Shoepac Lake

Presque Isle County, T33N, R2E, Section 15 and 22
Black River watershed, last surveyed 2007

Tim A. Cwalinski, Fisheries Management Biologist

Environment

Shoepac Lake is located in southwest Presque Isle County approximately 10 miles south of the town of Onaway, Michigan. Most of the shoreline is state-owned land, and public access is gained at a State Forest Campground on the south shore. A small unimproved boat ramp is available at the campground. The launch is comprised of sand and gravel and may limit launching, retrieving, and use of larger boats. There were ten private residences along the shoreline in 2007.

Shoepac Lake is surrounded by gently rolling, sandy, jack pine covered hills. The lake is 52 acres in size and has a maximum depth of about 94 feet, with steep dropoffs. Most of the lake is deeper than 20 feet with approximately 50% of the surface area over water deeper than 40 feet. The substrate in the shoal areas is sand, which is over-burdened with organic pulpy peat in the deeper areas. No inlet or outlet is present. About twelve-acres of the lake, along the northeast shore, is marsh less than three-feet deep.

Shoepac Lake is located within an area characterized by sinkholes. The bedrock is limestone, and subject to movement, resulting in periodic lake bottom changes. The water is stained dark. Past pH measurements have ranged from 7.0 to 8.5 with moderate alkalinity. Water stratification occurs each summer with the thermocline established typically within fifteen-feet of the surface. Dissolved oxygen concentrations are typically good for fish throughout the water column.

History

Early fish management for Shoepac Lake was directed through stocking efforts for cool-water fish species. Fingerling bluegill were stocked in five years between 1935 and 1941. Yellow perch fingerlings were stocked in 1933, 1937, and 1938. Largemouth bass fingerlings were stocked in 1936, while smallmouth bass fingerlings were stocked in 1934 and from 1938 through 1941. By 1942, early managers began to visualize Shoepac Lake as a waterbody in which trout could survive and produce a fishery. Despite this, rainbow trout stocking efforts did not begin until 1968 and continued intermittently until more recent and consistent trout stocking efforts began in 1981 (Table 1).

The first survey of the aquatic community of Shoepac Lake was made in mid-July of 1966. Limnological parameters were measured from the surface to the deepest part of the lake, which was reported as 110 feet. The lake was found to be thermally stratified with 80F at the surface and 37F near the bottom. Dissolved oxygen remained higher than 6 parts per million throughout the water column. It is uncommon for lakes in this region, to have cold, well oxygenated water below the thermocline. Northern pike, yellow perch, and largemouth bass were considered rare in Shoepac Lake in 1966, but this information was based on limited gill-net fishing effort during the survey.

In 1971 a fish survey was made to determine the effectiveness of trout stocking efforts. Suspended experimental gill-net lifts were used but no trout were collected. Yellow perch, largemouth bass, bluegill, northern pike, rock bass, and pumpkinseed were all collected in low numbers, as would be expected for most species using this type of gear.

The Shoepac Lake fish community was surveyed in October of 1979, using experimental gill-nets. A total of 12 overnight sets revealed that a poor warm water fish population existed. The lake had been stocked annually with trout since 1975, with an average of 2,000 trout per year. Since no trout were taken in this survey, it was suspected that survival was very low. This was concluded despite the fact that water conditions were still very suitable to trout survival in the summer. In addition, age and growth analysis indicated that most of the warm water fish population was slow-growing. No largemouth bass or northern pike were collected during the survey, while bullhead species were abundant. Based on the findings of this survey, it was decided to chemically reclaim the fish population. It was also suggested that future fish community surveys at Shoepac Lake should employ the use of both trap- and fyke-nets so as to get a more representative sample of the entire fish community.

Shoepac Lake was treated with rotenone by the MDNR Fisheries Division in early September of 1980 to remove the existing fish population. This was a large task for a sinkhole lake which has a large volume of water in relation to surface area. A total of 770 gallons of rotenone were used to treat the waterbody at a rate of one part per million. Three-hundred and thirty gallons of rotenone were spread over the lake surface while the remaining gallons were pumped down into depths below 15 feet. Attempts were made to spray the marsh area with the boat and jet pump, but this plan was abandoned due to extremely shallow water. As a result, the marsh area was treated with 10 gallons of rotenone which was applied while wading.

The treatment of the lake and marsh area went smoothly. Distressed fish started showing up immediately and continued to perish for several days. The species eradicated were as expected with the exception of largemouth bass. A few large largemouth bass were killed. The observed kill of rainbow trout was small, less than 10 fish. The eradication was believed to be as near total as possible. Test fish were placed in Shoepac Lake during October of 1980, a month after the eradication. These fish died immediately indicating that rotenone was still present in lethal concentrations. Plans were made to restock the lake with trout at a rate of 50/acre the following spring, using both brook and rainbow trout. Stocking efforts resumed the following spring (Table 1).

MDNR used 4 experimental gill-net lifts in the fall of 1981 to evaluate the previous years reclamation and subsequent trout stocking efforts. Brook trout ages 1 through 3 were collected in the survey. The majority were two years old and ranged from 10-14 inches in length. A total of 28 brook trout were collected and growth was considered to be extremely good. Only 1 rainbow trout was collected.

The next trout survival assessment was conducted in mid-October of 1983 at Shoepac Lake. Effort consisted of 6 experimental gill-net lifts. No brook trout were collected from previous stocking efforts, yet 19 recently stocked rainbow trout were collected. Rainbow trout growth was considered exceptional. Despite this catch, managers by 1987 decided that rainbow trout stocking efforts would cease for Shoepac Lake and would be replaced with brook trout.

A trout evaluation was made by MDNR in late-May of 1987. Five experimental gill-net lifts captured 17 yearling brook trout, all from the most recent stocking effort. In addition, Fisheries personnel used trap- and fyke-nets to evaluate the warm water fish community. A total of 25 net nights were used with this gear. Growth was considered slow for all coolwater species and it was apparent that these fish (non-trout) had become numerous in the lake, despite the fish reclamation project earlier in the decade. Species considered abundant in Shoepac Lake from the 1987 survey included: largemouth bass, bluegill, black crappie, pumpkinseed, rock bass, and bullheads. Species such as smallmouth bass, rainbow trout, brook trout, and white suckers were present, but not common. No northern pike were collected during this survey. Bluegill in the 4-5 inch range were most common (Table 2), while very few were 8 inches or larger. Most black crappie, rock bass and pumpkinseed were small. Largemouth bass of a variety of sizes and ages were well represented in the survey. The largest largemouth bass collected was 16 inches (Table 2). There were no records of angler reports for this period of trout stocking. It was becoming apparent that trout survival may be hindered from competition with other coolwater species.

A limnological survey in August of 1987 found that the water column was stratified and supported dissolved oxygen levels and temperatures suitable to trout survival. While conditions were still suitable for trout survival in Shoepac Lake at this time, competition from growing warm water fish populations was believed to limit trout abundance and carry-over from year to year. In 1988, fisheries managers began stocking brown trout in Shoepac Lake and terminated brook trout stocking. Brown trout are known to have a higher temperature tolerance and might be better at surviving in the presence of a warm-water fish community. Yearling brown trout stocking occured from 1988 through 1993 (Table 1). However, by 1993, fishing reports from this lake were dominated by catches of largemouth bass, bluegill, and northern pike, while reports of trout in the creel were nearly absent. Trout stocking efforts terminated for Shoepac Lake after 1993.

A dissolved oxygen and water temperature profile was determined for Shoepac Lake on August 8, 2005 in 94 feet of water by the Michigan Department of Environmental Quality. A thermocline was established between 10 and 15 feet of water while dissolved oxygen was present throughout the entire water column. These again were environmental lake conditions highly suitable to trout survival.

Current Status

The most recent fish community survey of Shoepac Lake was made from May 5-7, 2007. Effort consisted of: 7 experimental gill-net lifts, 4 large mesh trap-net lifts, 5 large mesh fyke-net lifts, 2 small mesh fyke-net lifts, and 2 mini fyke-net lifts. Water levels were considered low during this survey. A total of 1,616 fish were captured during the four day survey (Table 3). The catch was predominated by bullhead species (black and brown bullheads) which comprised 86% of the survey catch by number. Panfish such as black crappie, bluegill, pumpkinseed, and rock bass made up less than 11% of the survey catch by number and 8% by weight. Predator fish such as northern pike and largemouth bass comprised only 3% of the total catch by number and 14% by weight. Certain species such as yellow perch, smallmouth bass, and white sucker were not collected in 2007, but were collected in previous Shoepac Lake surveys and are still likely present. The 2007 survey was early in May when water temperatures were colder, which may have reduced the total catch, as well as the collection of some particular species.

Only 30 bluegills were collected during the 2007 survey, with most between 6 and 7 inches in length. This was a much lower catch than in the 1980s survey (Table 2). No bluegills larger than 8 inches were collected recently. It is believed this species was undersampled during the early survey period when water temperature was near or below 60F. Larger numbers of adult bluegill may have been staging in deeper water and thus not vulnerable to the near-shore nets. Bluegills in Shoepac Lake today grow relatively slowly compared to bluegills across the State of Michigan (Table 3). Black crappie appeared relatively abundant in 2007 (Table 2) compared to other species with most between 6 and 7 inches in length. Good sized crappie larger than 10 inches were available to anglers. This species had above average longevity, but slower than average growth. Age analysis (using fish scales) indicated they were growing more than an inch below state average. Rock bass were common and the largest was over 10 inches in length, but growth averaged an inch below state growth rates (Table 3). Pumpkinseed, like bluegill, were less common in the 2007 survey catch for reasons already mentioned. In summary, panfish diversity was fairly good in Shoepac Lake but growth of panfish was below the average growth rates for lakes throughout Michigan.

The size structure of the predator population appeared to be present in numbers and sizes which would support a fishery as well as serving the purpose of keeping the fish community in balance. Numerous ages (ages 4 through 12) and sizes of largemouth bass were collected with numerous fish of legal size (14 inches or larger). Largemouth bass grew more slowly when compared to the statewide averages for this species (Table 3), and appeared much more abundant in 1987 (Table 2) than in 2007. Northern pike, the other top predator, were common and represented by six year classes (ages 1 through 6). This species was not collected in the 1987 survey and may have been stocked by the public since then. Twenty-two percent of the pike collected in 2007 were legal-sized (24 inches or larger) but growth was slow and averaged about an inch slower than average pike populations throughout the state. There are no records of northern pike being stocked in this lake since the whole lake treatment to eliminate all fish in 1980. Since there are no inlets or outlets, the ancestors of the pike observed in 2007 either were survivors of the treatment or were illegally stocked. This species is a major predator of trout in lakes and can severely limit trout survival. They are now firmly established and an important member of the current Shoepac Lake fish community.

Analysis and Discussion

Shoepac Lake had been managed as a coldwater (trout) species lake for many decades from the 1970s through the early 1990s. Managers stocked a variety of trout species and sizes throughout this period. Chemical reclamation in 1980 was attempted in order to remove the entire fish community, so that subsequently stocked trout would have the best chance at survival and growth. These efforts were met with limited success. Trout survival from year to year remained low and catch reports for trout continued to be poor. This was despite the fact that variables such as dissolved oxygen and water temperature remained suitable for trout survival. Trout stocking efforts ceased after 1993.

The coolwater fish community was beginning to prosper by 1987. Despite this, growth rates of many of these species (such as bluegill and largemouth bass) continued to be poor. The 2007 fish community survey documented a generally slow-growing cool-water fish community typical of most northern Michigan cool-water lakes which have limited nutrients. Growth of nearly every game species collected in this recent survey was considered slow when compared to growth for such species statewide. Overall productivity at Shoepac Lake is naturally limited and has a direct effect on fish production and growth.

Management Direction

No change in fisheries management is recommended for Shoepac Lake at this time. Despite suitable habitat conditions for trout, past trout stocking efforts never produced a consistent quality fishery. Trout survival may only be enhanced today with frequent eradications of the current coolwater fish community. This would be a costly management technique for a waterbody the size and depth of Shoepac Lake and the cost-to-benefit ratio would not be favorable. Growth of the current coolwater fish community was generally slow, but many species could attain quality sizes if allowed to live long enough. This is true for northern pike, largemouth bass, rock bass, black crappie, and bluegill. The current fish population is sufficient to provide an acceptable fishery for this waterbody.

References

Table 1.-Recent stocking history of trout at Shoepac Lake, Presque Isle County.

Year	Species	Strain	Number	Number/acre	Size (in)
1993	Brown trout	Plymouth Rock	3,489	67	6.2
1992	Brown trout	Plymouth Rock	3,460	67	6.5
1991	Brown trout	Plymouth Rock	3,500	67	6.7
1990	Brown trout	Plymouth Rock	3,325	64	6.4
1989	Brown trout	Plymouth Rock	3,500	67	6.1
1988	Brook trout	Assinica/Maine	3,500	67	6.1
1988	Brown trout	Plymouth Rock	3,500	67	6.2
1987	Brook trout	Assinica/Rome	3,500	67	5.9
1986	Brook trout	Assinica/Rome	1,190	23	5.4
1986	Rainbow trout	Shasta	1,500	29	7.5
1985	Rainbow trout	-	1,500	29	5.8
1985	Brook trout	Assinica/Rome	1,500	29	5.9
1984	Brook trout	Assinica/Rome	1,500	29	5.6
1984	Rainbow trout	-	1,350	26	5.2
1983	Rainbow trout	Harrietta	3,000	58	6.6
1982	Rainbow trout	Harrietta	3,000	58	7.2
1981	Rainbow trout	Harrietta	2,000	39	2.5
1981	Brook trout	Assinica/Rome	2,000	39	1.6
1981	Brook trout	MI domestic	300	6	6.6
1981	Brook trout	Assinica	204	4	6.6

Table 2. –Length-frequencies of various game fish in Shoepac Lake in different years.

Length (in)	Bluegill 87	Bluegill 07	B. crappie 87	B. crappie 07	Rock bass 87	Rock bass 07
1		2				
2						
3	10	1				1
4	103	1				2
5	132	2	1		35	6
6	48	10	60	2	49	14
7	24	14	30	36	11	13
8	9			29		7
9				4		9
10			2	5		2
11			1	3		
12				3		
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

Table 2 continued. –Length-frequencies of various game fish in Shoepac Lake in different years.

Length (in)	N. pike 87	N. pike 07	Pumpkinseed 87	Pumpkinseed 07	L. bass 87	L. bass 07
1						
2						
3			14			
4			34	2		
5			35		5	
6			14		4	
7				3	7	
8				1	43	
9					48	1
10		1			19	1
11					9	1
12					3	2
13		3			2	1
14					13	6
15		2			5	1
16		3			11	1
17		3				
18		1				3
19		3				
20		2				
21		1				
22		1				
23		5				
24		2				
25		1				
26		2				
27						
28						
29		1				
30		1				

Table 3.-Species and relative abundance of fishes collected with survey gear at Shoepac Lake, May 7-10, 2007.

Common Name	**Number**	**Percent**	**Length Range** *(inches)*	**Growth***
Bullhead species	1,395	86%	5 - 13	
Black crappie	82	5%	6 – 12	-1.1”
Rock bass	54	3%	3 – 10	-1.0”
Northern pike	32	2%	10 – 30	-0.8”
Bluegill	30	2%	1 – 7	-0.4”
Largemouth bass	17	1%	9 – 18	-1.5”
Pumpkinseed	6	1%	4 – 8	
TOTAL	**1,616**			
* *growth is compared to statewide average for that species in inches*				