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

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Environment

Lake Cadillac (Fig. 1) is a 1,150-acre lake located entirely within the city limits of Cadillac, MI, in southeastern Wexford County. Lake Cadillac is in the Muskegon River watershed, as its outflow forms the headwaters of the Clam River. The Clam River, a noted brook trout stream, flows out of the north shoreline of the eastern basin of Lake Cadillac. Lake Mitchell, a 2,580 acre natural lake lying directly to the west, flows into Lake Cadillac via a ¼ mile long dredged channel which is navigable by most small boats. The maximum depth of Lake Cadillac is 28 feet, with approximately 50% of the lake shallower than 15 feet. According to Fusilier and Fusilier (2010), the size of the Lake Cadillac watershed is approximately 35,506 acres, and the lake flushes about once every 0.48 years. Lake Cadillac is classified as a mesotrophic lake, based on parameters including water clarity, phosphorous levels, and chlorophyll levels. Substrates in the lake are primarily sand and organic matter, with some patches of cobble and gravel. There are also a few areas on Lake Cadillac that still have remnant slabwood from the lumbering days (1870s to the early 1900s). There is a lake-level control structure (dam) on Lake Cadillac that controls the water levels of the lake, and also 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.

Much of the terrain surrounding Lake Cadillac is urban. There is very little natural shoreline remaining on Lake Cadillac. Other than one small coniferous wetland area remaining on the northern portion of the lake, the shoreline consists entirely of houses, condominiums, roads, or public parks and beaches. The parks (including William Mitchell State Park, Kenwood Park, and the Keith McKellop Lakefront Walkway) provide outstanding public access to Lake Cadillac (Fig. 1). Each has a boat launch with parking for a number of vehicles and trailers, although the William Mitchell State Park boat launch on Lake Cadillac is used primarily by campers at the park. There is a public dock and fishing pier located on the eastern end of the lake near the downtown business district. Another public fishing pier was installed on Lake Cadillac at William Mitchell State Park in the summer of 2006.

In addition to the canal from Lake Mitchell, Lake Cadillac has several other streams flowing into it (Fig 1). One is Black Creek, located on the north shore at Kenwood Park. Prior to the construction of the canal, Black Creek carried the outflow from Lake Mitchell into Lake Cadillac. Currently, Black Creek only carries flow into Lake Cadillac seasonally. The other streams flowing into Lake Cadillac are located on the south shore. One carries the outflow from Berry Lake and associated wetlands, and the other drains some wetlands just to the south of Lake Cadillac. Because they are fed by wetlands, the runoff events are more protracted in nature, as the wetlands store and slowly release water over time. Both of these streams only flow seasonally.

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, zebra mussels were located throughout Lake Cadillac. They are much more widespread on Lake Cadillac than on Lake Mitchell, at least so far. The aquatic invasive plant Eurasian milfoil is also abundant in Lake Cadillac. It was first observed in Lake Cadillac in 2003. In 2006-2008, treatments were conducted on the lake with the chemical 2,4-D. Another 140 acres was treated in 2012. As there is no citizen-based group that serves Lake Cadillac, the invasive species treatment program has been administered by staff from the City of Cadillac, with treatment plans designed by Progressive AE (Anonymous 2013). Milfoil weevils (aquatic insects known to feed on and damage Eurasian milfoil plants) were also stocked into Lake Cadillac from 2006-2009, apparently with little result.

History

The City of Cadillac (originally named "Clam Lake") was founded on the shores of Lake Cadillac in 1871 by George Mitchell. The abundant timber resources of the area were what brought Mitchell. Within several years there were a number of lumber mills on Lake Cadillac. The city was renamed "Cadillac" in 1877, after the 1700s French explorer. Lake Cadillac was originally known as "Little Clam Lake", and Lake Mitchell was called "Big Clam Lake". The names were changed to Lake Mitchell and Lake Cadillac in 1903 (lakemitchell.org). The two lakes were originally connected by Black Creek, which was a meandering, swampy stream. 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 Lake Mitchell level 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 between the lakes 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. It currently flows into Lake Cadillac in Kenwood Park on the northern shore.

The first documented fish stocking of Lake Cadillac took place in 1874, when lake whitefish were stocked (Table 1). Lake trout were also stocked in 1879 and 1897. Due to the shallow, warm nature of Lake Cadillac, it is not possible for coldwater species like lake whitefish and lake trout to survive for any length of time. Walleye and smallmouth bass were stocked in 1909 and 1910. Although Table 1 displays the known stocking records, there is evidence that some other fish stocking events occurred as well. The period from 1929-1941 saw intensive stocking of multiple species including bluegill, yellow perch, walleye, and emerald shiners (called "Great Lakes shiners" at that time). In 1960 and 1973-1977 a northern pike spawning marsh was operated on Black Creek (the stream that formerly connected Lakes Cadillac and Mitchell) in what is now the Cadillac Heritage Nature Study Area. The spawning marsh did produce fingerlings in several years (1960, 1974-1975) but also failed in some years (1973 and 1977). Eventually, the managing biologists decided that northern pike natural reproduction was sufficient in Lake Cadillac without the marsh. After 1975, no stocking took place in Lake Cadillac until 2004, when walleye were again stocked. Since then, walleye have also been stocked in 2006, 2008, 2011, and 2012.

The first fisheries survey of Lake Cadillac 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 Mitchell during the same

years. Netting with seines and gill nets was also conducted in some years. A total of 22 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), Beckman (1947), 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.

In 1947, a total of 297 walleye were jaw tagged and released into Lake Cadillac (Schneider and Crowe 1977). Tags were returned by anglers up to 10 years after the study began. Return rates were relatively low, at 3.4% in the first year and 11.1% overall.

The next fisheries survey of Lake Cadillac 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 Cadillac was conducted by MDNR in late April and early May of 1980. The survey consisted of three nights of electrofishing in which the entire shoreline of the lake was sampled. According to survey notes, the survey was not a complete effort- only the larger individuals for each species were captured, while smaller fish were ignored. A total of 166 fish representing 10 species (Table 2) were caught. Age and growth analysis from the 1980 survey indicated that all Lake Cadillac fish species, with the exception of smallmouth bass, were growing faster than the state average (Table 3).

A four-day netting survey was conducted by MDNR from April 18-22, 1988. The survey consisted of four trap nets and six large mesh fyke nets. In particular, the researchers were targeting walleye, which were likely spawning at that time. A total of 135 walleye were caught, representing 7 different age groups. A total 747 fish representing 11 different species were caught in the survey (Table 2). 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 one exception was walleye.

Another major survey was conducted from May 3-7, 1993, this one utilizing trap nets, large-mesh fyke nets, 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 Mitchell during the previous 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 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 Lake Cadillac survey, other species were collected as well. A total of 3,302 fish were collected, representing 18 species (Table 2). Brown

bullhead were the most numerous, with 1,904 collected. Other species collected in large numbers included walleye (223), smallmouth bass (137), rock bass (328), black crappie (337), and bluegill (183). Age and growth analysis from the 1993 survey showed a shift in growth from the 1980 survey (Table 3). In 1980, most species were growing faster than the state average. However, by 1993 growth had slowed for most species. While some species were still growing faster than the state average, it was not by much. Walleye in particular were growing slowly, at 1.4 inches slower than the state average.

Starting in 1994, MDNR began conducting fall electrofishing surveys on Lake Cadillac, utilizing the methods of 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, 1995, and 2002 surveys were moderately successful in capturing juvenile walleye, the 2003-2006 surveys were not, even with heavy stocking occurring in 2004 and 2006. Despite this, anglers were reporting sporadic catches of juvenile walleye. There have been some lakes where electrofishing of the shoreline in the fall was not successful, 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 protocol, only in the spring instead of in the fall (Tonello 2007; 2011). The 2007, 2008, and 2010 spring surveys were somewhat more successful than the 2002-2006 surveys in documenting survival of stocked juvenile walleye (Table 4).

The next comprehensive fisheries survey of Lake Cadillac was conducted in the spring of 2003. The 2003 survey consisted of five large-mesh fyke nets, two small-mesh fyke nets, and two trap nets, and was conducted from April 28-May 2. In this survey, a total of 3,073 fish were caught, representing 15 different species (Tables 2, 5, and 6). Well-represented species in the survey included, brown bullhead, black crappie, rock bass, pumpkinseed sunfish, and white sucker. Most fish species in the 2003 survey were growing at or above State average, with the exception of bluegill and yellow perch (Tables 3 and 7).

While a total of 50 walleye were caught in the 2003 survey, the overall catch for walleye was dramatically lower than in 1988 and 1993. Also, only two walleye smaller than 15 inches or younger than age 4 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 6 and 9, which would have been the 1994 and 1997 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 20,827 angler trips were taken on Lake Cadillac, equating to 53,243 angler hours generated (Table 8). An estimated total of 184,339 fish were caught, with 120,602 of those released. Bluegill was the most commonly released species, while black crappie was the most commonly kept species. The ice fishing creel season ran from January 19 through March 24. In that time, an estimated 3,685 ice fishing angler trips were taken on Lake Cadillac, equating to 15,023 angler hours generated (Table 9). An estimated 27,326 fish were caught by ice anglers on Lake Cadillac, with 15,029 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 Cadillac.

Combined, the summer and winter effort on Lake Cadillac was 24,512 angler trips, equating to 68,266 angler hours. When that effort total is combined with the angler effort from Lake Mitchell, 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. For comparison, Houghton Lake, another lake with impressive panfish populations, produced only 24.9 angler hours per acre (Clark et al. 2004) compared to 31.5 angler hours per acre on Cadillac and Mitchell.

Lake Cadillac has produced 84 entries into the MDNR Master Angler program since 1994 (Table 10). The most commonly entered species include bullhead (38 entries) and bowfin (16 entries). Particularly impressive were two northern pike Catch and Keep entries that each weighed 24.5 lbs. With five northern pike entries since 1994, Lake Cadillac ranks among the top lakes for Master Angler northern pike in the northwestern Lower Peninsula.

Current Status

The most recent comprehensive fisheries survey of Lake Cadillac 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 15 through May 18. Gear used included eight trap nets (30 net-nights) and 2 experimental graded-mesh inland gill nets (6 net-nights). Electrofishing was conducted on July 12, 2012, with three ten-minute electrofishing transects conducted with an 18-foot boomshocking boat. Seining was conducted on August 6, with a total of six 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 fish community in Lake Cadillac and in particular evaluate the walleye population.

During the May netting portion of the 2012 survey of Lake Cadillac, a total of 1,724 fish were caught, representing 15 different species (Tables 2 and 11). Brown bullhead were the most abundant species collected, with a total of 607 caught (ranging from 7-15 inches). Panfish species present in the 2012 netting catch included black crappie (342 fish caught ranging from 5-11 inches), bluegill (128 from 4-8 inches), pumpkinseed sunfish (90 from 4-9 inches), rock bass (112 from 4-11 inches), and yellow perch (42 from 5-9 inches). The most abundant game fish species caught in the netting portion of the 2012 survey was largemouth bass, with 118 caught ranging from 7-19 inches in length. Other game species present in the 2012 netting catch included smallmouth bass (69 from 7-19 inches), walleye (31 from 14-24 inches), and northern pike (106 from 11-27 inches). Other species caught in the netting portion of the 2012 survey included bowfin, common carp, green sunfish, white sucker, and yellow bullhead. Common carp and green sunfish were each represented by one individual, the first documented from Lake Cadillac for both of those species. The common carp was a large adult, and was not returned to the water.

During the electrofishing and seining portions of the 2012 survey of Lake Cadillac, a total of 573 fish were caught, representing 15 different species (Table 12). Species most frequently collected while seining and electrofishing were pumpkinseed sunfish (188 from 2-7 inches), bluegill (173 from 1-5 inches), and yellow perch (125 from 1-7 inches). Other panfish species present in the seining and electrofishing catch included black crappie (3 from 4-7 inches) and rock bass (10 from 2-9 inches). Game species present in the seining and electrofishing catch included largemouth bass (28 from 1-15 inches), northern pike (1 at 4 inches), smallmouth bass (21 from 1-8 inches), and walleye (2 from 15-

17 inches). Other nongame species present in the seining and electrofishing catch included bluntnose minnow, common shiner, logperch, sand shiner, spottail shiner, and white sucker.

In the 2012 survey, most species caught showed growth rates that were near the state average (Tables 3, 13 and 14). Slower growing species included black crappie, bluegill, northern pike, smallmouth bass, and yellow perch. Younger yellow perch (ages 1-3) caught in the electrofishing portion of the survey displayed average growth (Table 14), but older yellow perch (ages 5 and 6) from the netting portion of the survey were growing very slowly, at a full 2 inches slower than the state average (Table 13). Largemouth bass, pumpkinseed, rock bass, and walleye were all growing slightly faster than the State average. Walleye as old as 16 were present in the 2012 survey. Previously recorded fish species that were not present in the 2012 survey of Lake Cadillac included banded killifish, black bullhead, central mudminnow, creek chub, golden shiner, Iowa darter, Johnny darter, mimic shiner, and rosyface shiner (Table 2). Species caught in the 2012 survey that had not been identified in previous surveys of Lake Cadillac included common carp, green sunfish, and sand shiner.

Shoreline data were collected on Lake Cadillac by DNR Fisheries personnel on August 7, 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 Cadillac averaged 15.7 docks, 15.1 submerged trees and 9.7 houses per kilometer of shoreline (Table 15). Armoring structures and materials were present along 85.4% of the lake shoreline.

Analysis and Discussion

The Lake Cadillac fish community has undergone major changes in the past three decades or so. 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 Cadillac provided an excellent walleye fishery. However, in the late 1990s, walleye reproduction began to diminish. The 2012 survey documented very little natural reproduction in recent years (Table 13), with only one fish each from 2009 and 2003. 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 Cadillac contradicts that. Clearly, stocking is playing a major role in the current Lake Cadillac walleye fishery. However, even with stocking, the walleye population in Lake Cadillac is likely smaller than it was in the 1980s and early 1990s.

While the exact reason for the lack of walleye reproduction in Lake Cadillac in recent years is unknown, it may have something to do with the recent increase in largemouth bass abundance. According to Beckman (1947), largemouth bass were much less abundant than smallmouth bass in Lake Cadillac at that time. In the 1980 and 1988 fisheries surveys of Lake Cadillac no largemouth bass were caught (Table 2). Also, bass tournament catch data from the late 1980s and early 1990s (DNR files, Cadillac office) indicate that anglers in bass tournaments were catching mostly smallmouth bass in Lakes Cadillac and Mitchell. In recent years, largemouth bass have become much more abundant in the two lakes. In fact largemouth bass were quite abundant in the 2003 survey of Lake Cadillac, and were far more abundant than smallmouth bass in Lake Cadillac in the 2012 survey. 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 Cadillac in the last 15 years or so is related to the elevated population levels of largemouth bass.

Bass fishing has long been a popular endeavor on Lake Cadillac. 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, and may have influenced the recent proliferation of largemouth bass in Lake Cadillac. Bass anglers often justify their tournament procedures by pointing out that instead of releasing their fish alive, they could simply harvest them.

Another parameter that has changed over time in Lake Cadillac is fish growth; however, no clear lakewide trends are apparent. Growth for some species has declined, while increasing for others (Table 3). For example, in 1980, black crappie and bluegill both displayed outstanding growth, at over 2 inches faster than the state average. In 2012, both of those species were slower than the state average. Walleye and northern pike growth rates have also been variable over the years in Lake Cadillac. As recently as 2003, northern pike were growing 1.5 inches faster than the state average, but in 2012 were growing 1.0 inches slower. In 1980, walleye were growing 1.6 inches faster than the state average. In 1993, walleye growth was much slower, at 1.4 inches behind the state average. However, in 2012, walleye growth had again improved, and they were growing 0.3 inches faster than the State average. The causes of these variations in fish growth for Lake Cadillac unknown, although there are several possible explanations. It is possible that reduced walleye abundance has led to less intraspecific competition and therefore better growth. Reduced walleye abundance might also affect growth rates for other species as well. Walleye are known to be effective predators on many panfish species, and their reduced abundance in recent years could be allowing more 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 the use of copper sulfate on Lake Cadillac. 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), although this was more than has been seen in many years.

Other changes have taken place in Lake Cadillac in the relatively recent past as well. While much of Lake Cadillac has always been shallow and weedy, aquatic macrophyte growth has increased. In particular, Eurasian milfoil first appeared in Lake Cadillac in 2003, and has become a major nuisance since then. Currently, the Eurasian milfoil infestation of Lake Cadillac is held at bay only by regular 2, 4-D herbicide treatments (Anonymous 2013). If untreated, over time the Eurasian and hybrid milfoil would undoubtedly dominate much of Lake Cadillac, making it unsuitable for many popular activities, including fishing. It could also create negative effects on Lake Cadillac fish populations.

The data generated by the 2006-2007 creel surveys (Tables 8 and 9) demonstrate the popularity of the Lake Cadillac 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 Cadillac has been dramatically altered by human activity. In the 2012 survey, Lake Cadillac had very heavy shoreline armoring (85.4%) compared to other large shallow inland lakes in Michigan (average=28.4%; Wehrly et al. in press). Lake Cadillac had 9.7 dwellings per kilometer while the average large shallow lake in Michigan had 11.2 dwellings per kilometer (Wehrly et al. in press). Lake Cadillac also had 15.7 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 Cadillac also had slightly less submerged woody debris (15.1 trees/km) than other large shallow lakes in Michigan (average=17.3 trees/km; Wehrly et al. in press).

Management Direction

Lake Cadillac 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 Mitchell, 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 Cadillac 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, choking out native aquatic plant species. This would inhibit most lake recreational activities, including fishing.

Native species like black crappie, bluegill, pumpkinseed sunfish, smallmouth bass, and northern pike should continue to thrive in Lake Cadillac 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 meaningful natural reproduction of walleye in the last ten years. Therefore, spring fingerling walleye (Muskegon River strain) should continue to be stocked into Lake Cadillac, at a rate of 52/acre (60,000 fish) every other year. Since walleye were 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 Cadillac 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 Cadillac should be conducted by the DNR at least once every 10 years. 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 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 Cadillac citizens groups, businesses, and anglers to monitor the fishery.

Other opportunities for data-gathering on Lake Cadillac include conducting invertebrate surveys and sediment samples. Invertebrate surveys could be used in an attempt to explain the loss of mayflies on Lake Cadillac, 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.

The remaining riparian wetlands adjacent to and near Lake Cadillac 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 Cadillac 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.

In particular, the Lake Cadillac shoreline has been heavily impacted by human development. Over 85% of the shoreline has been hardened with seawalls or riprap, resulting in a loss of critical shoreline habitat. Also, many Lake Cadillac 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 Cadillac 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.

One area of Lake Cadillac shoreline along the Keith McKellop Walkway was successfully restored in 2011. The site consisted of mowed lawn to the water's edge, with no other vegetation present. In the project, the lawn was removed and replaced with erosion control blankets and coir biologs at the water's edge. Then, native aquatic and terrestrial plant species were planted on the site. They thrived in the summer of 2012. More projects of this nature should be completed on the Lake Cadillac shoreline.

If softer methods do not work in a particular situation and erosion remains an issue, then fieldstone riprap should be utilized instead of seawall. Native aquatic vegetation species can then be planted in front of the riprap. More guidelines for protecting fisheries habitat in inland lakes can be found in Fisheries Division Special Report 38 (O'Neal and Soulliere 2006).

References

Anonymous. 2003. An investigation of copper sulfate concentrations in sediment and water samples and sediment toxicity in three Michigan Lakes; Cadillac, Mitchell, and Houghton. Michigan Department of Environmantal Quality Report 02/25. Report prepared for MDEQ by Great Lakes Environmental Center, Traverse City.

Anonymous. 2007a. Survey report for Mitchell-Cadillac, Wexford County, Summer 2006. Michigan Department of Natural Resources, Lansing.

Anonymous. 2007b. Survey report for Mitchell-Cadillac, Wexford County, Winter 2007. Michigan Department of Natural Resources, Lansing.

Anonymous. 2013. Lake Cadillac invasive species control program- 2012 annual report. Progressive AE, Grand Rapids, Michigan.

Beckman, W. C. 1947. A preliminary report on the fisheries investigations on Cadillac Lake, Wexford County, Michigan. Fisheries Research Report #1141, Michigan Department of Conservation, Ann Arbor.

Carbine, W. F. and G. N. Washburn. 1944. An examination of Cadillac and Mitchell Lakes (Wexford County) to determine success of walleyed pike spawning. Fisheries Research Report #966, Michigan Department of Conservation, Ann Arbor.

Carbine, W. F. and G. N. Washburn. 1945. An examination of Cadillac and Mitchell Lakes (Wexford County) to determine success of game fish spawning. Fisheries Research Report #1022, Michigan Department of Conservation, Ann Arbor.

Carbine, W. F. 1947. An examination of Cadillac and Mitchell Lakes (Wexford County) to determine the success of game fish spawning. Fisheries Research Report #1105, Michigan Department of Conservation, Ann Arbor.

Clark, R. D., P. A. Hanchin, and R. N. Lockwood. 2004. The fish community and fishery of Houghton Lake, Roscommon County, Michigan with emphasis on walleyes and northern pike. Michigan Department of Natural Resources, Fisheries Special Report 30, Ann Arbor.

Fayram, A. H., M. J. Hansen, and T. J. Ehlinger. 2005. Interactions between walleyes and four fish species with implications for walleye stocking. North American Journal of Fisheries Management 25:1321-1330.

Funk, J. 1942. Fisheries Survey of Cadillac and Mitchell Lakes, Wexford County. Fisheries Research Report #767. Michigan Department of Conservation, Ann Arbor.

Fusilier, W. E., and B. Fusilier. 2009. Lake Cadillac Water Quality Studies 2002-2010. Water Quality Investigators, Chelsea, MI.

O'Neal, R. P., and G. J. Soulliere. 2006. Conservation guidelines for Michigan lakes and associated natural resources. Michigan Department of Natural Resources, Fisheries Special Report 38, Ann Arbor.

Schneider, J. C., and W. R. Crowe. 1977. A synopsis of walleye tagging experiments in Michigan, 1929-1965. Fisheries Research Report No. 1844, Michigan Department of Natural Resources, Lansing.

Serns, S. L. 1982. Relationship of walleye fingerling density and electrofishing catch per effort in northern Wisconsin lakes. North American Journal of Fisheries Management 2:38-44.

Serns, S. L. 1983. Relationship between electrofishing catch per effort and density of walleye yearlings. North American Journal of Fisheries Management 3:451-452.

Tonello, M. A. 2007. Inland lake fisheries surveys: Lakes Cadillac and Mitchell, 2006-2007. Michigan Department of Natural Resources, Cadillac.

Tonello, M. A. 2011. Inland lake fisheries surveys: Lakes Cadillac and Mitchell, 2008-2010. Michigan Department of Natural Resources, Cadillac.

Warnick, S. L. and H. L. Bell. 1969. The acute toxicity of some heavy metals to different species of aquatic insects. Journal- Water Pollution Control Federation 41:280-284.

Wehrly, K.E., G.S. Carter, and J.E. Breck. 2009 Draft. Standardized sampling methods for the inland lakes status and trends program. Chapter 27 in Manual of Fisheries Survey Methods. Michigan Department of Natural Resources, Fisheries Division internal document, Ann Arbor.

Wehrly, K. E., D. B. Hayes, and T. C. Wills. In press. Status and trends of Michigan inland lake resources, 2002-2007. Michigan Department of Natural Resources, Fisheries Special Report, Lansing.

Wisconsin Department of Natural Resources. 2012. Copper Compounds Chemical Fact Sheet. Wisconsin Department of Natural Resources Publication WT-968, Madison.

U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. 2006. 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.

Ziegler, W. and J. C. Schneider, 2000. Guidelines for evaluating walleye and muskie recruitment. Chapter 23 in J. C. Schneider editor. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.

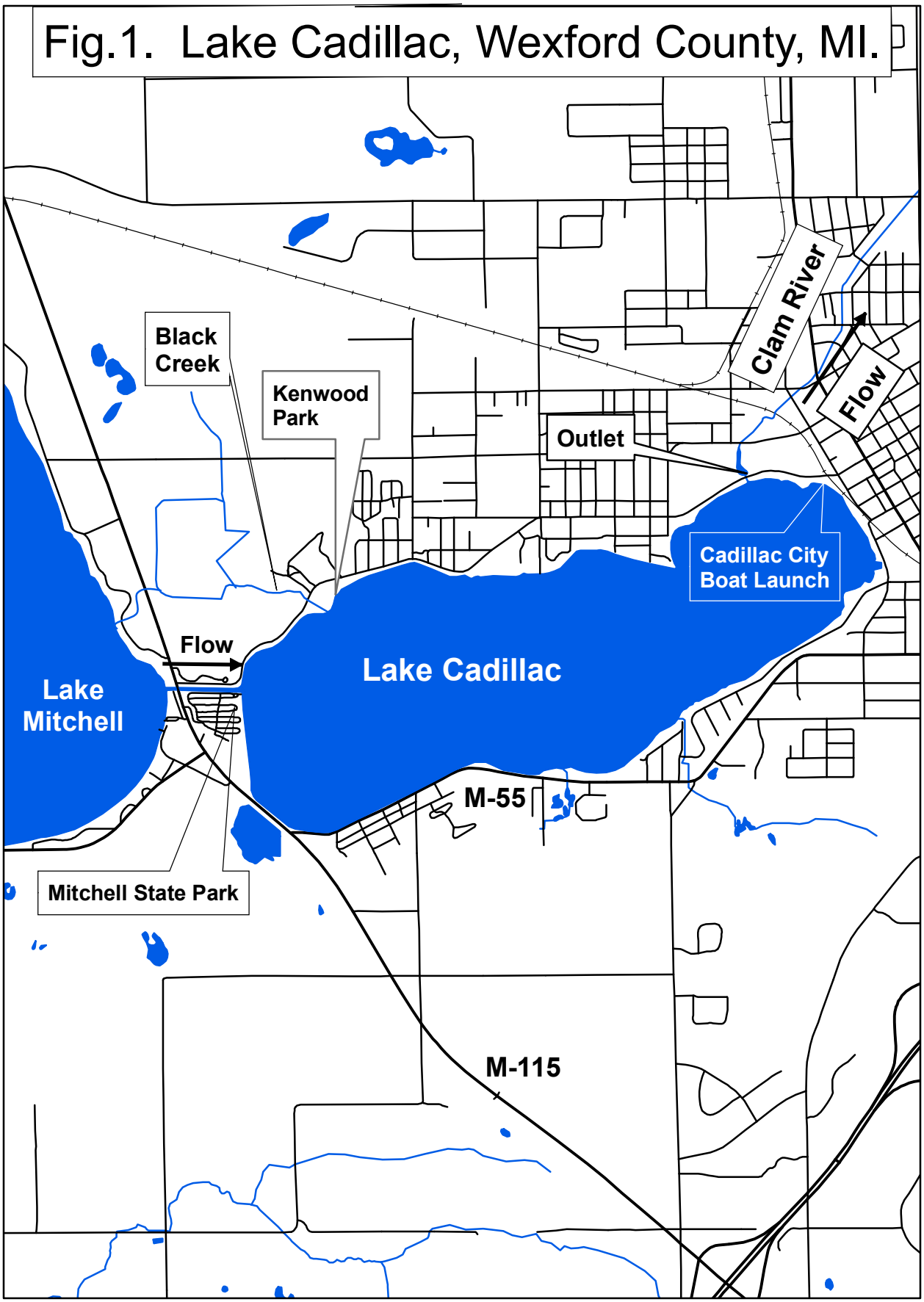
Fig.1. Lake Cadillac, Wexford County, MI.
Black Creek
Kenwood Park
Clam River
Flow
Outlet
Cadillac City Boat Launch
Flow
Lake Mitchell
Lake Cadillac
M-55
Mitchell State Park
M-115

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

Year	Species	Number	Size/age	Strain
1874	lake whitefish	5,000	fry	Detroit River
1879	lake trout	6,000	fry	Lake Michigan
1897	lake trout	10,000	fry	
1905	walleye	125,000	fry	
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	350,000		
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	220,000	fry	
	yellow perch	40,000	5 mo.	
1940	walleye	200,000	fry	
1941	yellow perch	80,500	5 mo.	
1960	northern pike	30	legal	
	northern pike	49	sublegal	
	northern pike	83,700	fingerlings	
1974	northern pike	100,000	spring fingerlings	
1975	northern pike	2,095	spring fingerlings	
1976	northern pike	8,000	spring fingerlings	
2004	walleye	67,549	spring fingerlings	Muskegon
2006	walleye	2,300,000	fry	Muskegon
	walleye	16,416	fall fingerlings	Muskegon
2008	walleye	28,629	spring fingerlings	Muskegon
2011	walleye	14,867	spring fingerlings	Muskegon
2012	walleye	71,834	spring fingerlings	Muskegon

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

Species	1942*	1961	1980	1988	1993	2003	2012
banded killifish	x						
black bullhead	x						
black crappie	x	x	x	x	x	x	x
bluegill	x	x	x	x	x	x	x
bluntnose minnow	x						x
bowfin	x		x	x	x	x	x
brown bullhead	x					x	x
bullhead (nonspecific)		x		x	x		
central mudminnow	x						
common carp							x
common shiner		x					x
creek chub	x						
golden shiner						x	
green sunfish							x
Iowa darter	x						
Johnny darter	x						
largemouth bass	x	x			x	x	x
logperch	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
rosyface shiner	x						
sand shiner							x
smallmouth bass	x	x	x	x	x	x	x
spottail shiner						x	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, seining, and gill netting conducted from 1928-1941.

Table 3. Mean Growth Index (comparison to State of Michigan average) for fish sampled from Lake Cadillac 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	+2.5	+1.6	-0.1	+0.5	-0.9
bluegill	+2.4	+0.5	0.0	-1.2	-0.4
largemouth bass			+0.4	+0.4	+0.3
northern pike		+2.0	+0.2	+1.5	-1.0
pumpkinseed			+0.5	+0.7	+0.7
rock bass	+1.2	+0.1	+0.2	+0.4	+0.2
smallmouth bass	-1.1		-0.9	+0.6	-0.3
walleye	+1.6	-0.8	-1.4	+0.0	+0.3
yellow perch	+0.3	+0.4		-1.7	-2.0

Table 4. Results of Serns-style walleye electrofishing surveys conducted on Lake Cadillac 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	127	31.8	8,544	7.4
Age 1	47	11.8	2,621	2.3
1995				
Age 0	15	3.8	1,009	0.9
Age 1	27	6.8	1,506	1.3
2002				
Age 0	18	4.50	1,211	1.1
Age 1	2	0.50	112	0.1
2003				
Age 0	0	0.00	0	0.0
Age 1	3	1.00	223	0.2
2004				
Age 0	7	1.89	508	0.4
Age 1	0	0.00	0	0.0
2005				
Age 0	0	0.00	0	0.0
Age 1	0	0.00	0	0.0
2006				
Age 0	0	0.00	0	0.0
Age 1	0	0.00	0	0.0
2007 (spring)*				
Age 1 (2006 year class)	21	5.45	1,468	1.3
Age 2	0	0.00	0	0.0
2008 (spring)*				
Age 1	0	0.00	0	0.0
Age 2 (2006 year class)	5	1.28	285	0.2
2010 (spring)*				
Age 1	0	0.00	0	0.0
Age 2 (2008 year class)	24	6.90	1,537	1.4

* 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 Cadillac with large mesh fyke nets and trap 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	129	7.8	65.3	2.8	6-12	9.5	99 (7")
bluegill	93	5.6	14.2	0.6	2-8	5.9	45 (6")
bowfin	23	1.4	149.6	6.5	19-30	26.2	
brown bullhead	714	43.0	742.7	32.0	8-15	13.4	100 (7")
largemouth bass	83	5.0	121.3	5.2	9-20	14.0	46 (14")
northern pike	75	4.5	235.8	10.2	13-39	23.4	29 (24")
pumpkinseed	56	3.4	20	0.9	5-8	7.4	95 (6")
rock bass	107	6.4	42.0	1.8	4-10	7.9	94 (6")
smallmouth bass	86	5.2	148.3	6.4	9-19	14.3	58 (14")
walleye	47	2.8	133.9	5.8	13-24	19.1	96 (15")
white sucker	241	14.5	641.6	27.7	9-24	18.7	
yellow bullhead	3	0.2	2.2	0.1	9-12	11.5	100 (7")
yellow perch	5	0.3	0.9	0.0	6-7	7.3	80 (7")
Total	1,662	100	2317.8	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 6. Number, weight, and length of fish collected from Lake Cadillac with small mesh fyke nets on April 28-May 2, 2012.

Species	Number	Percent by number	Weight (Pounds)	Percent by weight	Length range (inches)1	Average length	Percent legal size2
black crappie	4	0.3	1.3	0.2	2-10	7	50 (7")
bluegill	11	0.8	1.2	0.2	2-6	5.2	45 (6")
bowfin	19	1.3	112.4	17.1	21-29	25.4	
brown bullhead	387	27.4	400.3	61.0	7-15	12.9	100 (7")
golden shiner	1	0.1	0.0	0.0	3-3	3.5	
largemouth bass	12	0.9	17.0	2.6	10-17	13.7	50 (14")
northern pike	7	0.5	14.1	2.1	17-22	20.8	0 (24")
pumpkinseed	5	0.4	1.4	0.2	6-7	6.9	100 (6")
rock bass	26	1.8	11.6	1.8	1-10	7.7	73 (6")
smallmouth bass	1	0.1	1.6	0.2	14-14	14.5	100 (14")
spottail shiner	23	1.6	0.4	0.1	2-4	3.8	
walleye	3	0.2	10.4	1.6	20-23	21.8	100 (15")
white sucker	32	2.3	65.7	10.0	8-21	17.0	
yellow bullhead	2	0.1	1.0	0.2	9-10	10.0	100 (7")
yellow perch	878	62.2	18.3	2.8	2-8	3.5	0 (7")
Total	1,411	100	656.7	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 Cadillac 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	Mean Growth Index
Black crappie			7.5 (8)	8.6 (17)	10.0 (12)	10.4 (9)	11.4 (6)	11.9 (7)	12.2 (1)	12.6 (1)		+0.5
Bluegill			4.1 (6)	4.7 (5)	5.5 (2)	5.9 (15)	6.7 (8)	7.5 (1)	8.5 (1)		8.8 (1)	-1.2
Largemouth bass			10.2 (3)	12.1 (20)	13.9 (31)	14.6 (11)	16.8 (4)	17.1 (2)	17.8 (1)			+0.4
Northern pike		18.1 (12)	22.3 (46)	25.9 (16)	30.6 (4)		39.1 (1)					+1.5
Pumpkin-seed				6.7 (3)	6.9 (7)	7.3 (9)	7.8 (5)	8.1 (3)	8.7 (1)			+0.7
Rock bass			4.5 (3)	6.4 (17)	7.4 (10)	8.2 (11)	9.1 (7)	9.6 (8)	10.1 (1)	10.1 (1)		+0.4
Smallmouth bass		9.7 (1)		13.4 (19)	14.1 (27)	15.3 (9)	17.7 (6)	17.6 (4)	19.2 (2)	19.4 (1)		+0.6
Walleye		13.2 (1)	14.2 (1)	18.4 (7)	18.3 (3)	18.9 (11)	21.4 (5)	19.1 (5)	21.9 (11)	23.7 (2)	21.4 (3)	+0.0
Yellow perch	3.1 (2)	3.8 (10)	4.7 (15)	5.9 (15)	6.6 (10)							-1.7

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

Species	C/H	April-May	June	July	August	September	October	Season
HARVEST								
Walleye	0.0007	39	0	0	0	0	0	39
	(0.0011)	(56)	(0)	(0)	(0)	(0)	(0)	(56)
Northern pike	0.0063	161	21	82	50	21	0	336
	(0.0042)	(167)	(43)	(119)	(72)	(32)	(0)	(224)
Largemouth bass	0.0022	0	0	0	115	0	0	115
	(0.0032)	(0)	(0)	(0)	(170)	(0)	(0)	(170)
Yellow Perch	0.0537	501	673	1,011	222	137	318	2,862
	(0.0289)	(549)	(1,145)	(707)	(246)	(274)	(250)	(1,520)
Bluegill	0.5152	345	12,609	10,345	2,921	1,172	37	27,429
	(0.1405)	(343)	(5,773)	(3,676)	(1,547)	(1,198)	(52)	(7,127)
Pumpkinseed	0.0605	12	644	927	1,463	173	0	3,219
	(0.0334)	(24)	(671)	(808)	(1,380)	(284)	(0)	(1,758)
Rock bass	0.0048	58	124	6	52	18	0	258
	(0.0040)	(94)	(151)	(12)	(103)	(36)	(0)	(209)
Black crappie	0.5513	3,640	14,500	2,876	5,816	2,277	246	29,355
	(0.1307)	(2,404)	(4,834)	(1,510)	(3,172)	(978)	(253)	(6,520)
Brown bullhead	0.0023	0	0	123	0	0	0	123
	(0.0046)	(0)	(0)	(246)	(0)	(0)	(0)	(246)
TOTAL HARVEST	1.1971	4,756	28,571	15,370	10,639	3,799	601	63,737
	(0.2114)	(2,498)	(7,648)	(4,126)	(3,803)	(1,597)	(360)	(9,944)
RELEASED								
Walleye	0.0005	0	0	0	27	0	0	27
	(0.0010)	(0)	(0)	(0)	(53)	(0)	(0)	(53)
Northern pike	0.0311	479	589	144	128	264	50	1,655
	(0.0129)	(307)	(513)	(169)	(171)	(177)	(53)	(671)
Largemouth bass	0.0433	545	547	590	282	292	52	2,308
	(0.0193)	(395)	(351)	(686)	(427)	(289)	(58)	(1,009)
Smallmouth bass	0.0733	291	481	659	1,984	318	171	3,904
	(0.0234)	(201)	(314)	(468)	(997)	(191)	(243)	(1,203)
Yellow Perch	0.1553	554	2,778	2,743	1,267	78	851	8,270
	(0.0563)	(484)	(1,681)	(1,779)	(979)	(94)	(1,156)	(2,920)
Bluegill	1.1386	743	25,035	23,468	9,583	1,752	43	60,624
	(0.3307)	(519)	(13,462)	(8,454)	(5,468)	(1,421)	(74)	(16,879)
Pumpkinseed	0.0929	202	649	1,880	2,009	206	0	4,946
	(0.0790)	(364)	(641)	(1,777)	(3,703)	(305)	(0)	(4,184)
Rock bass	0.0276	287	930	191	34	29	0	1,472
	(0.0218)	(389)	(1,052)	(266)	(69)	(57)	(0)	(1,156)
Black crappie	0.7024	1,928	24,132	788	6,724	3,826	0	37,399
	(0.2036)	(1,490)	(8,952)	(591)	(4,573)	(2,078)	(0)	(10,390)
TOTAL RELEASED	2.2652	5,029	55,141	30,464	22,037	6,765	1,167	120,603
	(0.4293)	(1,816)	(16,315)	(8,884)	(8,167)	(2,568)	(1,186)	(20,570)
TOTAL CATCH	3.4623	9,785	83,713	45,834	32,676	10,564	1,768	184,339
	(0.5158)	(3,088)	(18,019)	(9,796)	(9,009)	(3,024)	(1,240)	(22,848)
ANGLER HOURS		5,844	15,831	14,964	11,018	4,342	1,244	53,243
		(1,783)	(2,629)	(2,159)	(1,886)	(836)	(589)	(4,400)
ANGLER TRIPS		1,707	6,521	6,283	3,946	1,904	467	20,827
		(468)	(1,332)	(1,271)	(INF)	(692)	(182)	(INF)

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

Species	C/H	January-February	March	Season
HARVEST				
Walleye	0	0	0	0
	(0)	(0)	(0)	(0)
Northern pike	0.0084	93	34	126
	(0.0064)	(68)	(58)	(90)
Yellow Perch	0.3302	2,439	2,521	4,960
	(0.1867)	(1,144)	(2,155)	(2,440)
Bluegill	0.0532	185	615	800
	(0.0483)	(131)	(679)	(691)
Pumpkinseed	0.0078	105	12	117
	(0.0069)	(96)	(25)	(99)
Rock bass	0.0017	13	12	25
	(0.0022)	(21)	(25)	(32)
Black crappie	0.4172	3,809	2,459	6,268
	(0.2400)	(1,485)	(2,783)	(3,155)
TOTAL HARVEST	0.8185	6,642	5,655	12,297
	(0.3531)	(1,883)	(3,586)	(4,050)
RELEASED				
Northern pike	0.0065	64	35	98
	(0.0051)	(61)	(37)	(71)
Largemouth bass	0.0016	11	13	24
	(0.0021)	(17)	(25)	(30)
Smallmouth bass	0.0042	56	6	62
	(0.0043)	(60)	(13)	(62)
Yellow Perch	0.7339	5,466	5,560	11,026
	(0.4265)	(2,297)	(5,133)	(5,624)
Bluegill	0.1124	899	789	1,688
	(0.0803)	(585)	(944)	(1,110)
Pumpkinseed	0.0026	39	0	39
	(0.0030)	(43)	(0)	(43)
Rock bass	0.0071	106	0	106
	(0.0060)	(84)	(0)	(84)
Black crappie	0.1321	1,502	483	1,985
	(0.0754)	(810)	(566)	(988)
TOTAL RELEASED	1.0004	8,144	6,886	15,029
	(0.4771)	(2,508)	(5,250)	(5,818)
TOTAL CATCH	1.8189	14,786	12,540	27,326
	(0.6923)	(3,136)	(6,358)	(7,089)
ANGLER HOURS		10,481	4,543	15,023
		(2,697)	(3,199)	(4,184)
ANGLER TRIPS		2,895	790	3,685
		(1,042)	(686)	(1,247)

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

Species	Number of Master Angler awards issued
Bullhead	38
Bowfin	16
Rock bass	8
Northern pike	5
Bluegill	5
Pumpkinseed	5
Black crappie	4
Smallmouth bass	2
Largemouth bass	1
Total:	84

Table 11. Number, weight, and length of fish collected from Lake Cadillac with trap nets and inland gillnets, on May 15-18, 2012.

Species	Number	Percent by number	Weight (Pounds)	Percent by weight	Length range (inches)1	Average length	Percent legal size2
black crappie	342	19.8	131.2	7.3	5-11	8.8	89 (7")
bluegill	128	7.4	29.8	1.7	4-8	6.7	77 (6")
bowfin	20	1.2	146.6	8.2	23-30	27.4	
brown bullhead	607	35.2	568.0	31.7	7-15	12.5	100 (7")
common carp	1	0.1	11.5	0.6	29-29	29.5	
green sunfish	1	0.1	0.1	0.0	5-5	5.5	0 (6")
largemouth bass	118	6.8	232.2	13.0	7-19	14.0	81 (14")
northern pike	106	6.1	237.2	13.3	11-27	21.1	19 (24")
pumpkinseed	90	5.2	31.5	1.8	4-9	7.3	97 (6")
rock bass	112	6.5	56.4	3.2	4-11	8.6	96 (6")
smallmouth bass	69	4.0	125.2	7.0	7-19	14.7	64 (14")
walleye	31	1.8	75.7	4.2	14-24	19.1	94 (15")
white sucker	52	3.0	134.5	7.5	11-23	18.5	
yellow bullhead	5	0.3	3.1	0.2	9-12	10.9	100 (7")
yellow perch	42	2.4	6.4	0.4	5-9	7.0	55 (7")
Total	1,724	100	1789.4	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 Cadillac by electrofishing on July 12, 2012 and seining on August 6, 2012.

Species	Number	Percent by number	Weight (Pounds)	Percent by weight	Length range (inches)1	Average length	Percent legal size2
black crappie	3	0.5	0.4	1.2	4-7	6.2	33 (7")
bluegill	173	30.2	5.1	15.0	1-5	3.2	0 (6")
bluntnose minnow	2	0.3	0.1	0.3	2-2	2.5	
common shiner	2	0.3	0.1	0.3	3-4	4.0	
largemouth bass	28	4.9	4.5	13.2	1-15	3.9	4 (14")
logperch	6	1.0	0.1	0.3	3-4	3.8	
northern pike	1	0.2	0.0	0.0	4-4	4.5	0 (24")
pumpkinseed	188	32.8	7.3	21.4	2-7	3.5	1 (6")
rock bass	10	1.7	2.3	6.7	2-9	6.0	60 (6")
sand shiner	3	0.5	0.0	0.0	1-2	2.2	
smallmouth bass	21	3.7	0.9	2.6	1-8	3.2	0 (14")
spottail shiner	5	0.9	0.0	0.0	1-4	2.7	
walleye	2	0.3	3.0	8.8	15-17	16.5	100 (15")
white sucker	4	0.7	6.7	19.6	8-20	14.7	
yellow perch	125	21.8	3.6	10.6	1-7	3.9	1 (7")
Total	573	100	34.1	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 Cadillac with trap nets and inland gill nets, May 15-18, 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	Mean Growth Index
Black crappie		5.6 (6)	6.3 (13)	7.8 (19)	8.6 (13)	9.3 (10)	9.8 (5)	10.4 (6)	11.0 (7)	11.3 (2)	11.8 (1)						-0.9
Bluegill			4.7 (3)	5.2 (4)	6.1 (17)	7.2 (6)	7.4 (18)	7.4 (3)	8.0 (1)								-0.4
Green sunfish		5.3 (1)															--
Largemouth bass		8.2 (3)	10.4 (4)	13.0 (6)	14.2 (14)	15.3 (8)	15.6 (12)	16.4 (8)	16.9 (3)	17.5 (3)	18.0 (2)	18.3 (6)	19.2 (1)	19.2 (1)			+0.3
Northern pike	12.8 (8)	15.4 (7)	19.4 (26)	22.6 (29)	23.8 (17)	26.5 (3)	25.7 (3)										-1.0
Pumpkin-seed			4.5 (2)	4.6 (2)	6.8 (15)	7.4 (4)	7.8 (13)	8.2 (7)		9.2 (1)							+0.7
Rock bass			4.9 (2)	6.4 (9)	7.4 (10)	7.8 (6)	8.7 (5)	8.8 (4)	9.6 (12)	9.7 (9)	10.5 (2)	11.3 (1)					+0.2
Smallmouth bass		8.3 (3)	9.9 (4)	11.9 (10)	13.6 (14)	16.0 (16)	16.6 (4)	17.3 (6)	18.1 (7)	18.8 (1)		19.2 (1)					-0.3
Walleye			14.5 (1)	16.2 (9)		19.4 (18)		22.6 (2)	24.5 (1)				21.5 (1)			24.3 (1)	+0.3
Yellow perch			6.7 (1)	6.0 (4)	6.2 (19)	7.7 (11)	7.0 (1)	9.2 (2)									-2.0

Table 14. Average total weighted length (inches) at age, and growth relative to the state average, for fish sampled from Lake Cadillac by electrofishing on July 12, 2012 and seining on August 6, 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							Mean Growth
Species	I	II	III	IV	V	VI	VII	VIII	IX	X	Index
Black crappie	4.2 (1)	6.9 (2)									--
Bluegill		4.7 (15)	5.3 (1)								+0.5
Largemouth bass	4.6 (3)		12.0 (1)		13.7 (1)	15.0 (1)					--
Pumpkinseed		4.5 (12)	6.0 (2)	7.3 (1)			8.0 (1)				+0.3
Rock bass		5.0 (1)	6.4 (1)	7.0 (3)	8.0 (1)						--
Smallmouth bass	5.2 (1)	8.1 (2)									--
Walleye				16.7 (2)							--
Yellow perch	4.1 (9)	5.4 (8)	6.6 (6)	6.4 (3)	6.7 (1)						-0.1