Monocle Lake
Chippewa County, T47N, R03W, Section 14
Lake Superior watershed

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Environment

Monocle Lake is located in northwest Chippewa County, within one mile of Lake Superior and about eight miles northwest of Brimley. A boat launch exists in the United States Forest Service (USFS) campground, located along the southeast corner of the lake.

The most striking geological feature of the immediate area is the relatively high Lake Superior escarpment, consisting of sand/gravel substrate, and vegetated with mixed hardwoods and some conifers. The lowland between the escarpment and Lake Superior varies in width from 1/4 to five miles. Monocle Lake and another lake in close proximity, Spectacle Lake, lie within this lowland. Both are land locked, but a permanent stream flows from Spectacle Lake into Monocle Lake. The surrounding lowlands consist of shallow sandy loam hills covered with both hardwood and conifer trees.

Monocle Lake is 146 acres, with a maximum depth of 55 feet. The narrow littoral zones comprise only about 15 percent of the surface area, and contours are quite sharp into deep water. Substrates are generally sand and gravel, and aquatic macrophytes are sparse. Pondweeds (Potamogetons) are the most common plants, while others such as wild celery (Vallisneria) and arrowhead (Sagittaria) are present only in very limited areas. Water level has been several feet lower than the long term normal for at least a decade, similar to many other isolated lakes along the Lake Superior shoreline.

Water quality is good with low nutrient levels and no noticeable eutrophication, although primary production is low. Because of the surrounding terrain, Monocle Lake is influenced by only a very small watershed, with limited nutrient inflow. The water is low in nutrients and soft, with alkalinity remaining consistently about 20 mg/l. Oxygen concentrations are acceptable into the thermocline, down to approximately 25-30 ft. The pH was 7.9 in 1998.

Development is limited at Monocle Lake. Some private cottages have existed along the north shoreline for many years, but over 80 percent of the shoreline is owned by the U.S. Forest Service (USFS). That agency maintains a campground, day use area and boat launch along the southeast shoreline.

History

Several species of fish were stocked by the Michigan Department of Natural Resources (DNR) between 1937 and 1941. Species stocked include walleye, smallmouth bass, yellow perch, bluegill and pumpkinseed sunfish. The bluegills did not survive for long. It is rumored that commercial fisherman occasionally planted lake sturgeon, but documentation of their stocking is non-existent. Since 1978, the DNR has stocked 30,800 walleye fingerlings, 660,000 walleye fry, 8,100 smallmouth fingerlings and

710 yellow perch (about 4 inch size). The yellow perch and rock bass fisheries have over the years enjoyed a good angling reputation, especially by campers.

Habitat manipulation efforts started in 1958, when the DNR placed 250 brush shelters. Several more were constructed and placed in 1986 by the USFS. Another brush shelter project was conducted cooperatively by the USFS, LSSU, and the Sault Sportsmens Club from 2000-2003 when 114 log cribs were installed of the western and southern shorelines, in 15-20 ft depths. During 1978, the USFS began building a rock walleye spawning reef along the central east to southeast shoreline. However, due to budget constraints the reef wasn't properly built and did not reach the surface as it was designed to do. Spawning success for walleye was marginal until 1989 when the reef was finally completed. The improved reef was successful and subsequent survey data indicated walleye were successfully spawning. Smallmouth bass have also been observed using the reef extensively. In addition, portions of the reef were designed to enhance lake sturgeon spawning. Although walleye and smallmouth bass usage has been documented, sturgeon and cisco usage has not, but they may also utilize the reef for spawning.

The sport fishery declined during the 1970's. Projected reasons for such a decline mostly centered upon lack of spawning habitat for the sportsfish predators in addition to heavy angling pressure. Competition from the large population of white suckers may have also contributed to the decline. A survey analysis from 1981 discussed fish community dynamics symptoms that implicated illegal netting in the lake. That survey effort did not capture a single sportsfish, even though walleyes had been planted in 1978, 1979, and 1980. A total of 22.4 pounds per acre of white suckers were manually removed from the lake during 1987. Additionally, the spiny water flea, Bythotrephes cedarstroemi, was first documented in 1997. A few large sturgeon have been speared or seen over the years, but no distinct fishery has developed; they were not the targeted species at the time of harvest.

A 1998 survey found that white suckers dominated the fish community, comprising 70% of the catch biomass. Many smallmouth bass were also captured, but only two were adults. Likewise, both walleye and yellow perch juveniles were common in electrofishing efforts and seine hauls, but adults were scarce in the nets. Dissolved oxygen was acceptable to about 30 ft. Although 132 lbs of small ciscos were stocked from Lake Superior in 1993, only two were captured in the 1998 survey, aged at 7 and 10 yrs. Walleye were growing 0.9 in slower than state average, while yellow perch were 1.2 in slower, and rock bass were equivalent to the state average. Northern pike were growing 1.3 in slower than state average, while smallmouth bass were 0.1 in slower.

Walleye population estimates were conducted by the USFS in 2000 and 2007. Both estimates were surprisingly similar, with 250 adults estimated in 2000 and 220 estimated in 2007. A total of 13.7 lbs/acre of white suckers were removed during the 2000 estimate, a management decision resulting from the large numbers captured in the 1998 survey. Walleye were growing 1.8 in slower than state average. The 2007 effort documented good walleye natural reproduction despite a very low lake water level. Even so, walleye were growing 2.3 in slower than state average in 2007. Although most of the artificial spawning reef was above water, new spawning habitat had been exposed in the north and northwest shorelines by wave action against the new shoreline.

Current Status

The 2009 intensive survey during mid-June (Figure 1) showed an improved fish community balance. White suckers comprised only 33% of the survey biomass, with rock bass comprising 19%, sand shiner 15%, walleye 12%, smallmouth bass 7%, northern pike 6%, lake herring 4%, and yellow perch 3% (Table 1). The fish community in 2009 consisted of blackchin shiner, blacknose shiner, bluntnose minnow, brown bullhead, white suckers, lake herring, logperch, northern pike, rock bass, sand shiner, smallmouth bass, spottail shiner, walleye, and yellow perch. Most significant change from 1998 was the reduced white sucker component. In addition, the rock bass component was greater in biomass due to a greater average size. Mid June was spawning season for several minnow species, which resulted in shoreline capture of over 6,500 sand shiners. Their weight comprised 15% of the catch biomass. Similar to the 1998 survey, few smallmouth bass were netted.

Walleye were growing 1.1 in slower than state average (Table 2), which was faster than they were growing in spring 2007. Rock bass were growing 0.3 in faster than state average, while yellow perch were 0.6 in slower than state average and both of these species were growing faster in 2009 than they were in 1998.

Analysis and Discussion

There have been periodic rumors of gillnets being set illegally in Monocle Lake over the years. Rumors of a gillnet surfaced during the spring of 1995 but conservation officers were unable to locate the net. On May 15, 1995, however, the opening day of walleye season, some anglers located that net. The net was 1,000 ft long and filled with approximately100 lbs of fish, containing a mixture of walleye, northern pike, and white suckers. It was determined that the net had been set for long period of time because in addition to fresh fish many others were well decomposed. Since one net was found, there is a possibility that previous rumors of gillnets were true as well. Periodic illegal gill-netting may alter the fish community structure in this small, relatively sterile lake. For example, the intensive 2009 survey used many nets for several days, and the total weight captured was only 237 lbs. The one confirmed gillnet in 1995 killed the equivalent of 42% of the total 2009 survey catch biomass.

Jet skis and other non-fishing water activities have apparently been increasing during the last fifteen years. Anecdotal stories about transient jet skiing, water skiing, and pleasure boating activities can be used to describe much of the traffic originating from the public boat launch. The impact to the fish community and the angling fishery from all the non-fishing activity is unknown at this time.

Monocle Lake is a low productivity system. Nutrients are limited, likely due to the sterile sand shoreline and small watershed. In addition, the U.S. Geological Services survey in 2009 found only 4.8 mg/l of calcium. Canadian science reports in The Ottawa Riverkeeper (2008) and the Environmental Research Web (2008), described a study by Dr. John Smol (Smol, 2009) concerning calcium in lakes. The study documented how 1980s acid rain onto terrestrial soils depleted calcium to the extent that currently no new calcium is leaching from certain types of riparian soils into lakes and streams. Even if the water is non-acidic, there may not be enough calcium to support an invertebrate community, including zooplankton. Smol referred to the phenomenon as "lake osteoporosis", and The Ottawa Riverkeeper article documented the critical concentration as 1.5 mg/l calcium. The concept may have relevance in Monocle Lake, since its calcium concentration is only slightly higher than that critical level described in Smol, 2009. Considering the Monocle Lake pH of 7.9 in conjunction with low

calcium, the concept of lake osteoporosis may possibly explain the low fertility and relatively small fish community in this lake.

Management Direction

There are two management objectives for this lake, 1) to maintain a fishable walleye population through natural reproduction and 2) to maintain good supplemental fisheries of yellow perch, northern pike and smallmouth bass. Management efforts for the walleye objective are in place and will require monitoring of walleye recruitment, growth rate, and population density. Recent habitat improvements by placement of additional brush shelters to concentrate the forage base may have set the stage for the second management objective, as well. Panfish and yellow perch growth rates increased in 2009 which may indicate that they may have been responding to the shelter provided by the submerged structure. However, rock bass and yellow perch were experiencing relatively high annual mortality among the larger, older fish, concurrent with a significant increase in summer mortality (Table 3). Perhaps their concentration at the new brush shelters allowed greater angling success. If so, the improved growth rates may have been a function of greater harvest and a smaller population, rather than of an increased forage base. The 2009 rock bass catch argued against the smaller population scenario, though, as their component of the catch biomass was much higher than it was in 1998, and the percent acceptable at 6+ in was also greater (Table 1).

Smallmouth numbers were adequate in 2009 to provide a modest angling fishery, as was the size range with 40% of the catch legal at 14+ in. The smallmouth bass population is entirely natural, with spawning on the artificial reef during periods of high water and spawning on the shoreline during low water levels. The northern pike population is also natural, although spawning habitat is very limited in Monocle Lake. Perhaps they are migrating through the small stream into and out of Spectacle Lake which has more potential vegetative spawning habitat. Cisco numbers and size imply some natural reproduction and their population appears to have naturalized.

The white sucker component of the catch biomass has decreased since 1998, from 70% to 33%. The proportion of that change relative to predation is unknown, since the USFS manual removal occurred in 2000, two years after the netting survey. The 2009 survey found several new minnow species and large numbers of some of these species. Shoreline sampling was a significant part of the survey, but new to the history of Monocle Lake surveys. In addition, it occurred during the minnow spawning season. The numbers should not be considered a significant change from previous surveys for that reason. Their presence, though, argues against potential depletion of the forage base by predators. Even so, the larger predators will target larger forage such as white suckers and cisco. Monitoring efforts and subsequent evaluation of the entire fish community will continue.

References

Historical files are kept at the Newberry Operations Service Center, 5100 S. M-123, Newberry, MI 49868

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Figure 1. Aerial photograph of Monocle Lake, Chippewa County, showing sampling locations during the June 9-13, 2009 survey using trap, fyke, and gill nets, mini and maxi-mini fyke nets, and boomshocking.

Table 1. Number, weight, and length indices of fish collected from Monocle Lake with trap, fyke, and gillnets, boomshocker and seine, June 9-13, 2009.

Species	Number	Percent by number	Weight (lbs.)	Percent by weight	Length range (in.)*	Average length	Percent legal size**
Blackchin shiner	249	3.1	1.2	0.5	2 – 2	2.5	---***
Bluntnose minnow	119	1.5	0.7	0.3	2 – 2	2.5	---
Blacknose shiner	136	1.7	0.7	0.3	2 – 2	2.5	---
Brown bullhead	2	0.0	1.4	0.6	11 – 11	11.5	100
White sucker	26	0.3	78.5	33.1	8 – 23	18.8	---
Lake herring	9	0.1	9.9	4.2	12 – 18	16.5	100
Logperch	63	0.8	0.3	0.1	2 – 3	2.6	---
Northern pike	3	0.0	14.1	5.9	24 – 31	27.2	100
Rock bass	146	1.8	44.1	18.6	3 – 10	6.9	64
Sand shiner	6,537	80.5	34.3	14.5	1 – 3	2.5	---
Smallmouth bass	15	0.2	17.1	7.2	6 – 16	12.4	40
Spottail shiner	21	0.3	0.2	0.1	2 – 3	3.3	---
Walleye	55	0.7	28.0	11.8	2 – 19	10.5	11
Yellow perch	742	9.1	6.4	2.7	1 – 8	2.6	1
Total		100.1		99.9			

* Note some fish were measured to 0.1 inch, others to inch group: eg., "5"=5.0 to 5.9 inches; "12"= 12.0 to 12.9 inches; etc.

** Percent legal size or acceptable size for angling harvest.

*** "---" signifies a species for which there is no minimum legal/acceptable harvest size.

Table 2. Weighted mean length and age composition for six species of fish sampled from Monocle Lake with trap, fyke, boomshocker and gillnets, and seine, June 9-13, 2009.

Species/Age	Number aged	Length range (in.)	State average len. (in.)	Weighted mean len. (in.)	Weighted age freq. (%)	Mean growth index*
Lake herring						---
Age III	1	12.9	10.3	12.9	11	
Age IV	3	14.4 – 17.8	11.3	15.8	33	
Age V	2	15.4 – 17.1	12.4	16.3	22	
Age VI	2	18.0 – 18.9	13.4	18.5	22	
Age VII	1	18.8	14.4	18.8	11	
Northern pike						---
Age IV	1	31.0	24.2	31.0	33	
Age VI	1	24.7	27.8	24.7	33	
Age VIII	1	25.7	---	25.7	33	
Rock bass						+0.3
Age II	4	3.3 – 3.9	4.3	3.6	7	
Age III	29	4.2 – 5.9	5.4	5.0	22	
Age IV	27	4.6 – 8.1	6.4	6.3	26	
Age V	24	7.0 – 9.3	7.2	8.1	22	
Age VI	12	7.8 – 10.0	8.1	8.6	11	
Age VII	11	8.9 – 10.9	8.8	9.5	12	
Age VIII	1	9.5	9.4	9.5	1	
Smallmouth bass						---
Age II	2	6.0 – 7.6	8.8	6.8	13	
Age III	3	9.8 – 11.9	11.1	11.3	20	
Age IV	7	10.6 – 15.2	13.0	13.0	47	
Age V	2	15.1 – 15.7	14.7	15.4	13	
Age VI	1	16.7	15.5	16.7	7	
Walleye						-1.1
Age I	26	6.1 – 7.5	8.2	6.9	26	
Age II	51	9.3 – 12.2	11.4	10.5	56	
Age III	3	12.8 – 13.3	14.4	13.2	5	
Age IV	3	14.6 – 18.1	16.2	16.6	6	
Age VII	1	18.2	20.8	18.2	3	
Age VIII	1	17.8	21.7	17.8	2	
Age X	1	19.2	23.1	19.2	2	
Yellow perch						-0.6
Age I	1	3.8	4.0	3.8	20	
Age III	9	5.4 – 6.6	6.8	6.2	44	
Age IV	4	7.1 – 8.6	7.8	7.9	20	
Age V	3	6.4 – 8.3	8.7	7.5	16	

* Mean growth index is the average deviation from the state average length at age.

Table 3. Monocle Lake, Chippewa County, mortality rate estimates (Robson and Chapman 1961) for several species from catch curves produced by intensive survey, June 9-13, 2009.

Species	Age(s)	Percent Mortality Estimate	Percent Instant Mortality*	Growth Index (in.)	Comments
Lake herring				---	
	3 – 7	32	39		
Northern pike				---	
	4 – 7	40	51		
Rock bass				+0.3	Increasing mortality of older
	2	4			and larger fish, combined
	3	28			with greater summer mortality,
	4	36			may imply angling harvest.
	5 – 8	56	82		
Smallmouth bass				---	Age 3 averaged 11.3 in, and
	2	13			experienced similar mortality
	3 – 6	34	42		as the older, larger fish.
Walleye				-1.1	
	1	26			
	2	76			
	3 – 10	29	34		
Yellow perch				-0.6	High mortality estimate for
	1	6			ages 3-5 (average 6.2-7.5 in)
	2	0			combined with high summer
	3 – 5	60	92		mortality, may imply angling harvest

* Greater instant mortality implies more angling harvest during summer months (or greater predation harvest due to increased predator metabolism in the summer and the need to intake more calories).