an important food item for many fish species.

In the past, both Lakes Cadillac and Mitchell were known for having large annual brown drake (ephemera simulans) mayfly hatches. However, in the last 20-25 years (no invertebrate data is available for Lake Mitchell, so exact timeframes are not clear), the mayflies have almost completely disappeared, with very few individuals observed. Although the exact reason for the disappearance of the mayflies in unknown, it may be linked to copper sulfate. Copper is known to negatively affect invertebrate populations, and mayflies in particular (Warnick and Bell 1969; Wisconsin DNR 2012). For many years, Lakes Cadillac and Mitchell were treated with large amounts of copper sulfate in an attempt to combat swimmer's itch. This practice resulted in an accumulation of copper in the sediments of both Lake Mitchell and Lake Cadillac (Anonymous 2003), which may have negatively affected the mayfly population. Although the practice was ceased in the mid-1990s, the mayflies have not returned in any significant numbers. A light number of mayflies was observed in the summer of 2012 (Steve Knaisel, personal communication), which was more than has been seen in many years. While the role of mayflies in the ecology of Lake Mitchell has never been studied in depth, it is possible that their loss has some part in the decline of Lake Mitchell fish growth (Table 3).

Other changes have taken place in Lake Mitchell in the relatively recent past as well. While Lake Mitchell has always been a shallow weedy lake, aquatic macrophyte growth has increased. In particular, Eurasian milfoil became a major nuisance in Lake Mitchell in the early 1990s, requiring treatment with 2, 4-D in most years. Currently, the Eurasian milfoil infestation of Lake Mitchell is held at bay only by annual 2, 4-D herbicide treatments. Recent evidence indicates that hybrid milfoil is now present in Lake Mitchell (Jermalowicz-Jones 2013). Hybrid milfoil can be more resistant to traditional treatments and require higher doses of herbicides than Eurasian milfoil. If untreated, over time the Eurasian and hybrid milfoil would undoubtedly dominate much of Lake Mitchell, making it unsuitable for many popular activities, including fishing. It could also create negative effects on Lake Mitchell fish populations.

The largemouth bass fishery of Lake Mitchell is extremely popular. Starting in the 1980s, bass tournaments became popular nationwide, and since then Lakes Cadillac and Mitchell have been very popular for tournaments. Currently, there are tournaments on the lakes on most summer weekends and some weeknights as well. These tournaments are welcomed by local businesses for the economic activity they generate. However, it is possible that the tournaments have affected the species distribution on Lakes Cadillac and Mitchell. For example, tournament anglers typically catch fish from

all over on both lakes, and then release all the fish at one boat launch on whichever lake the tournament started on (often Kenwood Park on Lake Cadillac or Mitchell State Park on Lake Mitchell), even though it is technically illegal to catch fish from one lake and then release them into another lake. It is possible that over the years, this practice may have had some impact on the species composition of both lakes. For example, Lake Cadillac historically was dominated by smallmouth bass, but in recent years largemouth bass have become more abundant; even to the point of being more numerous than smallmouth bass in the 2012 survey. Bass anglers often justify their tournament procedures by pointing out that instead of releasing their fish alive, they could simply harvest them.

The data generated by the 2006-2007 creel surveys (Tables 8 and 9) demonstrate the popularity of the Lake Mitchell fishery. While the study showed an estimated 37,540 angler trips and 117,567 angler hours for Lakes Cadillac and Mitchell combined (both summer and winter), those estimates are likely lower than the effort generated in a normal year. The winter of 2007 was not a good ice fishing season. Ice did not form on the lakes until mid-January in 2007, while in most years there is fishable ice by early December. This results in over one month of lost angler effort. In particular, ice fishing can be very popular over the Christmas/New Year holiday. Despite the lower-than-normal effort in 2006-2007, the 37,540 angler trips on Lakes Cadillac and Mitchell still resulted in over $900,000 in economic activity generated for the Cadillac area, assuming a daily expenditure of $24 per angler-day (U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, Census Bureau 2006). It is highly likely that in a more normal year, the fisheries in the two lakes generate more than $1,000,000 for the local economy of the Cadillac area.

Compared to other lakes in Michigan, the shoreline of Lake Mitchell has been dramatically altered by human activity. In particular, Lake Mitchell is very heavily populated with docks and dwellings (Table 15). In the 2012 survey, Lake Mitchell had 31.9 dwellings per kilometer while the average large shallow lake in Michigan had 11.2 dwellings per kilometer (Wehrly et al. in press). Lake Mitchell also had 28.1 docks per kilometer of shoreline, while the average large shallow lake in Michigan had 8.9 docks per kilometer (Wehrly et al. in press). Lake Mitchell also had much less submerged woody debris (3.0 trees/km) than other large shallow lakes in Michigan (average=17.3 trees/km; Wehrly et al. in press). Lake Mitchell also had very heavy shoreline armoring (75.0%) compared to other large shallow inland lakes in Michigan (average=28.4%; Wehrly et al. in press).

Management Direction

Lake Mitchell remains as one of the best and most popular fishing lakes in the northwestern lower peninsula with a large, diverse fish population that is relatively healthy. When combined with Lake Cadillac, the two lakes provide nearly 4,000 acres of fishable water. The fishing activities on the two lakes are extremely important to the Cadillac area, likely generating over $1,000,000 annually for the local economy. Therefore, it is of critical that the ecosystem of the two lakes be protected and maintained with the utmost diligence. In particular, the aquatic macrophytes of Lake Mitchell should continue to be managed on an annual basis. The emphasis should be on controlling Eurasian milfoil and protecting native plant species that are not at nuisance levels. If Eurasian milfoil is not controlled, it could dominate large areas of the lake. This would inhibit most lake recreational activities, including fishing.

Native species like black crappie, bluegill, pumpkinseed sunfish, largemouth bass, and northern pike should continue to thrive in Lake Mitchell without direct management efforts. At this point however, the walleye fishery appears to be heavily dependent upon stocking. The 2012 survey and recent Serns survey efforts have failed to document any natural reproduction of walleye in the last ten years. Therefore, spring fingerling walleye (Muskegon River strain) should continue to be stocked into Lake Mitchell, at a rate of 50/acre (130,000 fish) every other year. Since a full complement of walleye was stocked in 2012, they should again be stocked in the spring of 2014. Fall walleye electrofishing surveys should be conducted in years when walleye are stocked to assess the survival of these stocked fish. By looking at older walleye in addition to age-0 fish, the contribution of natural reproduction from non-stocking years can also be determined. Walleye stocked into Lake Mitchell will likely continue to come from the Mason County Walleye Association rearing pond, as well as other MDNR walleye rearing ponds around the State.

Comprehensive fisheries surveys of Lake Mitchell should be conducted by the DNR at least once every 10 years, though every five years would be preferable. Future fisheries surveys should continue to include electrofishing and seining efforts. While netting is often the most effective technique for catching panfish and sport fish, the electrofishing and seining efforts often catch juvenile and smaller minnow-type species, providing a better picture of the overall fish community. Also, another creel survey should be conducted on both Lakes Mitchell and Lake Cadillac, similar to that conducted in 2006/2007. Creel surveys provide important information about the use of the fishery by anglers, and can also be used to estimate generated economic activity. Creel surveys can also be used to gauge angler desires and concerns. Even if another creel survey is not conducted in the near future, DNR Fisheries personnel will continue to work with Lake Mitchell citizens groups, businesses, and anglers to monitor the fishery.

Other opportunities for data-gathering on Lake Mitchell include conducting invertebrate surveys and sediment samples. Invertebrate surveys could be used in an attempt to explain the loss of mayflies on Lake Mitchell, and whether it would ever be possible for them to return to the lake. Sediment sampling could be conducted to determine the extent of copper present, and whether or not that is the reason for the disappearance of the mayflies. These investigations would have to be conducted by agencies or groups other than DNR Fisheries Division.

Any remaining riparian wetlands adjacent to Lake Mitchell should be protected as they are critical to the continued health of the lake's aquatic community. Future unwise riparian development and wetland loss may result in deterioration of the water quality and aquatic habitat. Healthy biological communities in inland lakes require suitable natural habitat. Human development along the Lake Mitchell shoreline has changed and diminished natural habitat. Appropriate watershed management is necessary to sustain healthy biological communities, including fish, invertebrates, amphibians, reptiles, birds and aquatic mammals. Generally for lakes this includes maintenance of good water quality, especially for nutrients; preservation of natural shorelines, especially shore contours and native shoreline vegetation; and preservation of bottom contours, native aquatic vegetation, and wood structure within a lake. Lake Mitchell ranks very low in submerged woody debris. One potential restoration effort for Lake Mitchell would be to add woody structure to the lake. Submerged woody structure is important habitat for a number of Lake Mitchell fish species.

In particular, the Lake Mitchell shoreline has been heavily impacted by human development. Nearly 75% of the shoreline has been hardened with seawalls or riprap, resulting in a loss of critical shoreline habitat. Also, many Lake Mitchell lawns are mowed right down to the water's edge. This results in a loss of native vegetation species, many of which would help to prevent erosion if they were allowed to grow. All remaining natural shoreline along Lake Mitchell should be protected with the utmost diligence. Wherever possible, hardened shoreline should be restored to a natural state. This should include not mowing down to the water's edge. Instead of seawalls, softer measures should be used to control erosion. These can include installing biologs, planting native vegetation, and allowing native vegetation species (both aquatic and terrestrial) to grow. If these methods do not work in a particular situation, then fieldstone riprap should be utilized, with native aquatic vegetation species planted in front of the riprap. Guidelines for protecting fisheries habitat in inland lakes can be found in Fisheries Division Special Report 38 (O'Neal and Soulliere 2006).

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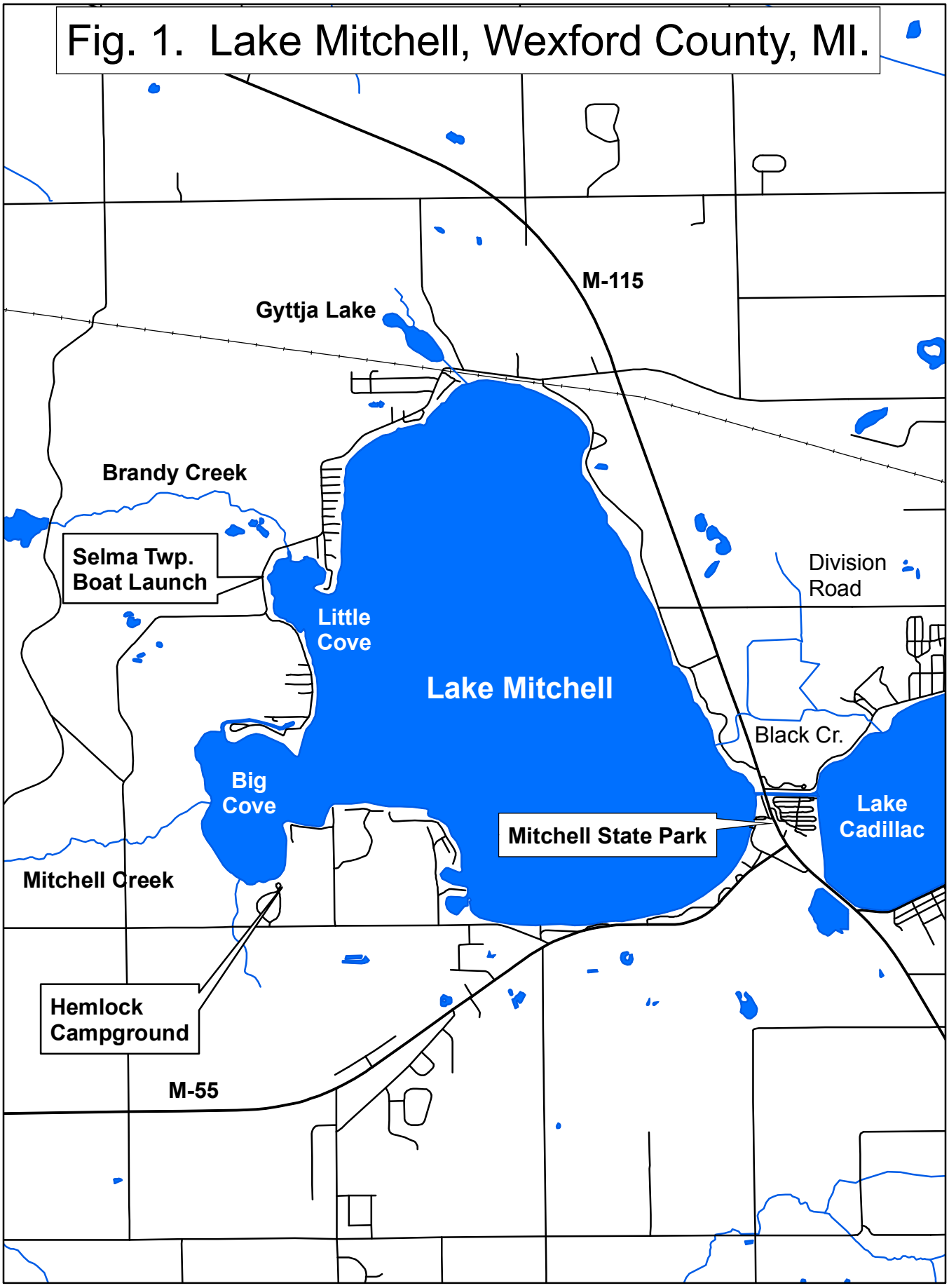
Fig. 1. Lake Mitchell, Wexford County, MI.
M-115
Gyttja Lake
Brandy Creek
Selma Twp.
Boat Launch
Little
Cove
Lake Mitchell
Division
Road
Black Cr.
Big
Cove
Mitchell State Park
Lake
Cadillac
Mitchell Creek
Hemlock
Campground
M-55

Table 1. Fish stocked in Lake Mitchell, Wexford County, 1874-2012.

Year	Species	Number	Size/age	Strain
1874	lake whitefish	15,000	fry	Detroit River
1876	Chinook salmon	10,000	fry	
1878	lake whitefish	120,000	fry	Detroit River
1881	smallmouth bass	4,000	fry	
1882	walleye	200,000	fry	
1879	lake trout	12,000	fry	Lake Michigan
1893	common carp	40	unknown	
1897	lake trout	10,000	unknown	
1909	smallmouth bass	3,000	fingerlings	
	walleye	100,000	fry	
1910	smallmouth bass	4,000	fry	
	walleye	60,000	fry	
1929	bluegill	2,250	3 mo.	
	yellow perch	80,000	fry	
1930	walleye	300,000	fry	
1933	walleye	400,000	fry	
1934	walleye	300,000	fry	
	yellow perch	10,000	7 mo.	
1935	walleye	170,000	fry	
	yellow perch	10,000	7 mo.	
	Great Lakes shiners	500,000		
1936	walleye	300,000	fry	
	Great Lakes shiners	250,000		
1937	walleye	300,000	fry	
	yellow perch	15,000	7 mo.	
1938	bluegill	30,000	5 mo.	
	walleye	200,000	fry	
	yellow perch	20,000	7 mo.	
1939	walleye	240,000	fry	
	yellow perch	48,000	5 mo.	
1940	walleye	200,000	fry	
1941	yellow perch	75,000	5 mo.	
2004	walleye	94,431	spring fingerlings	Muskegon
2006	walleye	5.3 million	fry	Muskegon
	walleye	10,751	fall fingerlings	Muskegon
2008	walleye	60,787	fall fingerlings	Muskegon
2011	walleye	17,092	spring fingerlings	Muskegon
2012	walleye	143,730	spring fingerlings	Muskegon

Table 2. Presence/absence of fish species in historical comprehensive fisheries surveys of Lake Mitchell.

Species	1942*	1961	1980	1988	1993	2003	2012
banded killifish	x						
black bullhead	x					x	
black crappie	x	x	x	x	x	x	x
blacknose dace					x		
blackside darter	x						
bluegill	x	x	x	x	x	x	x
bluntnose minnow	x						x
bowfin	x		x	x	x	x	x
brook trout				x			
brown bullhead	x			x		x	x
bullhead (nonspecific)		x	x		x		
central mudminnow	x						
common shiner	x	x			x	x	x
creek chub					x		
fathead minnow					x		
golden shiner	x	x			x	x	
hornyhead chub	x						
Iowa darter	x						
Johnny darter	x						
largemouth bass	x	x	x	x	x	x	x
logperch	x	x			x		
mimic shiner	x						
northern pike	x	x	x	x	x	x	x
pumpkinseed sunfish	x	x	x	x	x	x	x
rock bass	x	x	x	x	x	x	x
sand shiner							x
smallmouth bass	x	x	x	x	x	x	x
spottail shiner	x					x	x
straw-colored shiner**	x						
walleye	x	x	x	x	x	x	x
white sucker	x	x	x	x	x	x	x
yellow bullhead						x	x
yellow perch	x	x	x	x	x	x	x

*From Funk 1942, which included creel surveys conducted from 1928-1940 and seining and gill netting from 1941.

**No species exists today that is known as the "straw colored shiner". The latin name used in Funk (1942) for this species was notropis deliciosus, which is also not used today.

Table 3. Mean Growth Index (comparison to State of Michigan average) for fish sampled from Lake Mitchell in comprehensive fisheries surveys. A minimum of five fish per age group is statistically necessary for calculating a Mean Growth Index.

	1980	1988	1993	2003	2012
black crappie	+1.7	+1.2	-1.1	-0.1	-1.4
bluegill	+1.8	+0.6	-1.0	-0.9	-1.3
largemouth bass	+3.0		+1.4	-0.7	-1.1
northern pike		-2.3	-1.8	-0.8	-1.0
pumpkinseed	+1.5	+0.8	-0.4	0	-0.4
rock bass	+1.4	+0.9	+0.1	-1.1	
smallmouth bass			+1.4	+0.8	+1.3
walleye	-1.3	-0.7	-2.7	-2.8	+0.2
yellow perch		-0.3	-1.5		-1.5

Table 4. Results of Serns-style walleye electrofishing surveys conducted on Lake Mitchell by MDNR, 1994-2010.

	# Walleye captured	Catch Rate (# walleye/mile of shoreline sampled)	Year Class strength estimate	Serns Index (# walleye/surface acre)
1994				
Age 0	261	43.5	26,262	10.2
Age 1	42	7.0	1,835	0.7
1995				
Age 0	41	6.8	4,125	1.6
Age 1	71	11.8	5,923	2.3
2002				
Age 0	0	0.0	0	0
Age 1	0	0.0	0	0
2003				
Age 0	0	0.0	0	0
Age 1	0	0.0	0	0
2004				
Age 0	0	0.0	0	0
Age 1	0	0.0	0	0
2005				
Age 0	0	0.0	0	0
Age 1	1	0.3	125	0.0
2006				
Age 0	0	0.0	0	0
Age 1	0	0.0	0	0
2007 (spring)*				
Age 1 (2006 year class)	50	12.5	6,061	2.3
Age 2	0	0.0	0	0
2008 (spring)*				
Age 1	0	0.0	0	0
Age 2 (2006 year class)	4	1.0	638	0.2
2010 (spring)*				
Age 1	0	0.0	0	0
Age 2 (2008 year class)	46	11.7	5,873	2.3

* Although the survey was conducted in the spring, the calculations were done as if it were a fall Serns survey.

Table 5. Number, weight, and length of fish collected from Lake Mitchell with large mesh fyke nets on April 28-May 2, 2003.

Species	Number	Percent by number	Weight (Pounds)	Percent by weight	Length range (inches)1	Average length	Percent legal size2
black crappie	344	18.5	142.4	9.3	5-13	8.8	78 (7")
black bullhead	194	10.5	175.7	11.5	9-14	13.0	100 (7")
bluegill	276	14.9	35.0	2.3	4-8	5.6	21 (6")
bowfin	25	1.3	164.5	10.7	14-30	26.2	
brown bullhead	306	16.5	275.9	18.0	9-14	12.0	100 (7")
largemouth bass	158	8.5	240.4	15.7	7-20	14.1	46 (14")
northern pike	46	2.5	118.0	7.7	12-28	21.8	26 (24")
pumpkinseed	182	9.8	33.7	2.2	4-8	5.9	44 (6")
rock bass	25	1.3	10.9	0.7	5-10	8.1	84 (6")
smallmouth bass	5	0.3	10.1	0.7	13-16	15.7	80 (14")
walleye	67	3.6	156.9	10.2	16-23	19.1	100 (15")
white sucker	13	0.7	33.6	2.2	16-21	18.6	
yellow bullhead	214	11.5	135.9	8.9	5-13	10.7	99 (7")
yellow perch	1	0.1	0.2	0.0	7-7	7.5	100 (7")
Total	1,856	100	1533.2	100			

[1]Note some fish were measured to 0.1 inch, others to inch group: e.g., "5"=5.0 to 5.9 inch, "12"=12.0 to 12.9 inches; etc.

[2]Percent legal size or acceptable size for angling. Legal size or acceptable size for angling is given in parentheses.

Table 6. Number, weight, and length of fish collected from Lake Mitchell with small mesh fyke nets on April 28-May 2, 2003.

Species	Number	Percent by number	Weight (Pounds)	Percent by weight	Length range (inches)1	Average length	Percent legal size2
black crappie	15	10.9	4.8	6.4	4-11	7.8	67 (7")
black bullhead	7	5.1	5.3	7.1	10-12	11.6	100 (7")
bluegill	23	16.7	1.7	2.3	2-6	4.5	9 (6")
bowfin	1	0.7	5.8	7.8	25-25	25.5	
brown bullhead	8	5.8	6.6	8.9	29-29	9.7	100 (7")
common shiner	1	0.7	0.1	0.1	5-5	5.5	
golden shiner	1	0.7	0.0	0.0	4-4	4.5	
largemouth bass	5	3.6	3.0	4.0	5-13	9.7	0 (14")
pumpkinseed	9	6.5	1.9	2.6	4-7	5.9	44 (6")
rock bass	25	18.1	8.6	11.5	2-10	7.0	68 (6")
smallmouth bass	4	2.9	5.1	6.8	3-14	12.0	75 (14")
spottail shiner	4	2.9	0.1	0.1	4-4	4.5	
walleye	3	2.2	6.2	8.3	17-19	18.5	100 (15")
white sucker	7	5.1	22.2	29.8	16-23	19.8	
yellow bullhead	16	11.6	2.6	3.5	8-12	11.0	100 (7")
yellow perch	9	6.5	0.5	0.7	3-6	4.8	0 (7")
Total	138	100	74.5	100			

[1]Note some fish were measured to 0.1 inch, others to inch group: e.g., "5"=5.0 to 5.9 inch, "12"=12.0 to 12.9 inches; etc.

[2]Percent legal size or acceptable size for angling. Legal size or acceptable size for angling is given in parentheses.

Table 7. Average total weighted length (inches) at age, and growth relative to the state average, for fish sampled from Lake Mitchell with large and small mesh fyke nets, April 28- May 2, 2003. Number of fish aged is given in parenthesis. A minimum of five fish per age group is statistically necessary for calculating a Mean Growth Index, which is a comparison to the State of Michigan average.

	Age												
Species	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Mean Growth Index
Black crappie		(6) 5.5	(15) 7.8	(8) 8.5	(16) 8.5	(12) 9.9	(9) 11.3	(6) 11.9	(1) 12.4		(1) 13.2		-0.1
Bluegill		2.4 (1)	3.0 (2)	5.1 (17)	5.6 (11)	5.8 (4)	7.0 (7)	7.5 (3)	7.9 (2)	8.0 (1)	8.2 (4)		-0.9
Largemouth bass			8.6 (4)	11.4 (7)	13.2 (17)	14.0 (25)	15.0 (12)	17.1 (4)	18.0 (5)		18.5 (1)	18.9 (3)	-0.7
Northern pike		15.7 (2)	21.0 (10)	23.1 (20)	23.2 (13)	22.7 (3)							-0.8
Pumpkin-seed			4.7 (6)	5.5 (7)	5.8 (12)	6.8 (10)	7.5 (6)		8.4 (3)	8.5 (2)			0
Rock bass		2.7 (2)		4.4 (4)	5.5 (6)	6.7 (6)	8.0 (2)	8.2 (8)	9.2 (7)	9.4 (5)	10.1 (2)	10.5 (1)	-1.1
Smallmouth bass	3.0 (1)				15.1 (2)	16.1 (5)	13.1 (1)						+0.8
Walleye					16.8 (1)	16.7 (5)	17.5 (7)	18.2 (13)	19.6 (24)	20.9 (6)	22.6 (2)	22.1 (2)	-2.8
Yellow perch	3.6 (1)	3.9 (1)	4.5 (2)	5.5 (3)	7.0 (2)								-

Table 8. Estimated summer 2006 fishing harvest, catch per hour, and fishing pressure for Lake Mitchell. Two standard errors are given in parentheses (adapted from Anonymous 2007a).

Species	C/H	April-May	June	July	August	September	October	Season
HARVEST								
Walleye	0.0018	9	48	0	0	0	0	58
	(0.0026)	(19)	(81)	(0)	(0)	(0)	(0)	(83)
Northern pike	0.0166	451	0	41	31	19	0	543
	(0.0097)	(291)	(0)	(83)	(62)	(26)	(0)	(310)
Largemouth bass	0.0042	43	0	0	94	0	0	136
	(0.0058)	(86)	(0)	(0)	(168)	(0)	(0)	(188)
Yellow Perch	0.0030	0	30	0	67	0	0	97
	(0.0034)	(0)	(60)	(0)	(95)	(0)	(0)	(112)
Bluegill	0.1911	126	1,968	3,015	245	882	0	6,235
	(0.0871)	(185)	(1,141)	(2,287)	(254)	(909)	(0)	(2,731)
Pumpkinseed	0.1181	11	754	79	2,869	140	0	3,852
	NAN	(21)	(851)	(130)	NAN	(152)	(0)	NAN
Rock bass	0	0	0	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Black crappie	0.0463	465	582	339	125	0	0	1,511
	(0.0308)	(495)	(515)	(635)	(249)	(0)	(0)	(988)
Brown bullhead	0	0	0	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
TOTAL HARVEST	0.3810	1,105	3,382	3,474	3,429	1,041	0	12,431
	NAN	(610)	(1,517)	(2,379)	NAN	(922)	(0)	NAN
RELEASED								
Walleye	0.0094	0	138	166	0	0	2	306
	(0.0133)	(0)	(277)	(331)	(0)	(0)	(3)	(432)
Northern pike	0.0812	1,353	297	253	387	329	29	2,649
	(0.0319)	(854)	(219)	(248)	(304)	(203)	(26)	(986)
Largemouth bass	0.1429	1,425	1,585	392	350	791	119	4,662
	NAN	(782)	(1,009)	(418)	(324)	NAN	(131)	NAN
Smallmouth bass	0.0594	511	481	375	295	259	15	1,937
	(0.0277)	(271)	(426)	(575)	(302)	(285)	(16)	(871)
Yellow Perch	0.0837	141	176	0	1,585	827	2	2,731
	NAN	(148)	(197)	(0)	NAN	(888)	(4)	NAN
Bluegill	0.6127	442	5,898	8,049	3,807	1,795	0	19,991
	NAN	(608)	(3,847)	(5,151)	(2,657)	NAN	(0)	NAN
Pumpkinseed	0.1416	99	163	926	3,320	112	0	4,620
	(0.1060)	(129)	(202)	(1,118)	(3,209)	(126)	(0)	(3,409)
Rock bass	0.0088	113	139	0	37	0	0	288
	(0.0086)	(117)	(241)	(0)	(74)	(0)	(0)	(278)
Black crappie	0.1299	737	2,551	950	0	0	0	4,238
	(0.0896)	(1,178)	(1,805)	(1,901)	(0)	(0)	(0)	(2,874)
TOTAL RELEASED	1.2696	4,821	11,428	11,111	9,782	4,114	167	41,422
	NAN	(1,795)	(4,418)	(5,663)	NAN	NAN	(134)	NAN
TOTAL CATCH	1.6506	5,926	14,810	14,585	13,211	5,155	167	53,854
	NAN	(1,896)	(4,671)	(6,143)	NAN	NAN	(134)	NAN
ANGLER HOURS		8,167	7,241	6,582	6,558	3,590	490	32,627
		(3,235)	(1,309)	(1,270)	(1,369)	(986)	(265)	(4,088)
ANGLER TRIPS		2,198	1,862	1,938	1,417	642	96	8,154
		(1,170)	(603)	(595)	(493)	(234)	(56)	(1,545)

Table 9. Estimated winter 2007 ice fishing harvest, catch per hour, and fishing pressure for Lake Mitchell. Two standard errors are given in parentheses (adapted from Anonymous 2007b).

Species	C/H	January-February	March	Season
HARVEST				
Walleye	0.0002	3	0	3
	(0.0003)	(6)	(0)	(6)
Northern pike	0.0173	241	47	288
	(0.0107)	(134)	(55)	(145)
Yellow Perch	0.07	845	322	1167
	(0.0447)	(549)	(277)	(615)
Bluegill	0.0646	338	739	1077
	(0.0511)	(255)	(713)	(757)
Pumpkinseed	0.0192	218	103	321
	(0.0157)	(180)	(150)	(235)
Rock bass	0	0	0	0
	(0)	(0)	(0)	(0)
Black crappie	0.2484	1,861	2,281	4,142
	(0.1493)	(1,058)	(1,685)	(1,990)
TOTAL HARVEST	0.4197	3,506	3,492	6,998
	(0.2023)	(1,240)	(1,858)	(2,234)
RELEASED				
Northern pike	0.0264	297	144	441
	(0.0155)	(155)	(130)	(203)
Largemouth bass	0	0	0	0
	(0)	(0)	(0)	(0)
Smallmouth bass	0	0	0	0
	(0)	(0)	(0)	(0)
Yellow Perch	0.4467	5,673	1,776	7,449
	(0.2692)	(3,202)	(1,630)	(3,593)
Bluegill	0.1671	1,656	1,131	2,787
	(0.1303)	(1,078)	(1,595)	(1,925)
Pumpkinseed	0.0008	13	0	13
	(0.001)	(17)	(0)	(17)
Rock bass	0	0	0	0
	(0)	(0)	(0)	(0)
Black crappie	0.2465	1,783	2,326	4,109
	(0.1757)	(1,314)	(2,157)	(2,526)
TOTAL RELEASED	0.8876	9,422	5,378	14,800
	(0.4308)	(3,629)	(3,141)	(4,799)
TOTAL CATCH	1.3073	12,928	8,870	21,798
	(0.569)	(3,835)	(3,649)	(5,294)
ANGLER HOURS		12,894	3,781	16,674
		(5,488)	(2,481)	(6,022)
ANGLER TRIPS		3,793	1,081	4,874
		(2,397)	(841)	(2,541)

Table 10. Michigan DNR Master Angler awards issued for fish caught from Lake Mitchell, Wexford County, 1994-2012.

Species	Number of Master Angler awards issued
Bowfin	45
Bullhead	26
Bluegill	13
Black crappie	6
Rock bass	12
Smallmouth bass	6
Pumpkinseed	12
Largemouth bass	1
Warmouth	1
Yellow perch	1
Total:	123

Table 11. Number, weight, and length of fish collected from Lake Mitchell with large mesh fyke nets, trap nets, and inland gillnets, on May 7-11, 2012.

Species	Number	Percent by number	Weight (Pounds)	Percent by weight	Length range (inches)1	Average length	Percent legal size2
black crappie	394	15.5	111.7	4.9	4-13	7.7	57 (7")
bluegill	88	3.5	15.2	0.7	4-8	5.9	43 (6")
bowfin	14	0.5	104.3	4.6	21-32	26.9	
brown bullhead	1,453	57.0	1043.9	46.2	8-14	11.5	100 (7")
largemouth bass	121	4.7	205.3	9.1	8-18	14.4	55 (14")
northern pike	128	5.0	358.1	15.9	11-32	22.8	28 (24")
pumpkinseed	58	2.3	16.5	0.7	4-8	6.6	83 (6")
rock bass	9	0.4	4.1	0.2	6-10	8.3	100 (6")
smallmouth bass	17	0.7	31.0	1.4	9-19	14.8	65 (14")
walleye	65	2.5	178.6	7.9	13-27	19.8	89 (15")
white sucker	21	0.8	68.7	3.0	13-24	20.0	
yellow bullhead	168	6.6	119.0	5.3	8-13	11.4	100 (7")
yellow perch	14	0.5	2.8	0.1	5-9	7.7	86 (7")
Total	2,550	100	2259.2	100			

[1]Note some fish were measured to 0.1 inch, others to inch group: e.g., "5"=5.0 to 5.9 inch, "12"=12.0 to 12.9 inches; etc.

[2]Percent legal size or acceptable size for angling. Legal size or acceptable size for angling is given in parentheses.

Table 12. Number, weight, and length of fish collected from Lake Mitchell by electrofishing on July 9, 2012 and seining on August 7, 2012.

Species	Number	Percent by number	Weight (Pounds)	Percent by weight	Length range (inches)1	Average length	Percent legal size2
black crappie	9	1.4	0.4	0.9	4-5	4.6	0 (6")
bluegill	123	19.6	3.8	8.1	1-6	3.4	0 (6")
bluntnose minnow	8	1.3	0.1	0.2	2-3	2.8	
bowfin	1	0.2	5.2	11.1	24-24	24.5	
common shiner	1	0.2	0.1	0.2	6-6	6.5	
largemouth bass	37	5.9	13.1	28.0	1-17	7.2	5 (14")
northern pike	2	0.3	4.4	9.4	17-24	21.0	50 (24")
pumpkinseed	87	13.9	6.5	13.9	1-6	4.2	12 (6")
rock bass	2	0.3	0.2	0.4	3-6	5.0	50 (14")
sand shiner	1	0.2	0.0	0.0	2-2	2.5	
smallmouth bass	3	0.5	0.0	0.0	1-3	2.5	0 (14")
spottail shiner	303	48.2	3.8	8.1	1-4	3.4	
walleye	3	0.5	3.0	6.4	9-16	13.8	66 (15")
white sucker	2	0.3	3.7	7.9	12-19	16.0	
yellow bullhead	1	0.2	0.7	1.5	11-11	11.5	100 (7")
yellow perch	45	7.2	1.8	3.8	2-7	4.5	2 (7")
Total	628	100	46.8	100			

[1]Note some fish were measured to 0.1 inch, others to inch group: e.g., "5"=5.0 to 5.9 inch, "12"=12.0 to 12.9 inches; etc.

[2]Percent legal size or acceptable size for angling. Legal size or acceptable size for angling is given in parentheses.

Table 13. Average total weighted length (inches) at age, and growth relative to the state average, for fish sampled from Lake Mitchell with trap nets and inland gill nets, May 7- May 11, 2012. Number of fish aged is given in parentheses. A minimum of five fish per age group is statistically necessary for calculating a Mean Growth Index, which is a comparison to the State of Michigan average.

	Age																	
Species	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	Mean Growth Index
Black crappie		5.4 (8)	5.9 (13)	7.1 (19)	8.1 (12)	8.3 (10)	9.4 (13)	10.0 (8)	11.0 (4)	11.6 (2)	11.6 (2)	12.7 (1)	13.2 (1)					-1.4
Bluegill				4.6 (5)	5.1 (22)	5.6 (6)	6.6 (22)	7.6 (9)	7.6 (2)	8.2 (2)	7.9 (1)							-1.3
Largemouth bass			8.4 (8)	10.7 (8)	12.4 (13)	13.8 (20)	15.4 (17)	15.9 (11)	16.5 (8)	17.4 (4)	18.3 (3)							-1.1
Northern pike	11.8 (2)	16.0 (5)	20.4 (19)	23.0 (31)	24.8 (19)	25.4 (8)	28.7 (2)	29.1 (3)										-1.0
Pumpkin-seed				4.5 (1)	5.2 (11)	6.4 (11)	7.1 (22)	7.7 (8)	8.5 (1)		8.2 (1)							-0.4
Rock bass					7.3 (1)		7.0 (4)		9.0 (2)	9.1 (1)		10.9 (1)						--
Smallmouth bass		9.2 (1)	11.7 (3)	13.3 (3)	15.8 (3)	16.6 (5)	17.0 (1)				19.1 (1)							+1.3
Walleye				15.4 (16)		20.8 (23)		21.2 (7)	20.2 (1)	22.7 (1)	19.5 (2)	20.2 (1)	20.0 (1)	20.1 (4)	22.3 (4)	25.4 (2)	25.3 (3)	+0.2
Yellow perch				5.6 (9)	7.4 (11)			9.0 (1)										-1.5

Table 14. Average total weighted length (inches) at age, and growth relative to the state average, for fish sampled from Lake Mitchell by electrofishing, July 9, 2012. Number of fish aged is given in parentheses. A minimum of five fish per age group is statistically necessary for calculating a Mean Growth Index, which is a comparison to the State of Michigan average.

	Age								
Species	I	II	III	IV	V	VI	VII	VIII	Mean Growth Index
Black crappie		4.6 (7)	5.0 (2)						-1.9
Bluegill				4.7 (5)	5.1 (8)		6.5 (1)		-1.7
Largemouth bass	4.3 (9)	7.2 (15)	10.5 (4)	11.2 (1)	13.9 (3)			17.2 (1)	-1.3
Northern pike					24.9 (1)				-
Pumpkinseed			4.4 (1)	4.5 (3)	5.6 (14)	6.1 (5)	6.5 (2)		-0.7
Rock bass					6.6 (1)				-
Walleye	9.3 (1)			16.2 (2)					-
Yellow perch		4.5 (12)	5.2 (3)	6.2 (1)	7.8 (1)				-1.2