

Lake of the Woods
LaGrange County
Supplemental Largemouth Bass Evaluation

Date of Survey: April 26, May 2 and 10, 2010

Biologist: Neil D. Ledet, District 2 Fisheries Biologist

Objective: The objective of this survey was to evaluate the largemouth bass population in accordance with work plan 300FW1F10D43612.

Methods: Fish collection effort consisted of 5.20 hours of pulsed D.C. nighttime electrofishing over three nights. Only largemouth bass were collected. Two dip netters were used and the entire shoreline was covered each night. Bass were measured to the nearest 0.1 in TL and marked by removing a fin. Based on the number of marked and unmarked bass that were collected, a population estimate was made using the Schnabel method. Due to the difficulty in collecting sufficient numbers of smaller bass, stock size bass, (those 8 in TL and larger) were used for analysis. Scales were also taken to determine age and growth.

Results: A total of 1,028 unmarked and 155 marked largemouth bass was collected. These fish ranged in length from 4.5 to 19.3 in TL and were collected at a rate of 227.5 per electrofishing hour (Table 1). Age-2 through age-10 fish were represented in the sample. Only 2.9% of the unmarked bass were legal size, 14 in TL or larger. Largemouth bass growth was below average for northeast Indiana natural lakes (Table 2).

The Lake of the Woods largemouth bass population for all sizes was estimated at 2,843 fish (20.9 per acre). Of these, 2,281 (16.8 per acre) were stock size. Bass 12 in TL or larger were estimated at 5.1 per acre while legal size bass were estimated at only 0.6 per acre (Table 3).

Discussion: Lake of the Woods is a 136 acre natural lake located south of Stroh, Indiana on the Steuben-LaGrange county line. It has an average depth of 40 feet and a maximum depth of 84 feet. Gravel, sand and marl dominate the lake bed. The deep basin and lakebed substrate influences overall lake productivity. Although several species of aquatic plants have been documented in the lake, abundance appears limited. Approximately 60% of the shoreline is developed with summer cottages or permanent homes. The remaining shoreline is undeveloped and dominated by woods. This natural shoreline and the woody material that has fallen into the lake from this area are providing unique and important aquatic habitats.

In 1976, Lake of the Woods experienced a cisco die-off that appears to have been complete. The layer of cold, well oxygenated water has declined over the year which is vital for this coldwater species. Based on fish community surveys conducted in 1977 and 1984, largemouth bass, bluegill and yellow perch dominated the fishery (Appendix 1). Combined, these species represented between 57.4% and 69.9% of the fish community by number and the fishery was considered satisfactory, especially for a deep, relatively unproductive lake.

Harvestable size bass represented 2.2% and 2.0% of the 1977 and 1984 bass samples respectively. In spite of imposition of a 12 inch minimum size limit in 1992 (which increased to 14 inches in 1998) and sampling during the prime spring spawning period, only 2.9% of the bass collected in 2010 were harvestable size. Bass population estimates at Lake of the Woods were not conducted prior to implementing the minimum size limit. However, based on the average estimates conducted on similar sized lakes, the Lake of the Woods bass population has only increased by 5.4 fish per acre since imposition of the size limit. The average increase for similar size lakes is 8.7 per acre. The number of legal size bass per acre in Lake of the Woods is actually lower than the natural lake average prior to the limit.

Largemouth bass growth in Lake of the Woods has historically been average or below (Appendix 2). In 2010, growth for all year classes was below average despite densities that were also below average. Below average growth is not surprising in cases where bass dominate the fish community by number.

The number of legal size bass has also been historically low in Lake of the Woods. Considering the decline in growth and generally low average bass density, lake productivity is considered a more significant factor in the quality of the bass population than angler harvest.

Marl bottom lakes are less productive than muck bottom lakes. As marl is suspended from the lake bed due to wind and boat generated waves, it ties up nutrients that would otherwise be available for production of aquatic life. Lake of the Woods lies in an east west direction which allows waves generated from the prevailing west wind to pound the east shore. When you include the intensive power boating on the lake and additional wave refraction from bulkhead seawalls, the suspension of marl may magnify nutrient loss and contribute to the low overall lake productivity.

Although the benefits of the existing 14 inch minimum size limit at Lake of the Woods are less than clear, it's also not apparent that implementing a different limit would improve the bass population. Until the Division of Fish and Wildlife develops criteria for changing the standard regulations, the present limits should remain in effect.

Recommendations:

1. Property owners should re-facing their existing bulkhead seawalls with glacial stone to reduce wave refraction and the suspension of marl
2. The lake association or interested anglers should construction brush pile fish attractors.

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Date: 2/21/2011

Approved by: Stu Shipman, North Region Fisheries Supervisor
Date: 2/24/2011

Table 1. Number, percentage and age of Lake of the Woods largemouth bass, April - May 2010

TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AGE OF FISH
1.0				19.0	2	0.2	9,10
1.5				19.5	1	0.1	N/A
2.0				20.0			
2.5				20.5			
3.0				21.0			
3.5				21.5			
4.0				22.0			
4.5	2	0.2	1,2	22.5			
5.0	7	0.7	2	23.0			
5.5	17	1.7	2	23.5			
6.0	28	2.7	2	24.0			
6.5	33	3.2	2	24.5			
7.0	36	3.5	2,3	25.0			
7.5	41	4.0	2,3	25.5			
8.0	84	8.2	3	26.0			
8.5	114	11.1	3	TOTAL	1028		
9.0	72	7.0	3,4				
9.5	65	6.3	3,4				
10.0	49	4.8	3,4				
10.5	44	4.3	4				
11.0	82	8.0	4,5				
11.5	93	9.0	5,6				
12.0	108	10.5	5,6				
12.5	67	6.5	5,6				
13.0	27	2.6	5,6				
13.5	29	2.8	6				
14.0	13	1.3	6,7				
14.5	4	0.4	6,7				
15.0	3	0.3	6,7				
15.5	1	0.1	6				
16.0	2	0.2	6,7				
16.5	1	0.1	6,7				
17.0	2	0.2	N/A				
17.5	1	0.1	8				
18.0	0	0.0					
18.5	0	0.0					

Table 2. Back calculated lengths at annulus formation, Lake of the Woods, April-May 2010.

Species	Largemouth bass	Year Class	Number Aged	Back Calculated Length(inches)at Each Age								
				I	II	III	IV	V	VI	VII	VIII	
Intercept = 0.8		2009	2	2.8								
		2008	47	2.8	5.9							
		2007	43	2.9	5.6	8.2						
		2006	32	2.8	5.6	7.9	10.2					
		2005	24	2.7	5.6	8.5	10.5	12.0				
		2004	32	2.6	5.7	8.7	10.7	12.1	13.3			
		2003	6	2.9	5.6	8.9	11.1	13.0	14.1	14.9		
		2002	2	3.2	6.4	10.0	11.8	13.9	15.2	16.2	17.1	
		Average Length		2.8	5.7	8.4	10.6	12.4	13.7	14.9		
		Standard Deviation		0.11	0.14	0.41	0.38	0.55	0.54			
		Yr. Classes Averaged		6	6	5	4	3	2	1		

Table 3 Average number of largemouth bass per acre in medium size natural lakes (100-499 acres) in Indiana prior to and following the imposition of a 14" minimum size limit. Number of lake populations included in the average in ().

Size range (inches)	Average pre-size limit (21)	Average post-size limit (8)	Lake of the Woods 2010
≥ 8.0 in	11.4	20.1	16.8
≥ 12.0 in	3.1	8.1	5.1
≥ 14.0 in	1.7	3.1	0.6

Appendix 1. Species and relative abundance of fish collected from Lake of the Woods using gill nets and nighttime AC or DC electrofishing during fish community surveys, 1977 and 1984.

Species	1977	Percent	1984	Percent
Largemouth bass	88	26.0	197	33.1
Bluegill	58	17.2	141	23.7
Yellow perch	48	14.2	78	13.1
Warmouth	36	10.7	42	7.1
Yellow bullhead	28	8.3	14	2.4
Green sunfish	25	7.4	55	9.2
Brown trout	24	7.1	0	
Bowfin	8	2.4	2	0.3
Black crappie	7	2.1	10	1.7
White sucker	6	1.8	15	2.5
Pumpkinseed	3	0.9	6	1.0
Redear sunfish	2	0.6	3	0.5
Redfin pickerel	2	0.6	8	1.3
Lake chubsucker	2	0.6	9	1.5
Northern pike	1	0.3	0	
Rainbow trout	0		12	2.0
Channel catfish	0		1	0.2
Carp	0		1	0.2
Pirate perch	0		1	0.2
Electrofishing effort	1 h AC		1 h DC	
Gill net effort	12 lifts		10 lifts	

Appendix 2. Average length at last annulus formation for Lake of the Woods largemouth bass, 1977, 1984 and 2010.

Survey Year	Length (inches) at last annulus formation at each age							
	1	2	3	4	5	6	7	8
1977**	3.1	5.0*	6.6	9.2				
1984	3.8	6.7	8.9					
2010	2.8*	5.9	8.2	10.2	12.0	13.3	14.9	17.1*
Natural Lakes Average	3.5	6.9	9.5	11.6	13.4	14.7		

*only two fish aged

**Zero intercept