Beaver Lake
Alpena Co., T29/30N, R5E
Thunder Bay River Watershed, last surveyed 2010

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Environment

Beaver Lake is a 665-acre natural lake located in southwest Alpena County in Michigan's northern Lower Peninsula. Rayburn Creek is the main inlet to the lake on the north shore, while Beaver Creek is the outlet along the south shore. A small control structure built in 1888 exists on the outlet and maintains a legally established lake level (Cwalinski et al. 2006). This latter small creek flows to McGinn Creek which eventually flows to Wolf Creek and the Lower South Branch of the Thunder Bay River. The shoreline of Beaver Lake is partially developed on the east side and is heavily wooded on the west shore. Lake bottom type consists primarily of sand with some isolated marl and gravel habitat. Emergent and submersed vegetation is present, but sparse overall. Water clarity is rated as good and maximum depth is 77 feet, with a large amount of the lake deeper than 20 feet (57%) (Matt Tonello, DNR GIS specialist, personal communication). Nearly all the land around Beaver Lake is privately owned. A county park and boat access site is located on the east shore and provides fishing access. Exotic species such as rusty crayfish and zebra mussels are known to exist in this lake. Twenty-six Michigan Master Angler awards have been awarded to anglers fishing Beaver Lake for smallmouth bass (16), bullheads (6), channel catfish (2), bluegill (1), and walleye (1).

History

Early fish managers accepted the native fish community for what it was, and stocking was not considered necessary. Stocking records for Beaver Lake do not begin until the early 1970s when managers experimented with rainbow trout yearlings and 15,000 were stocked annually from 1973-1977. Biologists understood a thermocline with ample dissolved oxygen set up in a portion of the colder waters maintaining water temperatures suitable for trout to survive. They also knew that rainbow smelt (an exotic) and lake herring (cisco) both survived in this lake. Both of these species had similar oxygen and temperature requirements to trout. Later in the 1970s, MDOC (Michigan Department of Conservation) began stocking tiger muskellunge and northern pike (Table 1). Trout stocking efforts were not considered successful and were discontinued.

Fish management practices at Beaver Lake date back to the first half of the twentieth century and fish surveys were first conducted in 1925 by MDOC. Trammel and gill-nets were used to get an initial snapshot of the fish community. Species found included cisco, yellow perch, rock bass, smallmouth bass, largemouth bass, white sucker, sunfish species, central mudminnow, and various species of shiners and darters. Records are not available to equate catch rates and effort.

Twenty five years later in 1950, another survey was conducted by MDOC. This was a more detailed fish survey utilizing experimental gill-nets and shoreline seining. This second survey also incorporated aquatic vegetation surveys where 16 species of native plants were documented. Various pondweed species, chara, water lillies, and wild celery were considered common or abundant. A third part of the 1950 survey included an examination of the water quality conducted on a single day in August the lake

had a strong thermocline and reduced dissolved oxygen at depths below 40 feet. The pH of the lake was normal, ranging from 8.5 (slightly basic) at the surface, to 6.6 (slightly acidic) near the bottom. Macroinvertebrates such as mayflies, native crayfish, and freshwater shrimp were all noted as present. The fish community survey found varying amounts of different species including: rock bass (6-9"), yellow perch (6-7"), largemouth bass (5-11"), bluegill (3-7"), pumpkinseed sunfish (6-7"), and northern pike (17-21"). Other species included smallmouth bass, spottail shiners, bluntnose minnows, darter species, and common shiners.

Fish community surveys became more frequent in the next half-century. In 1962, MDOC surveyed the near-shore environment of the lake with seining gear. Three seining hauls produced a range of 457-814 fish/haul. Yellow perch less than 7 inches were most prevalent in the catch. Also caught were small pumpkinseed sunfish and largemouth bass. An array of smallmouth bass, rock bass, and bluegill sizes were found. MDOC then surveyed Beaver Lake in July 1968 with experimental gill nets. An examination of the lakes limnology again showed a strongly established thermocline with limited dissolved oxygen in the deepest reaches. However, suitable dissolved oxygen (6 ppm or greater) was found just below the thermocline break in cold water. Because of this, it was no surprise that 47 lake herring (6-9") were caught in the nets set in deep water. Many 6-8 inch yellow perch were collected, as well as two northern pike. Growth of yellow perch and herring was considered slow.

In July 1972, MDOC examined the fish community with the use of 12 trap net lifts, and 900 feet of experimental gill net lifts. A limnological profile found dissolved oxygen levels suitable to fish (6 ppm or greater) nearly down to the bottom in 66 feet of water. Simultaneously, water temperature ranged from 72F at the surface, to 41F at the bottom. Eleven species of fish were collected. Northern pike were again captured in relatively low numbers. Smallmouth bass and largemouth bass were found, with smallmouth bass being the dominant predator species. Again lake herring were common in the lake with a total of 52 collected. No walleye were collected, or had ever been collected at this point in Beaver Lake fish surveys. Panfish were relatively common including rock bass, small bluegill, and moderate sized yellow perch (6-10"). Bullheads, white suckers, and shiners were also collected. Growth of pike and largemouth bass was considered fast, while most other species growth was average when compared to growth for each species across Michigan.

Rainbow trout stocking efforts began the year following the 1972 survey. Managers believed this species could occupy the coldwater niche in Beaver Lake as herring had, and were hopeful that they would produce a quality fishery. Approximately 15,000 rainbow trout yearlings were planted each year from 1973-1977. The November 1976 survey at Beaver Lake was done in order to evaluate recent trout stocking efforts. MDOC personnel used 24 experimental gill net lifts, yet only one rainbow trout was collected. The catch was dominated by northern pike, a species likely to prey on soft rayed fish like trout and herring. Most of the pike ranged from 21-26 inches and the largest fish observed was 40 inches. In addition, anglers at the time reported catching very few trout the previous summer. Fishing was considered fair for bass and occasionally good for northern pike. There was a concern among anglers that desirable species such as yellow perch and bluegill were dominated by small fish. As a result of the 1976 survey, rainbow trout stocking efforts at Beaver Lake were discontinued. However, managers were not ready to give up on producing a more quality fishery for this waterbody.

In the late 1970s fish managers to view Beaver Lake as a coldwater fish community, but suspected based on previous efforts that trout survival would be low even in lieu of relatively low to moderate

pike densities. They also believed that anglers might be more satisfied with the fishery if slow growing panfish were thinned out and growth rates of remaining fish were jump started. At the time, the MDOC had a small statewide tiger muskellunge stocking program, and Beaver Lake was added to the list of recipients. Fall fingerling tiger muskellunge were stocked at a typical rate of 2 fall fingerlings/acre beginning in 1978 and continued through the next decade (Table 1).

In addition to the tiger muskellunge program, MDOC personnel worked with members of the Beaver Lake Association to construct a northern pike rearing marsh on the north end of the lake. This 3-acre marsh would possibly replace lost northern pike spawning and nursery grounds as a result of a century of shoreline development. However, there was no means for northern pike adults to enter the marsh. MDOC Fisheries Division began to stock pike fry each year directly into the marsh and lake residents manipulated the water level of the marsh each spring to maximize reproductive potential.

Fishery management had gained considerable momentum at Beaver Lake as a result of the activities in the late 1970s which included stocking, and marsh development and operation. The lake association continued this momentum by installing 138 brush shelters in the lake in 1978. A lake association member conducted a creel survey from late May through late September. Records of this angler census are incomplete, but it was said to have been designed by MDOC and instituted in the spring and summer of 1977. Angler trips were low the survey period and fishing pressure was highest in July. The catch was dominated by yellow perch (2,704), rock bass (1,075), bluegill (740), smallmouth bass (162), northern pike (110), rainbow trout (22), and largemouth bass (18). Notes from the survey indicated it was considered a minimum estimate of catch and fishing pressure for the lake. The survey did provide insight into the importance of some species to the fishery, and the low returns of some species such as rainbow trout. A summary of fishing pressure and catch by month can be found in Ryckman and Lockwood (1985).

Angler reports for Beaver Lake in the early 1980s indicate many tiger muskellunge reported in the catch by 1981 that averaged 25 inches in length. Growth and survival of tiger muskellunge was considered good based on angler reports. Anglers were also locating and catching fish off the recently installed brush shelters. Bass fishing was considered good and winter pike spearing remained a popular activity. Despite these positive reports, anglers were still unsatisfied with catching only small panfish, and some anglers suggested that bluegill were absent from Beaver Lake. By 1982, tiger muskellunge were still being caught by anglers, but the numbers caught had begun to taper despite continued stocking efforts. Northern pike catch rates were generally low and most were sublegal fish. Yellow perch were still growing slow according to anglers but the occasional large jumbo fish could be caught. Anglers continued to believe that the fishery was in decline. In order to combat this, the MDNR (Michigan Department of Natural Resources) began a walleye spring fingerling stocking program in 1986. This was done to improve the fishery for large game fish and to make another attempt to increase predation on abundant but slow growing panfish, particularly yellow perch. Thus, for a period, an active stocking program for three predators (tiger muskellunge, northern pike, and walleye) was ongoing at Beaver Lake. This was and still is considered a rarity for a small inland lake.

A fish community survey was conducted in late-May and early-June of 1987 at Beaver Lake by MDNR. Effort consisted of 62 total lifts of trap-nets and fyke-nets (varying mesh sizes), as well as 9 experimental gill-net lifts. The purpose of the survey was simple: evaluate current predator stocking efforts. The survey did not produce any tiger muskellunge, although anglers reported catching them

occasionally. A couple of walleye were collected, which was expected since stocking efforts had just begun. Based on catches, northern pike were considered common, but not abundant, with fish ranging from 9-34 inches. Quality catches of both largemouth and smallmouth bass were made with good numbers of large adults present. Two rainbow smelt were collected in the survey along with good numbers of bluegill, pumpkinseed sunfish, and rock bass. Lesser numbers of yellow perch were collected. Managers at the time noted that the size distribution of all fish collected was "acceptable" based on previous experience with other fish populations and angler expectation. Simultaneously, anglers reported catching decent numbers of panfish off brush shelters which were recently established by the Beaver Lake Association.

Walleye and northern pike stocking efforts continued into the 1990s at Beaver Lake and the tiger muskellunge program was discontinued statewide. The muskellunge program was considered successful at Beaver Lake in the early stages of stocking, but failed to produce a consistent fishery. During this period, angler reports indicated a walleye fishery had developed at Beaver Lake. From 1992 through 2006 walleye have been stocked in alternate years (Table 2). A fall juvenile walleye recruitment evaluation was made at Beaver Lake on one evening in early September 1998 and twenty-nine walleye ranging from 5-16 inches were collected. Sampling effort consisted of 2.5 hours of nighttime boomshocking near-shore. Most (27) of the fish were age-0 (young-of-year) walleye, while the remaining fish were age-2 adults. The 1998 year class was considered fair to strong based on the age-0 catch of 11/hour. No walleye older than age-2 were collected, possibly indicating poor survival of older stocked year classes. No natural reproduction was evident since a sample of age-0 fish were found to have all been marked with OTC (oxytetracycline) in the hatchery. After this index, biologists felt the walleye fishery was still in its youthful stages and recommended continued walleye stocking efforts.

In 1999, after an initial stocking of OTC marked walleye, a general fish community survey was conducted on Beaver Lake by MDNR with effort consisting of 17 trap-net lifts, 2 fyke-net lifts, and 4 experimental gill-net lifts. This was considerably less sampling effort than the 1987 fish survey. No tiger muskellunge were collected, and only five northern pike were caught. Muskellunge had not been stocked for years, however, the northern pike fry stocking and marsh operation was still ongoing. Largemouth bass were caught in relatively low numbers, and smallmouth bass were the dominant predator. Walleye catches had increased and multiple year classes were now present. Walleye were collected up to 25 inches long. Common species of panfish included rock bass, yellow perch, bluegill, and pumpkinseed. It was noted that panfish sizes tended to be small, although a few larger individuals of each species were collected. Non-game species including white suckers and bullheads were also collected. Despite the coldwater niche in Beaver Lake, no coldwater species such as rainbow smelt or lake herring were collected in the survey. However, these coldwater species were still likely present in low numbers.

Walleye stocking continued periodically at Beaver Lake (Table 1) and fishing for this species was considered excellent in 2003. In 2004, stocked spring fingerling walleye were also marked internally with the chemical oxytetracycline (OTC). In mid-October of 2004, another juvenile walleye evaluation was completed by MDNR. Two hours of shoreline were surveyed with nighttime direct current boomshocking gear, covering a distance of 3.8 miles. A total of 57 walleye (Table 3) were collected in this snapshot survey. Walleye were captured at a rate of 27 fish per hour and ranged in size from 6-25 inches. Most were age-0 indicating that the 2004 year-class was strong. A subsample of 30 age-0

walleye were collected to determine if the OTC mark was present, all fish in the sample contained the mark were therefore stocked. Walleye natural reproduction was considered absent or negligible within Beaver Lake and the fishery reliant on stocking efforts. Growth for all the fish captured in the survey was considered exceptional. Rainbow smelt were very abundant near-shore during the electrofishing survey and may help explain the fast growth rates observed for walleye. Rainbow smelt are known predators on juvenile fish which may be one of several factors contributing to the apparent lack of natural recruitment from walleye in Beaver Lake.

Current Status

In 2010, a fish community survey was conducted at Beaver Lake by MDNRE (Michigan Department of Natural Resources and Environment) Fisheries Division. The sampling efforts followed MDNRE Status and Trends lake survey protocol where effort is determined based on lake size (Wehrly et al. 2009 in Draft). In this case, effort consisted of 6 experimental gill-net lifts, 3 trap-net lifts, 6 large mesh fyke-net lifts, 1 maxi-mini fyke-net lift (for nearshore forage), and 30 minutes of direct current shoreline electrofishing at night. Lead lengths for the larger mesh trap and fyke-nets were 75-100 feet. Most of the survey was conducted from June 21-23, and the electrofishing survey was conducted on July 1. Water temperatures during the survey ranged from 71-73 Fahrenheit. A limnological lake profile (Table 4) was collected by the United States Geological Survey (USGS) on August 9 of the same year which demonstrated that Beaver Lake still has thermal stratification and a coldwater niche. Dissolved oxygen levels suitable for game fish survival and growth (6ppm or more) were found to about 36 feet. Temperatures ranged from 74F at the surface to below 50F at the bottom. A supersaturation of dissolved oxygen was found between 24 and 32 feet. The pH was normal and slightly basic (Table 4).

More than 4,600 fish were caught during the 2010 survey (Table 5) and representing 16 species. Sand shiners dominated the catch. This was a species that had not been found to be abundant in past surveys. However, this is probably explained by the differences in gear types used among surveys. Shiners were noted as very abundant during this particular survey. Large predators consisted of smallmouth bass, walleye, largemouth bass, and northern pike. Smallmouth bass and walleye were considered common, while the latter two species were less abundant. Smallmouth bass length distributions were similar to those observed in previous surveys (Table 6). Legal size smallmouth bass (14 inches and larger) were sampled in good numbers. Juvenile and young largemouth bass appear limited in Beaver Lake currently, yet some large individuals are present.

Northern pike remain scarce in Beaver Lake and only two specimens were collected in 2010. Whereas, walleye post stocking survival has remained good in Beaver Lake. Unlike northern pike, walleye catches have increased in each of the last three fish community surveys (Table 6). Age-1 walleye were collected in this survey which ranged from 7-8 inches. The presence of age-1 fish indicates some level of natural reproduction as they have not been stocked since 2006 because of concerns over disease transmission (MDNR Walleye Committee White Paper 2009). Good percentages of legal size walleye (15 inches and larger) were collected with the bulk of the fish between 17 and 20 inches and many of these walleye were from year-classes that were stocked. The largest walleye collected was 25 inches. Catch rates in the survey were slightly higher than in the 1999 survey (Table 6). Currently walleye growth is very good (Table 7) and it only takes about 3-4 years for this species to attain legal size in Beaver Lake.

Panfish comprised 77% of the total catch and were 30% of the total fish weight in the survey (excluding sand shiners). Not many panfish were caught in the survey overall (Table 5). The surface temperature of Beaver Lake during the sampling period was in the low 70s Fahrenheit, and catch rates should have been good, especially given that multiple gear types were deployed.
Rock bass ranged in length from 1-11 inches and were the most common panfish found in Beaver Lake. Rock bass appear to be quite prolific in Beaver Lake as many age-classes were represented in the catch (Table 7). Yellow perch are the preferred panfish by anglers at Beaver Lake and are the second most abundant (though were still caught in low numbers in this survey). Perch catch rate has not changed substantially among the various surveys over time and most perch in Beaver Lake are small (less than 8 inches; Tables 6 & 7). Densities of other sunfish such as bluegill and pumpkinseed remain low in Beaver Lake. Catches of both fish were very low in 2010 even when compared to past surveys and this was especially true for bluegill (Table 6).

No coldwater species, such as lake herring or rainbow smelt, were captured during the 2010 survey. The near-shore deployment of gears used in this survey made it less likely we would catch such species as these waters tend to be warmer. Some gill-nets were placed in the deeper parts of Beaver Lake (25-50 feet) and these also failed to catch any fish.

Other species captured during the survey included minnows, darters, bullheads, white suckers, other shiner species, and green sunfish. White suckers are very common in most large, clear, sand bottom lakes, such as nearby Hubbard Lake. However, only two were caught in the recent Beaver Lake survey. This is an important prey item for fish such as muskellunge and northern pike, and their scarcity in this lake may help explain the low densities of large predatory fish. Surprisingly, bullheads are also scarce in Beaver Lake. Both suckers and bullheads may compete with other fish for food resources. Having them in low numbers is less of a burden on the forage supply in Beaver Lake.

Analysis and Discussion

The current fish community of Beaver Lake can be generally characterized as having the following: 1) a panfish community considered normal in diversity for northern Michigan, but currently relatively low in abundance and dominated by rock bass and yellow perch, 2) a predator population demonstrating moderate diversity, but low densities for species other than smallmouth bass and walleye, 3) a small population of northern pike limited by spawning habitat and possibly forage, 4) a couple coldwater species (rainbow smelt and lake herring) which likely still utilize the small niche available in Beaver Lake, 5) smaller white sucker and bullhead populations than is typical for lakes in northern Michigan, and 6) fairly abundant minnow and shiner populations.

The Beaver Lake panfish community is high in diversity but fairly low in quality. Species available to anglers include rock bass, yellow perch, bluegill, and pumpkinseed sunfish. Rock bass tend to thrive in the lake and have done so for years, while perch numbers may be slightly depressed currently. Growth of perch is average when compared to the statewide average for this species, and large sizes are regularly attained. Bluegill and pumpkinseed sunfish densities seem to have declined in the recent 2010 survey. Comparisons of survey data indicate that bluegill and pumpkinseed populations have fluctuated over time in Beaver Lake. Low densities observed in 2010 could be the result of competition with other species (smelt, rock bass, perch) and/or predation.

The predator base of Beaver Lake is dominated by smallmouth bass and stocked walleye. Northern pike also inhabit its waters, albeit in relatively low numbers. Smallmouth bass represent an important keystone predator which helps keep many other species in balance. Additionally, smallmouth bass are important predators of rusty crayfish, another invading species which typically alters aquatic communities and water clarity. Smallmouth bass provide for quality open water fishing experiences in Beaver Lake. Recruitment, abundance and growth of this species appears good. Largemouth bass were found in low numbers in the recent survey, as had been the case in past surveys.

The Beaver Lake walleye population has grown steadily over the last two decades. This population was formed through in-lake stocking efforts dating back to the mid 1980s. Past fall walleye evaluations have documented good survival of stocked fish, and limited or negligible natural recruitment. The walleye fishery had been reliant on stocking by the State of Michigan. However, the 2010 survey has indicated that walleye successfully pulled off year-classes in years that were not stocked in Beaver Lake.

Northern pike densities in Beaver Lake have historically been low, even when supplementally stocked. Pike are efficient predators on panfish such as perch and bluegill. Reductions in their numbers may benefit the recovery of panfish populations allowing them to attain older ages, and therefore more desirable size ranges for anglers. Muskellunge have been considered as an additional predator in Beaver Lake and some lake association members have made inquiries into stocking them. However, muskellunge are highly reliant on soft rayed forage fish, such as white suckers, which are absent in Beaver Lake. Leading to doubts as to the potential for success in introducing the species which is in high demand for introduction to other more suitable environments.

Rainbow smelt are a non-native component of the Beaver Lake fish community. Smelt were abundant in the 2004 survey and none were observed in 2010 survey. We assume they still inhabit the lake, and that perhaps as been observed in many other systems, recruitment is highly variable leading to strong fluctuations in abundance. Rainbow smelt provide good forage for predators, but are also known competitors and even predators of larvae and young of some species.

Historical and current catches of non-game species such as bullheads and suckers are low in Beaver Lake. These species are competitors for the limited forage base, and low densities are desired. The shiner and minnow populations appear good at Beaver Lake.

Management Direction

1) The Beaver Lake aquatic community is complex and should be monitored on a moderately consistent basis. Many of the game fish play a vital role not only in the fishery, but also for overall ecosystem balance. A complete fish community survey documenting changes should be accomplished no later than 2025. Periodic evaluations (fall boomshocking) of the walleye population should be made more frequently (once every ten years minimum) providing managers with updated essential information on walleye year-class strength and growth for potential adjustments in stocking practices.

2) Walleye stocking did not occur from 2007 through 2010. In the past, evaluations have demonstrated a strong reliance of the walleye fishery on stocked fish. The survey conducted in 2010 showed that some substantial natural recruitment had been occurring. Further justifying the need for more frequent evaluation, it is our current belief that stocking will still be necessary to maintain the fishery at this

lake but this could be revised if consistently strong levels of recruitment are observed. Out current plan is to resume walleye stocking on a biennial basis at a rate of 53/acre. This is 35,000 spring fingerling walleye (1-2") every other year. Fish will be marked with OTC to distinguish stocked from naturalized recruits. Increases in natural reproduction can be balanced by future reductions in stocking, if needed.

3) Northern pike are native to Beaver Lake, but are not common. Operation of the rearing marsh had not substantially improved populations of pike. The current management prescription for pike calls for discontinuation of pike fingerling stocking at the marsh. The MDNR has not raised pike fingerlings for a number of years, and this would be a good time to see how other species (and anglers) respond to fewer pike in Beaver Lake. Limited numbers of pike will be naturally produced in the system but densities should remain low. Muskellunge need good soft rayed forage to grow and thrive. Such forage (e.g. white suckers) is not common in Beaver Lake thus muskellunge stocking will not be considered for Beaver Lake.

4) Smallmouth bass are the top native predator in Beaver Lake, they provide an excellent fishing opportunity, and are vital in maintaining ecosystem balance. Plenty of legal size fish are available to anglers, including trophy sized fish. Largemouth bass while low in abundance also provide trophy sized fish on occasion.

5) Anglers are urged to report catches of all species to the local DNR biologist. Sampling gear is not always efficient at capturing all species, sometimes leaving gaps of information for some species (e.g. rainbow smelt). Such reports are useful for management of the fishery not only currently, but for future managers as well. Currently the standard State of Michigan fishing regulations are appropriate for Beaver Lake.

References

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Table 1.-Northern pike and tiger muskellunge stocking history for Beaver Lake, Alpena County.

Year	Species	Number	Number/Acre	Avg. Length (in)
1978	Tiger muskellunge	1,500	2	--
1979	Tiger muskellunge	1,500	2	5.5
1982	Tiger muskellunge	2,000	3	5.8
1984	Tiger muskellunge	2,000	3	6.9
1986	Tiger muskellunge	2,000	3	7.6
1988	Tiger muskellunge	1,600	2	9.5
1990	Tiger muskellunge	2,000	3	9.7
1979	Northern pike	5,000	8	3.7
1980	Northern pike	5,000	8	3.7
1981	Northern pike	10,000	15	3.7
1982	Northern pike	100	1	3.5
1983	Northern pike	8,000	12	2.6
1984	Northern pike	12,000	18	2.3
1985	Northern pike	9,000	14	2.0
1986	Northern pike	11,000	17	2.5
1987	Northern pike	5,000	8	2.0
1988	Northern pike	15,000	23	3.0
1989	Northern pike	7,500	11	2.5
1990	Northern pike	10,000	15	2.5
1991	Northern pike	10,500	16	2.5
1992	Northern pike	2,500	4	3.0
1993	Northern pike	6,000	9	3.0
1994	Northern pike	8,000	12	3.0
1995	Northern pike	10,000	15	3.0
1996	Northern pike	5,000	8	3.0
1997	Northern pike	600	1	3.5
1998	Northern pike	1,500	2	2.0
2000	Northern pike	2,000	3	1.8
2001	Northern pike	500	1	3.9
2002	Northern pike	2,500	4	2.5
2003	Northern pike	2,000	3	3.0

Table 2.-Walleye stocking history for Beaver Lake, Alpena County. OTC is oxytetracycline stained bones.

Year	Month	Strain	Number	Number/Acre	Avg. Length (in)	OTC mark?
1986	June	--	35,000	53	1.4	No
1992	June	Bay De Noc	35,000	53	2.0	No
1994	June	Muskegon	35,000	53	1.4	No
1996	June	Muskegon	34,800	52	1.8	No
1998	May	Tittabawassee	40,000	60	1.7	Yes
2000	May	Tittabawassee	35,000	53	1.2	Yes
2002	June	Tittabawassee	35,000	53	1.6	Yes
2004	June	Tittabawassee	36,300	55	1.8	Yes
2006	June	Musk/Titt	30,888	47	1.9	Yes

Table 3. -Age and growth analysis of walleye collected during the fall nighttime evaluation at Beaver Lake, 2004.

Age Group	Number of Fish	Length Range (in)	Mean Length (in)
O	53	6.4 – 9.6	7.8
I			
II	2	16.3 – 17.0	16.7
III	1	21.7	21.7
IV	1	25.8	25.8
V			

Table 4.-Water temperature and dissolved oxygen profile for Beaver Lake, August 9, 2010. Data collected by the USGS.

Depth (ft)	Temperature (F)	Dissolved Oxygen (ppm)	pH
3.0	74.3	7.1	8.5
10.0	73.8	7.1	8.4
17.0	73.0	6.9	8.3
24.0	61.3	11.7	8.4
28.0	55.0	12.0	8.5
32.0	51.6	10.0	8.3
36.0	50.2	6.3	8.0
40.0	49.6	5.6	7.8
47.0	48.9	3.4	7.6
54.0	48.2	1.8	7.6
61.0	47.8	0.8	7.5
68.0	47.7	0.7	7.5
73.0	47.7	0.7	7.5

Table 5.-Species and relative abundance of fishes collected with survey gear at Beaver Lake, June 7 – July 1, 2010. Growth for certain species is compared to the statewide average.

Common Name	**Number**	**Length Range** *(inches)*	**Weight (lbs)**	**Growth***
Sand shiner	4,165	1.0 – 2.9	15.22	--
Rock bass	208	1.7 – 11.1	48.22	Average
Yellow perch	133	1.5 – 9.3	6.56	Average
Smallmouth bass	31	3.2 – 19.6	37.79	Below average
Walleye	26	7.2 – 25.5	48.03	Above average
Bluntnose minnow	21	2.0 – 3.0	0.13	--
Bluegill	8	1.8 – 6.8	0.68	--
Black bullhead	6	12.4 – 15.5	7.92	--
Iowa darter	4	1.8 – 2.9	0.01	--
Largemouth bass	4	18.0 – 19.3	14.82	--
Pumpkinseed sunfish	4	2.6 – 3.0	0.08	--
Brown bullhead	3	13.0 – 14.2	3.64	--
Mimic shiner	3	2.0 – 2.9	0.01	--
White sucker	2	19.4 – 19.5	5.82	--
Northern pike	2	20.0 – 26.8	6.00	--
Green sunfish	1	3.7	0.03	--
TOTAL	**4,621**		**195**	

Table 6.-Length-frequency distribution of certain game fishes collected during the 1987, 1999, and 2010 netting survey at Beaver Lake. Sampling effort has been variable between years.

Length (in)	N. pike 87	N. pike 99	N. pike 10	Walleye 87	Walleye 99	Walleye 10
1						
2						
3						
4						
5						
6						
7						1
8				2		3
9	1					
10	1				1	
11		2				
12	1					
13	3					
14	2					3
15						
16	1				1	2
17	1				1	6
18	1				2	3
19					1	2
20		1	1			4
21					1	1
22					2	
23					2	
24	2	1			2	
25	2				1	1
26			1			
27	1					
28		1				
29						
30						
31						
32						
33						
34	1					
35						
36						
37						
38						
39						
40						
41						
42						
43						

Table 6.-Continued

Length (in)	Y. Perch 87	Y. Perch 99	Y. Perch 10	S. Bass 87	S. Bass 99	S. Bass 10
1						
2			3			
3	5		66	3		3
4	2	2	25	4		4
5	2	4	12		1	
6	170	15	18	5		
7	38	22	5	5	5	4
8	8	18	1	7	2	1
9	1	6	2	15	5	
10		1		9	7	3
11		1		2	3	3
12				10	3	1
13				6	5	
14				4	6	2
15				1	5	2
16				11	7	1
17				7	4	3
18				6	5	3
19				1	1	1
20				3	7	
21				1	3	
22					1	
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						

Table 6.-Continued

Length (in)	L. bass 87	L. bass 99	L. bass 10	Bluegill 87	Bluegill 99	Bluegill 10
1						1
2						2
3	2			10	1	
4	6	4		31	6	1
5		3		38	73	2
6				58	38	2
7	1			58	19	
8	5			21	1	
9	5			4		
10	1					
11	1					
12	4					
13	11					
14	11					
15	6					
16	5					
17	11					
18	3		2			
19	4		2			
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						

Table 7.-Comparison of mean length (inches) at age for various game fishes of Beaver Lake from 1962 to 2010. Number in parentheses represents number aged.

Species	Age group	1962 June	1972 July	1987 May	2010 May
Yellow perch	I	3.5 (1)	3.7 (1)	4.1 (4)	3.5 (17)
	II		5.3 (2)	5.8 (5)	5.6 (17)
	III	5.9 (40)	6.2 (11)	6.6 (14)	6.5 (6)
	IV	7.1 (4)	7.1 (12)	7.8 (15)	7.1 (6)
	V		10.1 (1)	8.9 (2)	7.1 (1)
	VI				
	VII	10.4 (1)	9.9 (6)		
	VIII				
	IX				
	X				
Walleye	I				8.1 (4)
	II				
	III				14.7 (3)
	IV				17.8 (4)
	V				18.7 (12)
	VI				19.4 (2)
	VII				
	VIII				25.5 (1)
	IX				
	X				
	XI				
	XII				
Cisco	I		7.9 (25)	7.8 (22)	
	II		8.9 (11)		

Table 7.-continued

Species	Age group	1962 June	1972 July	1987 May	2010 May
Rock bass	I		2.6 (3)		2.1 (3)
	II		5.6 (2)	3.7 (6)	3.2 (17)
	III		6.4 (5)	4.5 (8)	4.8 (19)
	IV		6.8 (3)	5.9 (19)	6.6 (20)
	V		8.7 (13)	7.1 (6)	7.9 (6)
	VI		9.1 (8)	7.7 (6)	
	VII		9.8 (2)	8.6 (9)	9.9 (13)
	VIII			9.3 (7)	9.9 (9)
	IX			9.8 (7)	11.1 (1)
	X			10.4 (6)	
	XI				
S. bass	I	4.0 (19)	6.1 (29)	3.9 (8)	4.1 (7)
	II	6.7 (18)		7.5 (15)	7.8 (6)
	III	10.4 (26)	12.9 (1)	9.8 (25)	11.1 (9)
	IV	14.1 (4)	14.5 (1)	13.4 (14)	14.6 (3)
	V	15.6 (1)		14.2 (8)	15.8 (1)
	VI	16.7 (2)	17.8 (3)	15.7 (16)	17.2 (2)
	VII			16.7 (9)	17.9 (3)
	VIII			17.9 (8)	18.1 (2)
	IX			19.3 (2)	
	X			21.1 (2)	
	XI				19.7 (2)
N. pike	I		18.5 (10)	13.5 (5)	
	II		24.1 (4)	17.4 (3)	20.0 (1)
	III			24.3 (2)	
	IV		33.1 (1)	25.2 (2)	
	V		30.2 (1)	27.5 (1)	
	VI				
	VII				26.8 (1)
	VIII			34.5 (1)	
	IX				
	X				

Table 7.-continued

Species	Age group	1962 June	1972 July	1987 May	2010 May
L. Bass	I	4.5 (14)		4.2 (10)	
	II	7.8 (2)	9.6 (2)	8.0 (7)	
	III		12.4 (1)	9.5 (6)	
	IV		15.4 (1)	12.3 (5)	
	V		16.2 (4)	13.7 (8)	
	VI		18.0 (1)	14.9 (23)	
	VII		20.5 (1)	16.7 (2)	
	VIII			17.7 (9)	
	IX	17.5 (2)		18.9 (3)	
	X				18.4 (3)
	XI	18.6 (1)			19.3 (1)
	XII	19.2 (1)			
Bluegill	I		2.5 (1)		2.3 (2)
	II		3.5 (16)	3.5 (11)	4.3 (1)
	III		5.4 (17)	4.8 (18)	4.7 (1)
	IV		6.8 (8)	6.3 (5)	5.6 (1)
	V		7.4 (10)	7.0 (9)	6.5 (1)
	VI		8.5 (5)	7.9 (13)	6.8 (1)
	VII		9.5 (2)	8.9 (10)	
	VIII		9.7 (3)		
P. sunfish	I				2.6 (2)
	II		4.3 (2)	4.0 (10)	3.0 (2)
	III		5.5 (6)	4.8 (5)	
	IV		6.6 (6)	5.9 (13)	
	V			6.6 (7)	
	VI			7.7 (6)	
	VII			8.6 (9)	
	VIII			9.3 (7)	
	IX			9.8 (7)	
	X			10.4 (6)	