

## **Bear Lake**

Kalkaska County, T27N R5W Sec. 17, 20  
Manistee River Watershed, 2004

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### **Environment**

Bear Lake is a 316-acre lake in eastern Kalkaska County, Michigan (Figure 1). Bear Lake lies within the Manistee River watershed. It has no inlets or outlets. The lake has a maximum depth of 60 feet, and is managed as a two-story lake. Two-story lakes are those that have shallow water habitat for warm and coolwater gamefish such as bass and panfish, along with deep cold water habitat suitable for trout. Only 16% of Bear Lake is shallower than 5 feet, while 45% of the lake is deeper than 20 feet. Bear Lake is fairly round and uniform in shape, but it does have one small, shallow, connected pond of several acres in size that is only three or four feet deep at its deepest point. The substrates in Bear Lake are predominantly marl and sand, although there are a few areas with organic muck. There is little aquatic vegetation in the lake, and an overall lack of cover. There are a few logs and stumps, and artificial cover structures were reportedly installed back in the 1940s. The shoreline of Bear Lake is heavily developed, as there are roughly 130 private residences on Bear Lake. The country surrounding Bear Lake is hilly and mostly forested, with predominantly sandy soils. Public access to Bear Lake is obtained at the MDNR access site on the southeast corner of the lake. The access site has a paved launch ramp and parking for six or so vehicles with trailers.

### **History**

According to official records, Bear Lake was first stocked by MDOC (the Michigan Department of Conservation, the precursor to the Michigan Department of Natural Resources) with smallmouth bass in 1931 (Table 1). The first recorded stocking of rainbow trout was in 1937. However, a letter dated September 10, 1931, refers to large rainbow trout being caught from Bear Lake, so they were obviously planted prior to then. Many early MDOC fish stocking records were lost in a fire. Plantings of rainbow trout continued until the mid 1970s, when brown trout were stocked instead. Since then, Bear Lake has been stocked by MDNR with at least 10,000 brown trout annually. Supplemental stockings of rainbow trout were added in 2003. The current prescription calls for 15,000 Wild Rose strain brown trout and 5,000 Eagle Lake strain rainbow trout to be stocked annually. Other plantings over the years included smallmouth bass in 1931 and 1965, walleye fry in 1936-1938, lake whitefish fry in 1949, hybrid sunfish (redeer x green) in 1970, and steelhead in 1982. Also, a small number of tagged adult rainbow trout are stocked in some years for the Kalkaska National Trout Festival fishing contest. Bear Lake is classified as a Type B lake under the new trout regulations, which went into effect in April 2000. Type B regulations include a year-round fishing season, a minimum size limit of 12 inches for brown trout, and a daily bag limit of five trout.

MDNR/MDOC fisheries surveys of Bear Lake were conducted in 1966, 1967, 1970, 1971, 1972, 1976, 1981, 1987, and 1996. Most of these surveys were efforts to assess the trout stocking program in Bear Lake. The lake was chemically treated with rotenone in 1964 to remove competing species and

improve the rainbow trout population. The treatment was not successful, and reports of poor trout fishing continued into the early 1970s. After a four year period in which no trout were stocked, the brown trout stocking program began in 1975. A 1976 survey showed an immediate response, with good numbers of brown trout caught, with fish ranging up to 22" in length. The 1981, 1987, and 1996 surveys also showed good survival and growth of stocked brown trout.

The 1996 survey, in particular, revealed an excellent brown trout population. Twenty-seven brown trout were captured, ranging from 9-25 inches in length, representing five year classes. The brown trout exhibited outstanding growth, averaging 14.6 inches during their second year in the lake and 18.9 inches during their third year in the lake. Brown trout growth rates from the 1996 survey are comparable with or better than prior surveys (1987, 1981, and 1976), and higher numbers of larger brown trout were captured in the 1996 survey. White suckers were the most numerous species observed in the 1996 survey. Almost 1,500 white suckers ranging from 7-22 inches were captured. White suckers represented 83.5% of the catch by number and 97% by weight. This was a significant contrast to the 1987 survey, when only 21 white suckers were captured. An explanation for the extraordinarily large number of white suckers encountered in the 1996 survey is that the survey coincided with inshore sucker spawning migrations.

To reduce white sucker biomass, a manual white sucker removal was performed in May of 2001. White suckers can compete with and inhibit the populations of more desirable species, like yellow perch (Hayes, 1990). Due to other commitments, the manual removal missed the temperature window for optimum capture of white suckers during their spawning run. Comments from riparians stated that large schools of suckers could be seen in the shallows the week before the nets were set. Even so, a total of 739 white suckers weighing 1580 lbs. were removed from the lake. Also found was a high incidence of cataracts on one or both eyes of the suckers. An interesting side note to the catch was the 215 smallmouth bass captured compared to 10 in the 1996 survey, and the 23 largemouth bass captured compared to 0 in the 1996 survey. One longnose sucker was also captured in the 2001 netting effort. Longnose sucker had never been previously documented from Bear Lake. It was probably introduced to the lake from an angler's bait bucket. Also, one tagged rainbow trout was caught during the manual removal, which came from an April 2001 private stocking for the Kalkaska National Trout Festival fishing contest.

In late October, 2004, there was a moderate die-off of yellow perch reported by Bear Lake riparian landowners. The Grayling MDNR Fisheries crew collected samples of dead fish and sent them to the Michigan State University Fish Health Lab. Analysis performed by the MSU Fish Health Lab indicated that the die-off was due to an overgrowth of *Microcystis* sp. (most likely *M. aeruginosa*). *Microcystis* is a blue-green algae that can sometimes be toxic to fish and other animals. In other Michigan lakes, *Microcystis* blooms have been linked with the presence of zebra mussels (Solomon, 2002), but zebra mussels have not been documented in Bear Lake as of February, 2006. The fall 2004 yellow perch die-off is not expected to have any long-term impacts on the yellow perch population of Bear Lake.

### **Current Status**

The most recent fisheries survey of Bear Lake was conducted during the late spring and summer of 2004. Sampling methods of this survey included large-mesh fyke nets, trap nets, inland gill nets,

minnow seining, and electrofishing. Sampling locations are detailed in Figures 2 and 3. The netting portion of the survey occurred from May 24 through May 27, and the electrofishing portion was completed on August 16.

During the 2004 survey, a total of 1,550 fish, representing 13 different species, were caught (Table 2). Rock bass were the most frequently collected species in the survey. A total of 703 rock bass from 4-10 inches were caught, representing 19.4% of the catch by weight. White suckers were also very abundant, with 223 individuals caught, representing 54.6% of the catch by weight. A total of 146 smallmouth bass were caught, from 7-18 inches in length and representing 17.4% of the catch by weight. Smallmouth bass aged from the 2004 survey displayed average growth (Table 3), as they were at the state of Michigan average length at age. Yellow perch were represented by 128 individuals from 4-9 inches in length. Yellow perch were growing 0.5 inches below the state of Michigan average length at age, and the yellow perch year class from 2000 seems to be strong. Sand shiners were the most abundant minnow species caught in the 2004 survey, with 299 individuals captured. Other species represented in the catch in smaller numbers included bluntnose minnow, brown trout, brown bullhead, Iowa darter, johnny darter, largemouth bass, pumpkinseed sunfish, and rainbow trout. The one species which was seen in previous surveys of Bear Lake, but not in the 2004 survey, was bluegill.

A total of 23 brown trout ranging from 7-26 inches were caught (Table 2). Five different age classes were represented, including age 1 (fish which would have been stocked in the spring of 2004), and ages 3-6 (Table 3). It is interesting that no age 2 brown trout were caught in the 2004 survey. Those fish would have been stocked in 2003. The brown trout aged in the survey displayed nearly average growth, as they were only 0.3 inches below the state of Michigan average length-at-age.

Eight rainbow trout ranging from 7-16 inches were also caught. Four different age classes (ages 1-4) were represented (Table 3), even though MDNR had only stocked rainbow trout the year before, in 2003. The rainbow trout from the older year classes were probably those privately stocked in 2002 for the Kalkaska Trout Festival.

The most recent limnological samplings were collected on July 28, 2004. Two different sites were sampled. Water color was clear at both sites. Site 1 had a secchi disk reading of 31.8 feet, while site 2 had a secchi disk reading of 29.1 feet. Temperature was 73.13F at the surface at site 1, and the thermocline began at about 24 feet. The depth at site 1 was 59 feet, and the temperature at the bottom was 58.4F. Dissolved oxygen at site 1 was 9.89 mg/L at the surface. Dissolved oxygen levels began to drop at about 36 feet, down to 3.0 at 48 feet, and from there down to .20 mg/L at the bottom. When dissolved oxygen levels drop below 3.0 mg/L it is difficult for fish to survive. The conductivity at site 1 was .208 microsiemens at the surface, .215 at mid-depth, and .248 at the bottom. The pH at site 1 was 7.99 on the surface, 8.23 at mid-depth, and 7.18 on the bottom. At site 2, the surface temperature was 74.0F and the thermocline again began at about 24 feet. The depth at site 2 was 41 feet, and the temperature at the bottom was 62.8F. Dissolved oxygen at site 2 was 8.4 mg/L at the surface, down to 4.51 mg/L at the bottom. The conductivity at site 2 was .207 microsiemens at the surface, .207 at mid-depth, and .275 on the bottom. The pH at site 2 was 8.26 at the surface, 8.32 at mid-depth, and 7.5 at the bottom.

## Analysis and Discussion

Based on the results of this survey, it is evident that the trout stocking program for Bear Lake continues to be successful. The stocked brown trout are surviving multiple years and growing to large sizes. While the largest brown trout caught in the survey was 26 inches, we observed an angler catch one that was nearly 30 inches during the survey. The Bear Lake brown trout stocking program is popular with anglers and should be continued. The supplemental rainbow trout stocking program also seems to be successful. The stocked rainbow trout also seem to be surviving and growing well. They will enhance the fishery in the lake and add some diversity to the sport catch.

Although white suckers comprised 54% of the catch by weight, that is a significant change from the 1996 survey, when white suckers made up 97% of the catch by weight. It appears that the 2001 manual removal was successful in substantially reducing the white sucker population in Bear Lake. Hayes (1990) showed that yellow perch growth rates improved when the white sucker population was manually reduced in Douglas Lake in Otsego County. According to the study, white suckers compete with other more desirable species like yellow perch for limited food resources. Therefore, more white sucker manual removals from Bear Lake may be necessary in the future.

The smallmouth bass population in Bear Lake seems to be quite healthy, with 146 individuals caught in the 2004 survey. Bear Lake smallmouth bass are naturally reproducing, growing, and surviving well. Angler reports regarding smallmouth bass in Bear Lake have been very positive. Bear Lake also contains an abundant population of rock bass, including some of Master Angler proportion. Although rock bass are not heavily utilized by anglers, in Bear Lake they could provide an outstanding angling opportunity. Yellow perch are also very abundant in Bear Lake, and also provide an excellent angling opportunity.

### **Management Direction**

Brown trout (Wild Rose strain) should continue to be stocked annually at rates of 47.5 yearlings per acre (15,000). Since no natural reproduction takes place, stocking must continue to maintain the fishery. The stocked brown trout should continue to survive for multiple years after stocking and grow to sizes in excess of 20 inches. The trout stocking program should also continue to be supplemented with modest numbers of stocked rainbow trout annually. Stocking 5,000 (16/acre) yearling Eagle Lake-strain rainbow trout will enhance the trout fishery in Bear Lake and provide variety for anglers.

Since white suckers still represent a large proportion of the biomass in Bear Lake, manual removals should continue to be done periodically to lower the white sucker population. The next manual sucker removal should be done later in this decade, perhaps in 2008 or 2009, depending upon staff and personnel resources.

Native desirable species like smallmouth bass, rock bass, and yellow perch should continue to thrive in Bear Lake. Although the yellow perch population structure could be improved somewhat to provide larger fish for anglers, there are very few tools available to fisheries managers to manipulate yellow perch populations in inland lakes such as Bear Lake.

### **References**

Hayes, D. B. 1990. Competition between white sucker (*Catostomus commersoni*) and yellow perch (*Perca flavescens*): results of a whole lake manipulation. Michigan Department of Natural Resources, Fisheries Research Report 1972, Ann Arbor.

Solomon, D. 2002. *Microcystis* in Southern Michigan Lakes. Michigan State University Extension, Kellogg Biological Station.

Tonello, M. A. 2000. Lake surveys: Bear Lake, 1996. Michigan Department of Natural Resources, Cadillac.

**Table 1.** Fish stocked in Bear Lake, Kalkaska County, 1931-2005.

Year	Species	Number	Size	Strain
1931	Smallmouth bass	1,000	5 mo. fingerlings	
1935	Walleye	85,000	?	
1936	Walleye	360,000	?	
1937	Walleye	150,000	?	
	Rainbow trout	3,650	6 mo. fingerlings	
1938	Walleye	210,000	?	
	Rainbow trout	12,000	7.5 mo. fingerlings	
1941	Rainbow trout	15,000	5 mo. fingerlings	
1942	Rainbow trout	1,026	3 mo. fingerlings	
1944	Rainbow trout	2,000	adults	
1945	Rainbow trout	3,000	21 mo.	
1946	Rainbow trout	3,000	21 mo.	
	Rainbow trout	1,000	33 mo.	
1947	Rainbow trout	6,000	adults	
1949	Rainbow trout	10,000	4.5" fingerlings	
	Rainbow trout	5,000	7.5" fingerlings	
	Lake whitefish	60,000	fry	
1950	Rainbow trout	4,000	7.1" fingerlings	
1951	Rainbow trout	6,000	7.2" fingerlings	
1952	Rainbow trout	6,000	7.7" fingerlings	
1953	Rainbow trout	6,000	8.2" fingerlings	
1954	Rainbow trout	6,000	8.9" fingerlings	
1955	Rainbow trout	6,000	legal	
1956	Rainbow trout	6,000	legal	
1957	Rainbow trout	6,000	legal	
1958	Rainbow trout	7,200	sublegal	
1959	Rainbow trout	6,000	legal	
1960	Rainbow trout	6,000	legal	
1961	Rainbow trout	4,000	legal	
1962	Rainbow trout	4,000	legal	
1965	Rainbow trout	29,992	sublegal	
	Rainbow trout	31,152	legal	
	Smallmouth bass	8,544	fingerlings	
1966	Rainbow trout	79,000	spring fingerlings	
1967	Rainbow trout	55,000	spring fingerlings	
	Rainbow trout	10,000	yearlings	
1969	Rainbow trout	15,000	yearlings	
1970	Rainbow trout	15,000	yearlings	
	Hybrid sunfish	56,000	fry	
1975	Brown trout	11,289	yearlings	
1976	Brown trout	15,000	yearlings	
1977	Brown trout	16,006	yearlings	
1978	Brown trout	16,000	yearlings	
1979	Brown trout	10,000	yearlings	
1980	Brown trout	10,000	yearlings	
1981	Brown trout	10,000	yearlings	Harrietta
1982	Brown trout	10,000	yearlings	Harrietta
	Steelhead	5,671	yearlings	Little Manistee
1983	Brown trout	12,600	yearlings	Harrietta

**Table 1.** Fish stocked in Bear Lake, Kalkaska County, 1931-2005, cont'd.

Year	Species	Number	Size	Strain
1984	Brown trout	15,000	yearlings	Harrietta
1985	Brown trout	10,353	yearlings	Harrietta
1986	Brown trout	11,400	yearlings	Plymouth Rock
	Brown trout	4,600	yearlings	Wild Rose
1987	Brown trout	13,500	yearlings	Harrietta
1988	Brown trout	15,000	yearlings	Plymouth Rock
1989	Brown trout	15,000	yearlings	Plymouth Rock
1990	Brown trout	13,500	yearlings	Plymouth Rock
	Brown trout	1,500	yearlings	Soda Lake
1991	Brown trout	15,000	yearlings	Plymouth Rock
1992	Brown trout	14,600	yearlings	Wild Rose
1993	Brown trout	14,900	yearlings	Wild Rose
1994	Brown trout	15,000	yearlings	Wild Rose
1995	Brown trout	13,600	yearlings	Seeforellen
1996	Brown trout	12,775	yearlings	Seeforellen
1997	Brown trout	15,600	yearlings	Wild Rose
1998	Brown trout	14,500	yearlings	Wild Rose
1999	Brown trout	15,000	yearlings	Wild Rose
2000	Brown trout	10,000	yearlings	Wild Rose
2001	Brown trout	15,160	yearlings	Wild Rose
2002	Brown trout	15,460	yearlings	Wild Rose
	Rainbow trout	31	adults	Private Plant
2003	Brown trout	15,300	yearlings	Wild Rose
	Rainbow trout	5,760	yearlings	Eagle Lake
2004	Brown trout	15,100	yearlings	Wild Rose
	Rainbow trout	6,000	yearlings	Eagle Lake
2005	Brown trout	15,000	yearlings	Wild Rose
	Rainbow trout	6,000	yearlings	Eagle Lake

**Table 2.** Number, weight and length (inches) of fish collected from Bear Lake with small mesh fyke nets, large mesh fyke nets, inland gillnets, beach seining, and electrofishing, May 24-27, and August 16, 2004.

Species	Number	Percent by number	Weight (Pounds)	Percent by weight	Length range (inches) <sup>1</sup>	Average length	Percent legal size <sup>2</sup>
Rock bass	703	45.4	166.4	19.4	1-10	6.6	68 (6")
Sand shiner	299	19.3	1.4	0.2	1-2	2.4	
White sucker	223	14.4	469	54.6	8-22	17.4	
Smallmouth bass	146	9.4	149.1	17.3	7-18	12.1	27 (14")
Yellow perch	128	8.3	17.7	2.1	4-9	6.9	33 (6")
Brown trout	23	1.5	28.1	3.3	7-26	12.2	43 (12")
Largemouth bass	14	0.9	21.8	2.5	1-20	13.2	29 (14")
Rainbow trout	8	0.5	5.4	0.6	7-16	11.6	50 (12")
Pumpkinseed sunfish	2	0.1	0.2	0.0	4-5	5.0	
Bluntnose minnow	1	0.1	0.0	0.0	2-2	2.5	
Brown bullhead	1	0.1	0.3	0.0	8-8	8.5	
Iowa darter	1	0.1	0.0	0.0	2-2	2.5	
Johnny darter	1	0.1	0.0	0.0	2-2	2.5	0 (6")
<b>Total</b>	<b>1,550</b>	<b>100.0</b>	<b>859.4</b>	<b>100.0</b>			

<sup>1</sup>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.

<sup>2</sup>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 Bear Lake with small mesh fyke nets, large mesh fyke nets, and inland gill nets, May 24-27, 2004. Number of fish aged is given in parenthesis.

Species	Age										Mean Growth Index	
	I	II	III	IV	V	VI	VII	VIII	IX	X		
Brown trout	8.16 (11)		15.3 (7)	17.2 (1)	20.1 (1)	16.2 (1)						-0.3
Largemouth bass			12.3 (3)	13.2 (3)	13.4 (2)	16.0 (2)	18.0 (1)			20.0 (1)		---
Pumpkinseed			5.4 (1)									---
Rainbow trout	8.4 (4)	13.0 (1)	14.6 (2)	16.0 (1)								---
Rock bass			5.4 (15)	6.3 (14)	7.3 (14)	8.1 (10)	8.9 (3)	9.2 (1)	9.9 (2)	10.4 (3)		+0.3
Smallmouth bass		7.2 (2)	10.1 (32)	12.7 (26)	14.5 (13)	16.0 (10)	16.6 (3)	17.1 (1)	17.9 (2)			+0.0
Yellow perch		6.0 (3)	6.2 (6)	6.9 (17)	8.1 (8)	9.5 (1)						-0.5

Figure 1. Bear Lake, Kalkaska County.

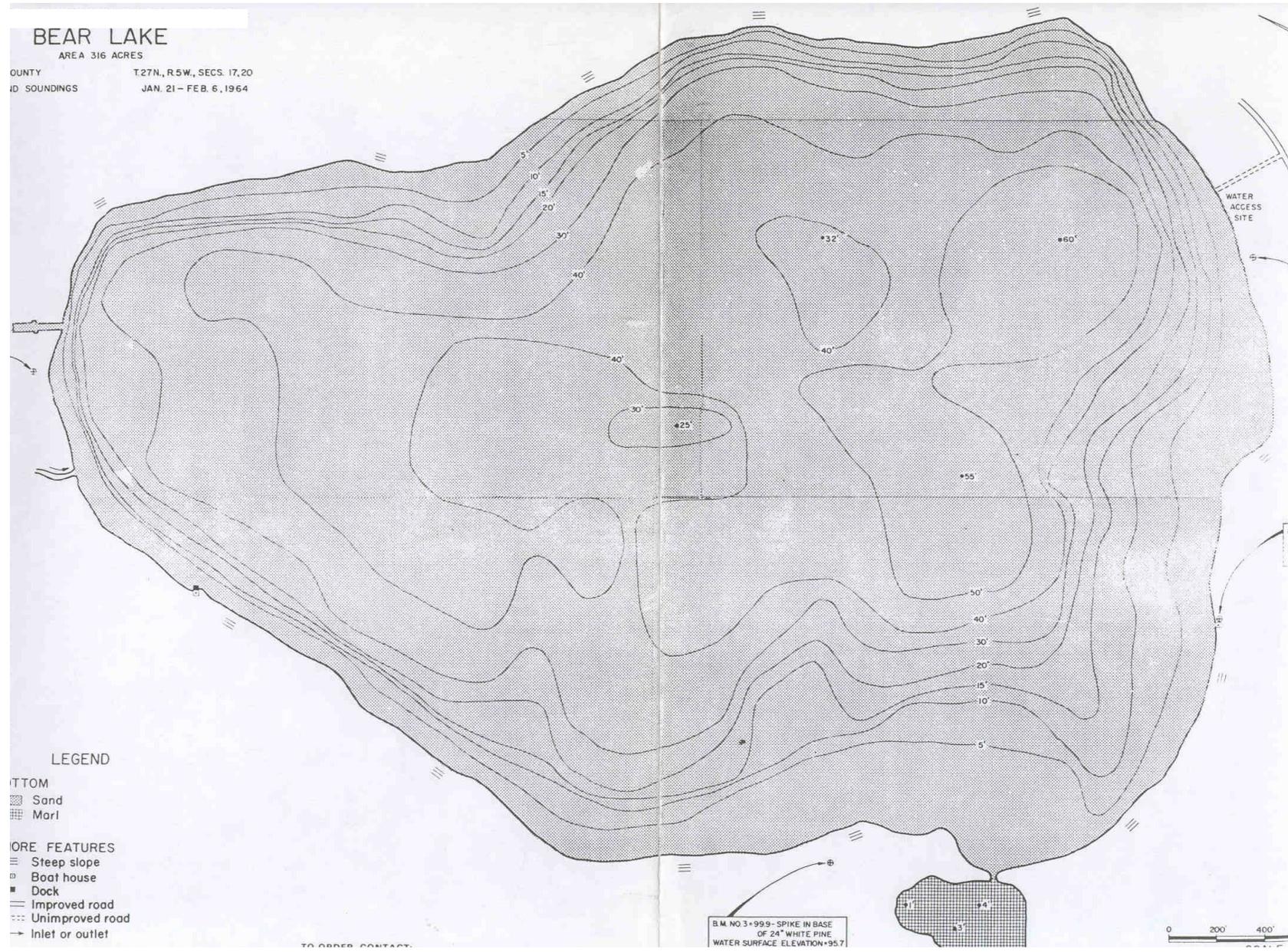


Figure 2. Trap net, fyke net, and gill net set sites from the 2004 MDNR Bear Lake fisheries survey.

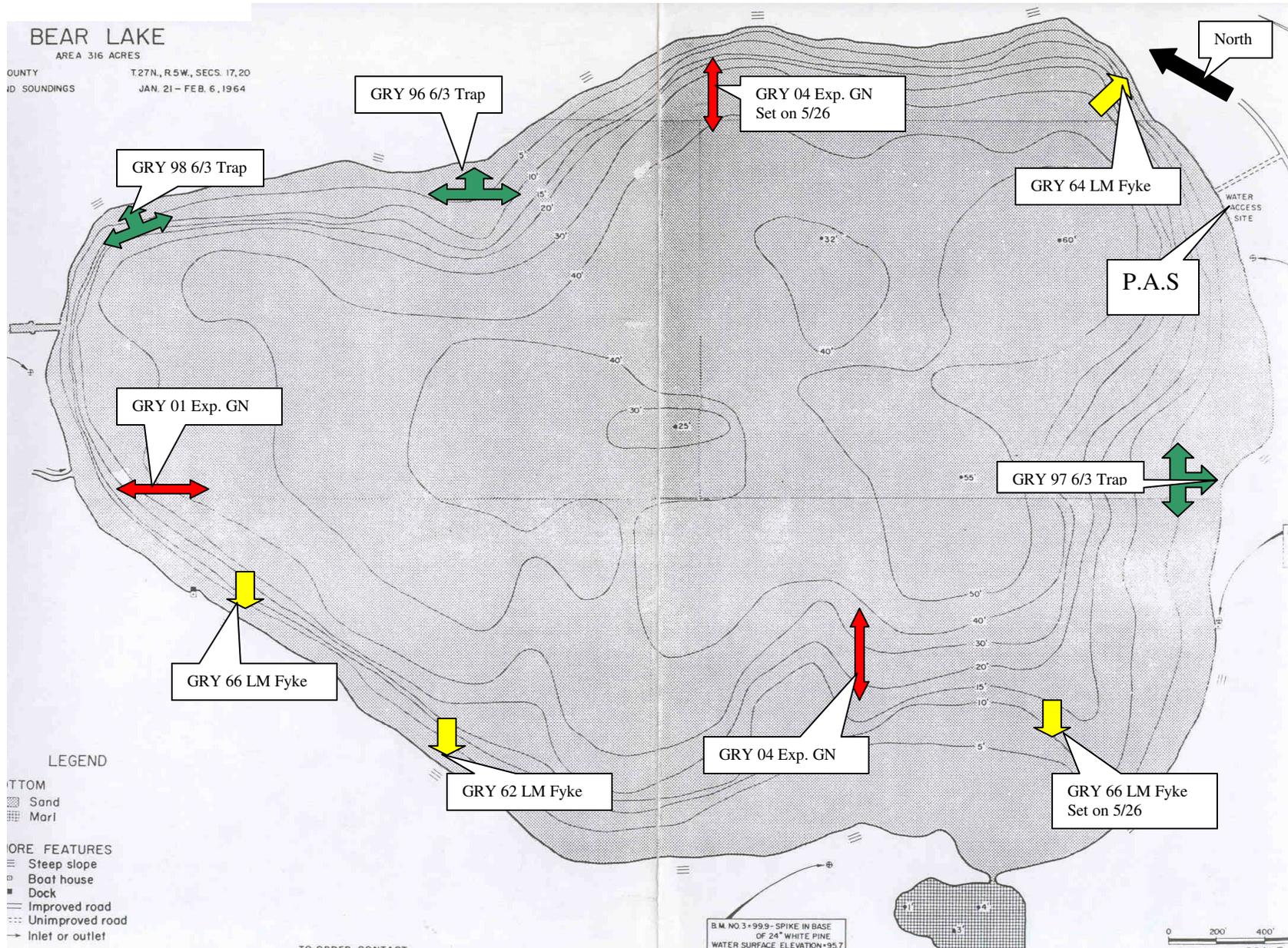


Figure 3. Boomshocking and seining sites for the MDNR 2004 Bear Lake fisheries survey.

