

## **Bodi Lake**

Luce County, T50N, R08W, S29  
Little Two Hearted River Watershed, Last surveyed 2004

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### **Environment**

Bodi Lake lies near the Lake Superior shoreline in northeast Luce County. Easiest approach to the lake is north from M-123 about 12 miles on County Road 500.

The surrounding geography consists of rolling sand dune hills, covered with pines and white birches. Interspersed between many of the hills are swamplands generally covered with swamp conifers. Culhane Creek flows out of the lake during normal or high water levels. The creek was flowing in 2002, after being a dry swale for a decade due to low lake water levels. By 2004, however, it was once again a dry swale with no water flow. A small unnamed creek flows into the lake from the eastern shoreline, draining a small watershed.

Bodi Lake has a predominantly sand and gravel shoreline. The deep water substrate is organic, and the water is stained a medium brown color. It encompasses 306 acres and reaches a maximum depth of 45 ft (Figure 1). Its littoral zone incorporates two large gravel points covered with bulrushes (*Scirpus*); one in the north and one where the small creek enters from the east. Shoreline contours include gradual slopes and sharp dropoffs. Much of the perimeter shoreline supports colonies of bulrushes and some yellow pond lilies (*Nymphaea*). Shoal areas, especially in the narrows between the two main basins, support dense colonies of pond weeds (*Potamogetons*). Despite the brown water and organic substrates, pH in March 1986 was 7.3. Acceptable oxygen concentrations were present only above the thermocline in September 1985. Surface water temperature at that time was 64°F. Methyl orange alkalinity was 23. Oxygen was again measured during a status and trends survey on July 2, 2001. The surface temperature was 69°F, and dissolved oxygen was good at 9.6 mg/l. The oxygen concentration was 9.2 mg/l at 10 ft depth, but fell to 7.7 mg/l at 15 ft. It was not measured any deeper.

Riparian development consists of just a few cottages and a popular State Forest Campground. Boat access is through the campground, and most of the angling pressure comes from campers. During 2001 and 2004, however, low lake levels resulted in the cement planks of the launch site ending about twenty feet before "the water's edge". The water in 2004 was roughly 5-6 ft lower than the long-term normal level.

### **History**

The Michigan Department of Natural Resources (MDNR) introduced walleye, yellow perch and northern pike between 1937 and 1941, bluegills in 1950, and largemouth bass in 1958, 1960, 1978 and 1979. None of the bluegills and few of the bass apparently survived or spawned successfully, possibly because records as far back as 1949 described an overabundance of bullheads. MDNR conducted a manual removal of bullheads, suckers, rock bass and northern pike in 1985. Despite that effort, the fish community remained highly skewed toward brown bullheads. With the fish community reduced by the

1985 manual removal, MDNR stocked walleyes in 1986, 1987, 1988 and 1989. It was a successful effort, as the 1991 netting survey captured 25 walleyes, 76 % of them 15+ inches. The 1991 netting survey found that bullheads comprised 55 % of the total catch, while white suckers comprised 33 %. Walleyes comprised 5% of the total catch, and northern pike comprised 2%. Average size of the pike was 15.8 inches, with no pike larger than 18 inches. Despite the large number of bullheads, rock bass were present in good numbers and in good size ranges. Fish species found in 1991 were brown bullheads, largemouth bass, minnow species, northern pike, pumpkinseed sunfish, rock bass, yellow perch, walleyes, and white suckers.

MDNR manually removed bullheads again during 1992 and 1993. Nighttime boomshocking efforts in 1992 and 1993 found good survival of fingerling walleyes. The 1997 netting survey documented many positive changes in the fish community balance since the bullhead removals. Although bullheads in 1997 comprised 80 % of the catch, the northern pike biomass had risen to almost 7%. Another manual removal was conducted in 1998, concurrently with population estimates for walleyes and northern pike. Only 3.6 lbs./acre of bullheads were removed, while the population estimates were 1.4 walleyes/acre and 3.75 pike/acre. The walleyes stocked in 1998 were marked with oxytetracycline as fry to allow an estimate of contribution by stocked fish. Analysis of the sample collected later in the fall showed that every walleye fingerling captured was a stocked fish.

### **Current Status**

The 2001 netting survey found a large drop in bullhead numbers, a slight drop in walleye numbers, and an increase in northern pike numbers (Table 1). Bullheads comprised only 16% of the total catch, but with an average size of 13.2 inches. Northern pike numbers were similar to those from 1991, but their proportion of the survey biomass was skewed very high by the capture of a 37- and a 41-inch fish. Mainly because of those two fish, pike comprised 48% of the total catch biomass. Pike at 24+ inches totaled only 10% of the population, compared with 0% in 1991. Length/ frequencies of northern pike implied a heavy angling harvest (Table 2). Walleyes comprised 10% of the total biomass, and 70% were legal at 15+ inches. Walleye ages showed that we had captured fish from each age II through VIII (Table 3), with very little difference in numbers from stocked versus un-stocked years (Table 4). The results showed that there was a minor amount of natural walleye reproduction in the lake, which apparently contributed about as many fish to the population as did the stocking. The results, however, could be due to aging error, as the numbers aged were very small. The previous oxytetracycline marking effort indicated either no or else very minor natural reproduction. Less than 1% of the perch were acceptable at 7+ inches, while the total only comprised 2.9% of the catch (Table 1). Golden shiners in Bodi Lake (Table 1) provide another prey species to support the northern pike and walleye populations.

The 2004 walleye fingerling survival survey captured 51 fingerlings averaging 5.8 inches, as well as nine larger walleyes. The fingerlings from the rearing pond in 2004 were in poor shape, and we had concerns about their subsequent survival in the natural lakes. This survey went far to alleviate that concern; survival was very good. Eight of the larger walleyes ranged in size from 12.2-15.0 inches, and averaged 13.8 inches, while the last measured 19.8 inches. The larger walleyes were ages 2 and 4, which coincided with previous stocking years (Table 5).

### **Analysis and Discussion**

It appears from survey data that little walleye reproduction will result from the modest amounts of spawning habitat present. The walleye fishery will remain dependent upon MDNR priorities and fingerling availability from MDNR ponds. Anglers have lately been complaining about not being able to catch walleyes. However, similar numbers were caught in the 1997 and 2001 surveys. Both rock bass and sunfish are more numerous than they were previously, but very few of them are keeper-sized. Yellow perch were virtually non-existent in this lake until the mid-1990s. For example, three were caught in 1985, and only two were caught in 1991. The latest surveys, however, document an increase that may stimulate angler interest within a few years. The large increase in small panfish alleviated fears that walleyes were over-stocked and limiting panfish survival due to predation. A new management prescription was written in 2002 to return the stocking rate from 36 fingerlings/acre back to 50 fingerlings/acre on alternate years. Northern pike natural reproduction appears to be adequate and does not require supplemental stocking at this time.

The northern pike population is currently low, but steadily increasing, and a few trophy specimens have been documented, such as the 37- and 41-inchers netted in 2001. During the 1985 manual removal of white suckers, pike growth index was -1.1 inches. Six years later, the small pike from the 1991 survey were growing at - 4.2 inches. Another six years later, their growth rate from the 1997 survey had increased to -2.4 inches. Finally, in 2001, their growth index had increased to -1.8 inches. Implications are that removal of so many suckers, the preferred forage for northern pike, in 1985 had caused a growth problem from which they have not yet fully recovered.

A potential obstacle to maintaining a pike fishery might be lack of forage. The low numbers of pike, their size structure and their poor growth, all indicate that the population is subjected to both considerable fishing harvest and lack of forage. However, their growth rate is increasing in concert with a modest increase in numbers of white suckers. Low numbers and slow growth of yellow perch imply an overall low ecosystem productivity. In addition, low productivity combined with pike predation may help explain why the sucker population has rebounded so slowly over time. The suckers should be protected from further removal efforts. Rock bass and sunfish present a contradiction to the theory of low productivity, since their numbers are increasing. A specific management direction is to take advantage of the numerous small panfish, using them as forage for an increased number of stocked walleyes.

Another potential obstacle to management goals will be any rebound in the bullhead population. Fish community numbers in the past were probably kept in check by fingerling competition with or predation by bullheads, as well as by fishing pressure. Bullheads in 1997 were documented to be taking 4-6 inch panfish. Thinning of the bullhead population has apparently produced some increase in the catchable numbers of pike, as well as allowing perch and sunfish populations to increase. Both walleyes and northern pike are predators upon small bullheads (Carlander, 1969). Bodi Lake now supports both species, which should help keep the fish community in good relative abundance balance. Over harvest of pike in the future, however, is of special concern. Any decrease in pike numbers could allow the bullhead population to rebound and again negatively impact the fish community. The lake should be monitored periodically. Future management should give consideration to supplemental stocking of pike if recruitment becomes a problem.

One factor that may have a significant change from the 2001 survey was the lake level, which has remained 5-6 ft below normal for the past several years. The resulting beach is very wide and sandy,

with some occasional gravel. However, the extent of fish community degradation due to such low water levels is unknown.

### **Management Direction**

Fishery management goals are to provide fishable populations of walleye and northern pike. Those goals require that MDNR continue to stock walleye fingerlings at 50/acre on alternate years. The sucker population must be allowed to increase naturally without any future removals, and the bullhead population must be contained in low numbers. Even so, rock bass, pumpkinseed sunfish, and some largemouth bass will also contribute to angler creels.

### **References**

Carlander, K.D. 1969. Handbook of Freshwater Fishery Biology. The Iowa State University Press, Ames, Iowa.

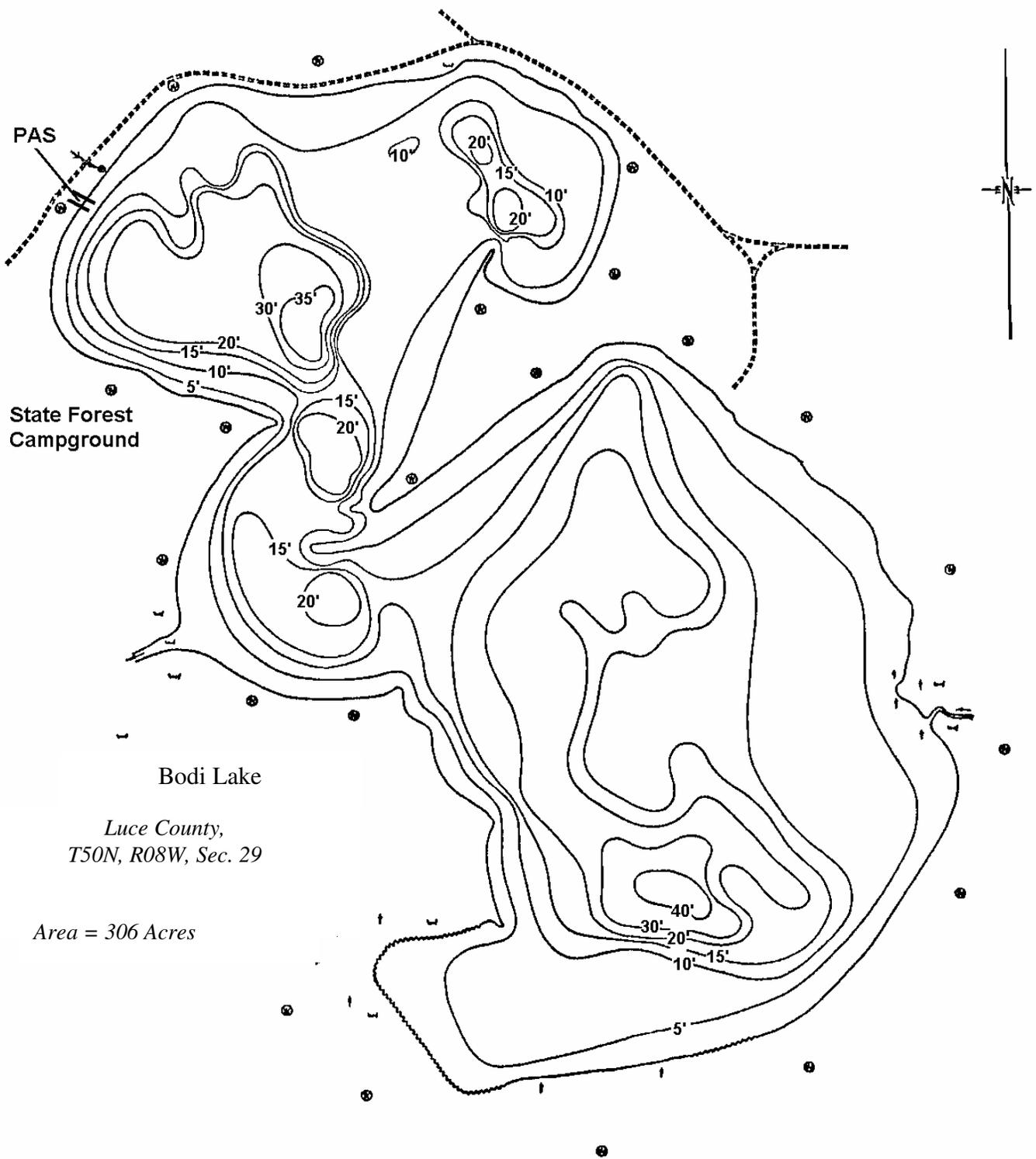


Figure 1 – Contour map of Bodi Lake, Luce County.

Table 1 – Number, weight, and length indices of fish collected from Bodi Lake with Trapnets, Fykenets, Gillnets, Seine and Boomshocking, July 2-5, 2001.

Species	Number	Percent by number	Weight (pounds)	Percent by weight	Length range (inches) <sup>1</sup>	Average length	Percent legal size <sup>2</sup>
Brown Bullhead	30	3.7	32	16.3	10 - 15	12.8	100
Golden Shiner	6	0.7	0.1	0.1	3 - 4	4.5	100
Largemouth Bass	1	0.1	2.4	1.2	16 - 16	16.5	100
Northern Pike	40	4.9	94.5	48.1	2 - 41	20.6	10
Pumpkinseed	325	39.7	14.1	7.2	1 - 8	4.6	5
Rock Bass	196	23.9	20.2	10.3	1 - 11	6.1	13
Walleye	10	1.2	19.8	10.1	11 - 22	17.5	70
White Sucker	2	0.2	7.8	4	21 - 21	21.5	100
Yellow Perch	209	25.5	5.7	2.9	2 - 10	3.8	1
Total		99.9		100.2			

<sup>1</sup>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.

<sup>2</sup>Percent legal size or acceptable size for angling.

Table 2 - Length/frequencies of fish caught during the status and trends survey in Bodi Lake, July 2-5, 2001, using fyke nets, trap nets, gill nets, seines and boomshocking.

Species	Brown Bullhead		Golden Shiner		Largemouth Bass		Northern Pike		Pumpkinseed Sunfish		Rock Bass		Walleye		White Sucker		Yellow Perch										
Legal size (in)	>=7.00		>=		>=14.00		>=24.00		>=6.00		>=6.00		>=15.00		>=		>=7.00										
Avg. length (in)	13.2		4.0		16.5		20.3		3.3		4.1		17.5		21.5		3.9										
Avg. weight (lb)	1.07		0.02		2.38		2.36		0.04		0.10		1.98		3.90		0.03										
	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.									
Total	30	32.02	6	0.12	1	2.38	40	94.45	325	14.06	196	20.20	10	19.84	2	7.80	209	5.65									
No. legal	30		0		1		4		15		26		7		0		2										
% Legal size	100%				100%		10.0%		4.6%		13.3%		70.0%				1.0%										
% Total catch	3.7%	16.3%	0.7%	0.1%	0.1%	1.2%	4.9%	48.1%	39.7%	7.2%	23.9%	10.3%	1.2%	10.1%	0.2%	4.0%	25.5%	2.9%									
CPE	1.13	1.20	0.23	0.00	0.04	0.09	1.50	3.55	12.22	0.53	7.37	0.76	0.38	0.75	0.08	0.29	7.86	0.21									
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10	1	0.55																1	0.23			3	2.62			2	1.02
11	4	2.84																		3	3.45	1	0.49				
12	5	4.51																1	0.39			1	0.63				
13	15	16.91																		1	0.79						
14	4	5.53																									
15	1	1.68																1	0.77			1	1.21				
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Sample total:	30	32.02	6	0.12	1	2.38	40	94.45	325	14.06	196	20.20	10	19.84	2	7.80	209	5.65									
All species total:	Number		819	Pounds	196.52																						

Table 3 - Weighted age frequency (percent) of five species of fish caught from Bodi Lake with Trapnets, Fykenets, Gillnets, Seine and Boomshocking, July 2-5, 2001.

Species	Ages										Number Caught
	I	II	III	IV	V	VI	VII	VIII	IX	X	
Largemouth Bass				100.0							1
Northern Pike	2.8	31.9	22.2	39.6	3.5						40
Pumpkinseed	15.4	54.3	22.7	3.5	1.0	1.0	1.4	0.4	0.4		325
Walleye		10.0	20.0	10.0	20.0	10.0	10.0	20.0			10
Yellow Perch	6.9	72.2	19.9					0.5	0.5		209

Table 4 - Bodi Lake fish stocking history, 1980 - 2006.

Date	Waters	Species	Strain	Marking	Age	Number
1986	Bodi Lake	Walleye	Manistique	none	Spring fingerling	1,079
1987	Bodi Lake	Walleye	Manistique	none	Spring fingerling	12,226
1988	Bodi Lake	Walleye	Manistique	none	Spring fingerling	10,182
1989	Bodi Lake	Walleye	Bay De Noc	none	Spring fingerling	9,817
1991	Bodi Lake	Walleye	Bay De Noc	none	Spring fingerling	8,985
1992	Bodi Lake	Walleye	Bay De Noc	none	Spring fingerling	15,080
1993	Bodi Lake	Walleye	Bay De Noc	none	Spring fingerling	10,470
1993	Bodi Lake	Walleye	Bay De Noc	none	Fall fingerling	941
1994	Bodi Lake	Walleye	Bay De Noc	none	Spring fingerling	10,000
1995	Bodi Lake	Walleye	Bay De Noc	none	Spring fingerling	15,017
1996	Bodi Lake	Walleye	Bay De Noc	none	Spring fingerling	14,950
1998	Bodi Lake	Walleye	Bay De Noc	oxytetracycline	Spring fingerling	10,912
2000	Bodi Lake	Walleye	Bay De Noc	none	Spring fingerling	10,100
2002	Bodi Lake	Walleye	Bay De Noc	none	Spring fingerling	8,381
2004	Bodi Lake	Walleye	Bay De Noc	none	Spring fingerling	12,000
2006	Bodi Lake	Walleye	Bay De Noc	none	Spring fingerling	12,177