Big Star Lake
Lake County, T17N R14W Sec. 23, 24, 25, 26, 27, 34, 35
Pere Marquette River Watershed. Last surveyed 2004.

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Environment

Big Star Lake is a 912-acre lake (Figure 1) in southwestern Lake County, Michigan within the Pere Marquette River watershed. It is the largest lake in Lake County. The country surrounding the lake is hilly and forested, with predominantly sandy soils. Big Star Lake consists of three different "arms" or basins that are similar in size, and with normal water levels at least 70% of the lake is shallower than 15 feet. Substrates in Big Star Lake are predominantly sand and organic muck and the west basin contains a shallow, weedy bay. A few stumps and deadheads provide fish cover. The shoreline of Big Star Lake is heavily developed and Hay (1995) estimated 317 houses or cottages occurred on it at that time. Public access to Big Star Lake is provided at the Michigan Department of Natural Resources (MDNR) site on the western shore which has a paved launch ramp and parking for 51 vehicles.

Due to its shallow nature, Big Star Lake has abundant aquatic vegetation. There have been some problems with Eurasian milfoil and other nuisance aquatic vegetation. MDEQ has issued permits on Big Star Lake for control of aquatic nuisance vegetation for a number of years (Eric Bacon, MDEQ Water Bureau, personal communication). The 2006 permit from DEQ for aquatic nuisance macrophytes called for the treatment of 95.5 acres of Eurasian milfoil with 2, 4-D in several different forms, including Reward, Renovate, and granular 2, 4-D. Excessive Eurasian milfoil can lead to a number of fisheries problems, including poor growth and stunting for a number of important species.

Big Star Lake has no inlet and one intermittent outlet with a lake-level control structure. Water that flows out of Big Star Lake through the outlet flows through a series of wetlands into Jenks Creek, a tributary of Danaher Creek, which is a tributary of the Pere Marquette River. The legal lake level was set in 1987 at 829.0' above mean sea level. Big Star Lake has a maximum depth of 25 feet at normal lake level; however, the lake is susceptible to fluctuations with the groundwater table. During unusually dry or wet conditions the water level can fluctuate several feet. One restriction on the lake-level control structure is that water cannot be discharged when the water temperature exceeds 68°. This is to protect the brown and/or brook trout in Jenks Creek.

History

According to official records, Big Star Lake was first stocked with bluegill in 1929 by the Michigan Department of Conservation (MDOC), the precursor to the MDNR (Table 1). From 1929 through 1941, it was stocked with varying numbers of largemouth bass, smallmouth bass, yellow perch, and bluegill. Walleye fry were stocked once, in 1935. The early stocking information shown in Table 1 may be incomplete, as many early MDOC stocking records were destroyed in a fire.

The first fisheries survey of Big Star Lake was conducted by the MDOC in 1937 (Brown, 1942) and the author recommended discontinuing all fish stocking. He felt that natural reproduction would be

sufficient to support the populations of the native game and panfish species found in the lake. One interesting finding of the 1937 survey is that northern pike were not captured. Unpublished MDNR file correspondence indicated that northern pike were not present in Big Star Lake until sometime in the 1940s. The first official record of them can be found in a 1948 creel census done by Conservation Officers which showed a number of northern pike caught. How northern pike were introduced and who introduced them is unknown. In other correspondence from the MDNR file, one biologist surmised that northern pike were introduced by anglers.

In 1953, MDOC undertook a substantial fisheries survey of Big Star Lake which obtained scale samples used to determine fish growth rates (Taube and Crowe, 1953). The 1953 survey showed that largemouth bass, bluegill, and black crappie were growing slowly. The authors stated that "bluegills and crappies are definitely stunted", but did not recommend management actions to alleviate the stunting.

The MDOC conducted additional fisheries surveys in 1958, 1959, and 1960 which all showed that bluegill in Big Star Lake were stunted. The lake was treated with Toxaphene in September of 1960, to thin the bluegill population and allow surviving bluegills to grow to larger and more desirable size. Surveys done in 1961 and 1962, after the treatment, seemed to show substantial reduction in numbers of most fish species. In correspondence dated 1962, MDOC District Fisheries Biologist, John MacGregor, stated that "I believe the chemical reclamation was a tremendous success, doing precisely what it was designed to do". He also wrote that "extensive netting in 1961 and 1962 showed a marked reduction in the numbers of perch and panfish but no change in the species composition"; and that, "all species are present in good numbers, and have an increased average length, as is expected by reducing the number of smaller fish". Moderate fish kills were reported by Conservation Officers in the summers of 1967 and 1968. The fish kills were attributed to natural causes, most likely oxygen depletion in certain areas of the lake caused by decaying aquatic vegetation and/or algae blooms, due to hot summer temperatures.

Northern pike have been prominent in the fish population of Big Star Lake since their apparent introduction in the 1940s. Several substantial fall die-offs were noted by lake residents in the late 1950s and early 1960s. Northern pike fishing, which had apparently been phenomenal in the winter of 1949-50 (shortly after their introduction to the lake), had continued to decline through the 1950s. In an attempt to improve northern pike fishing, 2,000 fingerlings were stocked in 1961. Correspondence in MDNR files indicates that some biologists believed that a drop in the lake level had denied northern pike access to spawning habitat, resulting in a reduced population. Residential development of the shore and removal of natural shoreline vegetation to create beaches may have also played a role in the drop of the northern pike population.

A proposal was developed in 1965 to establish an artificial northern pike spawning marsh on private property. In 1966, the marsh, located on the eastern shore of the lake near the outlet, was put into production and it continued to operate in 1967, 1968, and 1969. Records indicate that 117 adult northern pike were netted from the lake and placed into the marsh in 1968 and 113 adults in 1969. Fisheries Biologist Bill Bullen wrote in 1971 correspondence that Big Star Lake held the largest pike population of any lake he had worked on. He attributed this to the operation of the pike marsh and also to high water levels which had allowed northern pike access to prime spawning areas. The spawning marsh did not operate from 1970 through 1972 due to high water levels. An unsuccessful attempt was

made to operate the marsh in 1973 which was hampered by continued high water levels and vandalism to the fish trap. In 1974, 210,000 northern pike fry were stocked into the marsh, but fisheries personnel were unable to evaluate whether fingerlings eventually migrated out into the lake. In 1975, approximately 300 adult northern pike either were stocked or migrated on their own into the marsh, but again, the outlet structure was vandalized, making evaluation impossible. Due to the these difficulties, the artificial pike rearing program was abandoned in 1977. A northern pike spearing ban and winter harvest closure were also put in place in 1971.

Additional MDNR fisheries surveys of Big Star Lake were conducted in 1971 and 1979. In the 1971 survey, excellent numbers of northern pike, largemouth bass, black crappie, bluegill, and yellow perch were captured. Although there were still quite a few small bluegill caught, there were also a fair number of 6-8" bluegill available. Age and growth data were not collected in the 1971 survey. Good numbers of bluegill, black crappie, largemouth bass, and northern pike were caught in the 1979 survey, but total catch was down. Age and growth analysis of the fish caught in 1979 indicated that most species were growing near or slightly above the state average.

In 1980, 7,257 fall fingerling tiger muskie (a northern pike/northern muskie hybrid) were stocked into Big Star Lake (Table 1). Tiger muskie stocking continued until 1991, when the tiger muskie program for the entire state was ended. The tiger muskie program was extremely popular with anglers and lake residents, and it provided a good fishery in Big Star Lake. In a fisheries survey in 1985, 22 tiger muskies were captured, ranging from 11-31 inches in length. This indicated good survival (Hay, 1985), but age and growth data showed that the muskies were growing very slowly. In the 1985 survey, Hay (1985) stated that largemouth bass, bluegill, black crappie, and pumpkinseed sunfish were growing well and that Big Star Lake had "good fish populations, with plenty of legal or acceptable size game fish".

In 1991, 22,382 spring fingerling walleye were stocked into Big Star Lake, the first walleye introduction since 1935. A total of 127,000 walleye have been periodically stocked into Big Star Lake from 1992 to present, with introductions in 1993, 1996, 1999, 2002, 2004, and 2005 (Table 1). A fisheries survey was conducted in 1995 which documented good growth and survival of stocked walleye (Hay, 1995). Populations of other sportfish species in the lake also appeared healthy and desirable in 1995. Bluegill averaged 6.5 inches in length and northern pike, largemouth bass, and pumpkinseed sunfish were also growing faster than the state average. Four tiger muskies were also caught in the 1995 survey.

There have been two Master Angler fish entered from Big Star Lake in recent years, including a 22.75 inch largemouth bass weighing 6.69 pounds entered in 1999, and a 10.0 inch bluegill weighing 1.06 lbs entered in 2006.

In 2000 and 2001, the MDNR received a number of positive reports regarding walleye fishing success in Big Star Lake. Anglers reported taking good numbers of adult walleye up to 23 inches in length. However, starting in 2003, we began to hear reports that fewer walleye were being caught. These reports and absence of surveys since 1995 prompted us to schedule a fisheries survey of Big Star Lake in 2004.

Current Status

The most recent fisheries survey of Big Star Lake was conducted during the late spring and summer of 2004. Fish sampling was conducted with small-mesh fyke nets, trap nets, inland gill nets, minnow seines, and electrofishing gear. The netting portion of the survey occurred from April 26 through April 30, and the electrofishing portion was completed on June 22.

A total of 1,991 fish, representing 14 different species, were caught (Table 2). Bluegill were the most frequently collected panfish species in the survey. A total of 650 bluegill from 1-8 inches were caught, representing 7.5% of the catch by weight. Other panfish species caught included black crappie (23 individuals from 2-14 inches, averaging 8.5 inches in length) and pumpkinseed sunfish (three individuals from 1-5 inches in length). A total of 169 yellow perch were also caught, from 1-9 inches in length. Largemouth bass ranged from 2-18 inches length, with 47 individuals caught. Eight northern pike were caught, ranging from 19-37 inches in length. Five walleye were caught, ranging from 15-22 inches in length. White suckers were very abundant, with 189 individuals caught, representing 68.4% of the catch by weight. Other species caught in the 2004 survey included bluntnose minnow, blacknose shiner, brown bullhead, golden shiner, killifish, and sand shiner.

Bluegill captured during the netting portion of the survey (Table 3) were growing slightly better (0.1 inches) than the state average length at age, while black crappie were growing 0.9 inches slower than the state average. Netted yellow perch were growing 1.4 inches slower than the state average. Insufficient largemouth bass, northern pike, or walleye were collected during the netting portion of the survey to make inferences regarding age and growth. However, largemouth bass captured during the electrofishing portion of the survey (Table 4) were found to be growing 0.6 inches faster than the state of Michigan average length at age.

Analysis and Discussion

The 2004 MDNR fisheries survey showed that Big Star Lake has a generally healthy, but slow growing, fish population. The results were fairly similar to the results of the previous Big Star Lake fisheries survey, done in 1995.

Big Star Lake has panfish populations that are generally healthy. Bluegill were very numerous in the 2004 survey of Big Star Lake, with some individuals reaching eight inches. Bluegill should provide good fishing opportunity, as well as being an excellent forage base for predators like walleye and largemouth bass. The black crappie population also appears healthy, although they are not as numerous as the bluegill. Pumpkinseed sunfish are fairly rare, but may also be present in the panfish catch from time to time. Although yellow perch are numerous in Big Star Lake, most are small and exhibit poor growth.

The largemouth bass population appears to be healthy, with a fair number of fish over the minimum legal size limit of 14". Smallmouth bass were not present in the 2004 survey and none have been captured in MDNR surveys since 1979.

Northern pike populations in Big Star Lake appear to fluctuate based on water levels. When water levels are high, it appears that they can spawn in the inundated nearshore wetland habitat. When water

levels are low the nearshore habitat is dry and northern pike reproduction probably is not as successful. The managed pike marsh also may have played a role in the outstanding northern pike populations found at different periods throughout the 1900s. However, there were times when the northern pike population was booming and the pike marsh was not in operation. It is expected that when water levels come back up the northern pike population will increase again, although residential development along the shoreline and consequent loss of riparian habitat may interfere with that recovery.

The walleye population of Big Star Lake, which is dependent on stocking, appears to have decreased based on the results of the 2004 survey and angler comments. Walleye natural reproduction is likely not occurring, due to a lack of spawning habitat. Only five fish were caught in the 2004 survey and they were born during years that walleye fingerlings were planted. These fish showed good growth and all but one were larger than 20 inches in length. While Big Star Lake may not currently offer large numbers of walleye, many of the walleyes that are present are of decent size.

There appears to be a large population of white suckers in the lake since they comprised the majority of fish biomass in the catch of the 2004 MDNR fisheries survey. Hayes (1990) showed that yellow perch growth rates in Douglas Lake in Otsego County improved when the white sucker population was manually reduced. He showed that white suckers competed with yellow perch for limited invertebrate food resources. White suckers may also compete with other desirable species like bluegill and juvenile walleye. Therefore, a manual removal of adult white suckers from Big Star Lake should provide benefit to a number of panfish and gamefish species.

Management Direction

Walleye fingerlings should be stocked into Big Star Lake to maintain a viable walleye fishery. The previous management regime called for stocking 25,000 spring fingerling walleye (27.4/acre) every third year. We plan to stock 23,000 spring fingerling walleye (25/acre) every other year. Hopefully switching to an every-other year regime will reduce the risk of a large "gap" in the fishable walleye population which could result from failure to produce fingerlings or unexpected mortality after stocking. Since Big Star Lake was most recently stocked with walleye in 2005, the next stocking will take place in 2007, and then every other year hence.

Since white suckers represent a large proportion of the biomass, manual removals should be done periodically to lower the white sucker population. The first manual sucker removal should be done in 2007 and then as needed. Manual removal should be done with trapnets and fykenets fished in the spring to target white suckers as they enter the shallows to spawn. White sucker removal should provide for better survival of stocked walleye fingerlings and an increase in the growth rates of panfish.

The northern pike population will likely continue to fluctuate as water levels rise and fall but those that are available should continue to grow well and reach legal size (24"). The restrictions on northern pike ice fishing and spearing for Big Star Lake were removed in April of 2006. It is now legal to spear for northern pike and this coming winter it will be legal to ice fish for northern pike.

A fisheries survey should be conducted on Big Star Lake in 2010 to monitor the walleye population and assess the effectiveness of the walleye stocking program. Also, bluegill and yellow perch growth

rates should be examined to determine if there was any response to the manual removal of white suckers. The 2010 survey will also show the status of the white sucker population and provide an opportunity for additional sucker removal, if necessary.

Any remaining riparian wetlands adjacent to Big Star Lake should be protected as they are critical to continued health of the lake's fish community. Unwise riparian development and wetland loss in the future will result in deterioration of the water quality and fisheries habitat. As shown above, northern pike are particularly sensitive to changes in riparian wetlands which they rely on for spawning and rearing.

References

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Table 1. Fish stocked in Big Star Lake, Lake County, 1929-2005.

Year	Species	Number	Size	Strain
1929	Bluegill	19,000	4-5 mo.	
1930	Smallmouth Bass	6,000	1 mo.	
	Largemouth Bass	400	yearlings	
1931	Largemouth Bass	1,850	2 mo.	
	Bluegill	4,500	5 mo.	
1934	Largemouth Bass	150	4 mo.	
	Bluegill	800	adults	
1935	Smallmouth Bass	1,640	4 mo.	
	Walleye	510,000	fry	
	Yellow perch	3,000	7 mo.	
1936	Largemouth Bass	200	yearlings	
	Yellow perch	20,000	8 mo.	
1937	Bluegill	30,000	4-5 mo.	
1938	Smallmouth Bass	2,320	5 mo.	
	Yellow perch	4,000	6 mo.	
	Bluegill	18,000	3 mo.	
1939	Smallmouth Bass	2,400	4 mo.	
	Largemouth Bass	2,000	3 mo.	
	Yellow Perch	9,000	9 mo.	
	Bluegill	10,000	3 mo.	
1940	Bluegill	5,000	3 mo.	
1941	Largemouth Bass	2,000	3 mo.	
	Bluegill	5,000	3 mo.	
1961	Northern Pike	2,000	fingerlings	
1966	Northern Pike	47	adults	
1980	Tiger Muskellunge	7,257	fall fingerlings	
1981	Tiger Muskellunge	3,600	fall fingerlings	
1982	Tiger Muskellunge	5,000	fall fingerlings	
1983	Tiger Muskellunge	3,000	fall fingerlings	
1984	Tiger Muskellunge	3,240	fall fingerlings	
1985	Tiger Muskellunge	2,400	fall fingerlings	
1986	Tiger Muskellunge	3,000	fall fingerlings	
1987	Tiger Muskellunge	3,100	fall fingerlings	
1988	Tiger Muskellunge	2,600	fall fingerlings	
1989	Tiger Muskellunge	3,600	fall fingerlings	
1990	Tiger Muskellunge	3,600	fall fingerlings	
1991	Tiger Muskellunge	3,600	fall fingerlings	
	Walleye	22,382	spring fingerlings	Muskegon
1993	Walleye	18,175	spring fingerlings	Bay De Noc
	Walleye	6,887	fall fingerlings	Bay De Noc
1996	Walleye	20,050	spring fingerlings	Bay De Noc
1999	Walleye	25,390	spring fingerlings	Muskegon
2002	Walleye	25,684	spring fingerlings	Muskegon
2004	Walleye	10,171	spring fingerlings	Muskegon
2005	Walleye	20,102	spring fingerlings	Muskegon

Table 2. Number, weight and length (inches) of fish collected from Big Star Lake with small mesh fyke nets, large mesh fyke nets, inland gillnets, beach seining, and electrofishing, April 26-30, and June 22, 2004.

Species	Number	Percent by number	Weight (Pounds)	Percent by weight	Length range (inches)[1]	Average length	Percent legal size[2]
Bluntnose minnow	655	32.9	8.3	1.4	2-5	3.0	
Bluegill	650	32.6	43.9	7.5	1-8	4.1	9 (6")
Sand shiner	209	10.5	1.0	0.2	1-3	2.5	
White sucker	189	9.5	400.4	68.4	3-21	17.2	
Yellow perch	169	8.5	6	1.0	1-9	3.8	7 (7")
Largemouth bass	47	2.4	50	8.5	2-18	11.2	38 (14")
Black crappie	23	1.2	12.8	2.2	2-14	8.5	70 (7")
Blacknose shiner	12	0.6	0.2	0.0	4-5	5.0	
Brown bullhead	12	0.6	12.4	2.1	8-14	12.9	100 (8")
Northern pike	8	0.4	35.8	6.1	19-37	26.1	75 (24")
Banded killifish	7	0.4	0.0	0.0	1-2	2.4	
Walleye	5	0.3	14.3	2.4	15-22	20.3	100 (15")
Pumpkinseed sunfish	3	0.2	0.2	0.0	1-5	3.8	0 (6")
Golden shiner	2	0.1	0.2	0.0	6-7	7.0	
Total	1,991	100.0	585.4	100.0			

[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 3. Average total weighted length (inches) at age, and growth relative to the state average, for fish sampled from Big Star Lake with small mesh fyke nets, trap nets, and inland gill nets, April 26-30, 2004. Number of fish aged is given in parenthesis.

	Age										Mean Growth
Species	I	II	III	IV	V	VI	VII	VIII	IX	X	Index
Black crappie	3.3	7.8	9.9	10.1	10.9	11.1		13.6	13.9		-0.9
	(6)	(2)	(4)	(1)	(4)	(2)		(1)	(2)		
Bluegill	1.8	2.9	4.8	6.4	7.4	8.5					+0.1
	(3)	(22)	(27)	(6)	(24)	(1)					
Largemouth bass	2.9	8.5	12.0	14.2	15.0	17.0			18.7		
	(2)	(1)	(1)	(2)	(2)	(1)			(1)		
Northern pike		19.3		22.6	26.9	26.8	25.1	30.1			
		(1)		(1)	(2)	(1)	(1)	(2)			
Pumpkinseed		4.1	5.4								
		(1)	(1)								
Walleye		15.2			21.6						
		(1)			(4)						
Yellow perch	2.8	3.3	4.7	7.5	8.6	9.4					-1.4
	(7)	(13)	(8)	(9)	(4)	(1)					

Table 4. Average total weighted length (inches) at age, and growth relative to the state average, for fish sampled from Big Star Lake by electrofishing, June 22, 2004. Number of fish aged is given in parenthesis.

	Age										Mean Growth
Species	I	II	III	IV	V	VI	VII	VIII	IX	X	Index
Bluegill					8.2						
					(5)						
Largemouth bass	5.3	9.3	11.2	14.6	15.5	15.6	17.3	17.8			+0.6
	(4)	(16)	(2)	(1)	(4)	(5)	(2)	(1)			
Yellow perch					8.7						
					(1)						

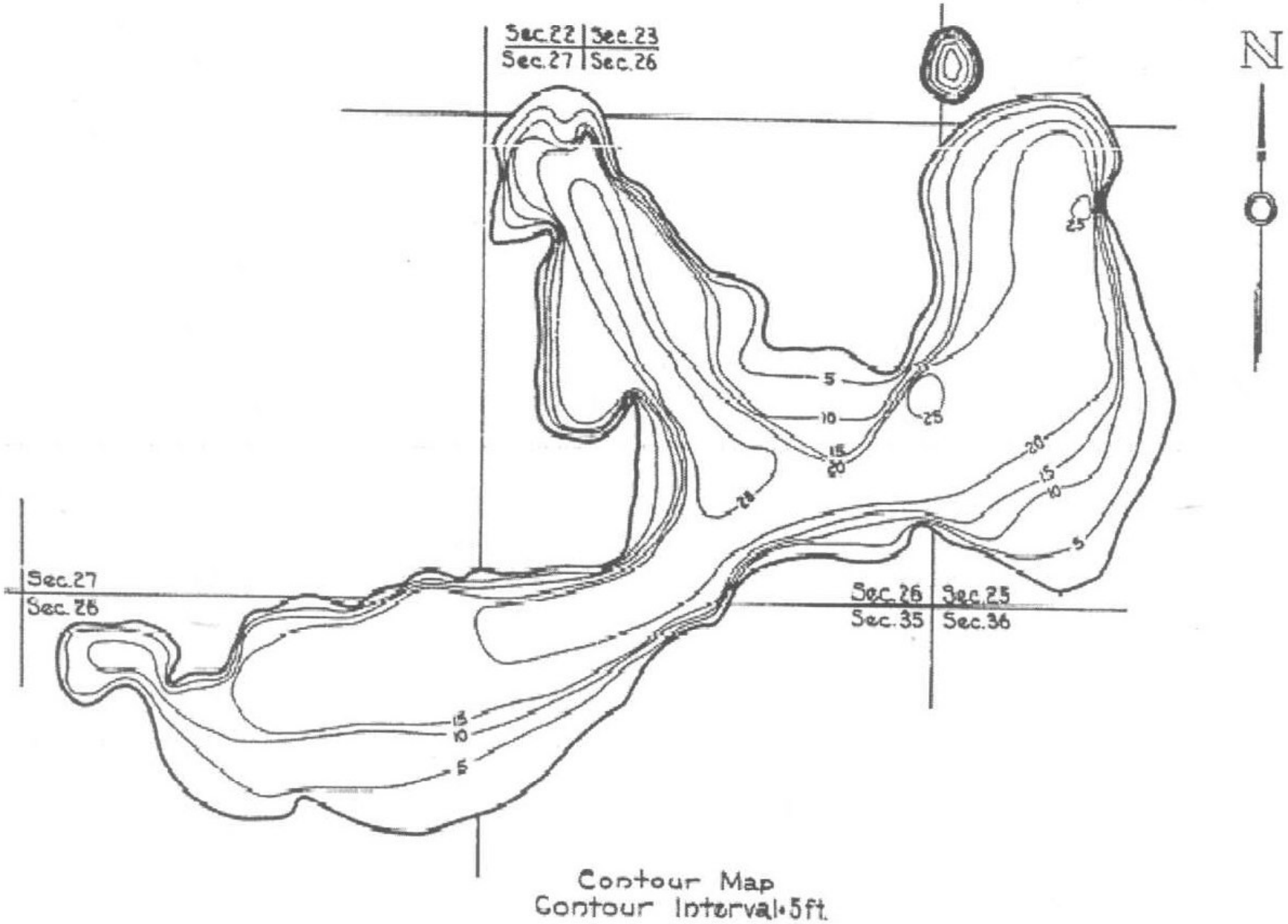

Figure 1. Contour map of Big Star Lake.