

## **DONNELL LAKE**

Cass County (T6S, R14W, Sec. 35, 36)  
Surveyed June 1-3, and June 30, 1992

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### **Environment**

Donnell Lake lies in central Cass County in southwest Michigan, 1 mile southeast of the town of Vandalia. The 4,659-acre watershed drains to Christiana Creek which flows south to the St. Joseph River.

Rolling hills composed of sandy glacial outwash and gravel characterize the geography of the area. The watershed of this natural lake is comprised of 52% forest or abandoned farm fields, 28% active farms, 9% lakes, 8% wetlands, and 3% urban (Michigan State University [MSU] 1994). The immediate riparian area around the lake accounts for the urban percentage. The single inlet enters Donnell Lake on the east side. It drains Lime, Buck and Lewis lakes. An outlet exists on the southwestern shore, south of the public access. It feeds Paradise Lake, which in turn outlets to Christiana Creek.

Donnell Lake is 246 acres in size and up to 63 feet deep ([see map of Donnell Lake](#)). It has a flushing rate of 1.11 years (Water Quality Investigators 1994). There is a small island (2 acres) on the eastern side of the lake. Shoal areas (less than 20 feet deep) account for about 35% of the surface area of the lake. Vegetation is sparse except for *Chara* and certain submergent species in the littoral zone.

Water quality conditions were surveyed on September 4, 1992. The water had a light green color, and a Secchi disk reading of 6.5 feet. Often, the water is more transparent (Water Quality Investigators 1994). Within the water column, alkalinity ranged from 140 ppm to 168 ppm and the pH was 8.5 at the surface. These values indicate that the water is hard and well buffered. Water temperature varied from 67.6F at the surface to 44.4F at the bottom (60 feet), with the thermocline occurring at 17-27 feet. Oxygen levels during this survey dropped below 3.0 ppm at 23 feet. Limnological data was collected previously in 1985 and 1956. All values were similar to those collected in 1992, with the exception that oxygen declined to 3.0 ppm at a depth of 30 feet on August 22, 1985. Even back in 1956 oxygen levels dropped below 3.0 ppm at the 20- to 25-foot level.

Several years ago the Donnell Lake area was recognized as having serious problems with nitrate contaminated wells (MSU 1994). Groundwater is seriously degraded with nitrate, with shallow wells often exceeding the EPA drinking water standard of 10 mg/l. Water sampling conducted by MSU found both nitrate and ammonia levels to be elevated at the inlet to Donnell Lake.

In an effort to solve this problem, MSU and Western Michigan University (WMU) received a nonpoint source pollution grant from Michigan Department of Environmental Quality (MDEQ), Surface Water Quality Division (SWQD) to study the problem. Results to date (funding ends in 1998) show that the most likely source of the widespread nitrate contamination is excessive animal manure in pastures or excessive application of manure from confinement facilities to cropland. This area of Cass County is well known for its number of pigs (pigs out number people 4:1). The combination of too many pigs in a given pasture for too long a period resulted in excessive compaction of soil and led to serious runoff and erosion problems. Through the efforts of this project, education and technical assistance is being directed primarily towards agriculture. Thousands of pigs are either being moved out of the watershed, or into confinement where the manure can be better managed. There are also plans to provide sewers to all Donnell Lake residents by 1998.

Development around Donnell Lake is heavy with a combination of primary residences and cottages. The only state owned property along the lake is the public access site. Presently, it has a dirt parking lot with a hard surfaced ramp. The lot can accommodate up to 15 vehicles with trailers.

### **Fishery Resource**

According to historical records, Donnell Lake has been managed by the state since at least 1887. In 1887 gill nets were used for one night. Smallmouth bass, perch, and herring were noted as present. The lake at that time was undeveloped, with the shores described as "flat and marshy with soft grassy shores." Between 1934 and 1944, the state stocked various combinations of bluegill, largemouth bass, and yellow perch.

A major survey of the lake was conducted in September 1956. The survey utilized a seine and 22 gill net sets. Gill nets were set as deep as 47 feet. Results showed a typical warm water fish community dominated by bluegill, largemouth and smallmouth bass, yellow perch, black crappie, longnose gar, and northern pike. Forage fish were very abundant, including brook silversides. However, no lake herring (ciscoe) were collected. Game fish appeared to be growing well, but it is interesting to note the survey reported that "fishermen complain of poor fishing, even though the fish are there." What makes this intriguing is that a similar complaint is on file from a 1961 letter, and it was the same complaint in 1990 that prompted the 1992 survey. The person who wrote in 1961 believed fishing to be poor, especially during the summer months, due to the abundance of natural food, especially the "millions of wigglers" (burrowing mayflies).

Anglers have requested walleye stocking since the mid 1950s. The state did stock walleye in 1975 (500,000 fry) and 1976 (50,000 spring fingerlings). However, boomshocking surveys during fall 1975 and 1978 found no walleye survival. The fish community was similar to that found in the 1956 survey.

The fish community was most recently surveyed on June 1-3, and June 30, 1992. Effort entailed the use of four standard trap nets (6'x3'x1.5" mesh), four experimental gill nets

125'), and two mini/maxi fyke nets. All nets were set for two nights. Boomshocking (220-V DC) was also conducted for 1 hour at night.

The 1992 survey showed that today's fish community (Table 1) is very similar to that of 40 years ago, and most likely to that of 100 years ago, with the exception that ciscoe appear to have been extirpated. Gill nets were set to depths of 37 feet, which should have been ample to collect ciscoe. Bluegill, yellow perch, largemouth and smallmouth bass, black crappie, and northern pike make up the primary game fish community.

This was the first survey in many years within this district in which a bluegill exceeding 10 inches in length was caught. Bluegill, overall, were very impressive looking. However, by Schneider's index (1990) for bluegill classification, the population ranked only as average based on trap net data and poor-average based on electroshocking data. Growth of bluegill was at the state average rate (Table 2). Ten year classes of bluegill were present, and the estimated age frequency (Table 3) shows good survival through age V, but what appears to be variable recruitment in earlier years (age I-III). Over 50% of the total bluegill catch was of acceptable size (greater than 6 inches).

Largemouth bass were quite abundant. Less than 5% of the catch was of acceptable size (12 inches). Growth rates were below state average (Table 2), but recruitment levels were excellent (Table 3).

Yellow perch were collected for seven age classes, up to 12 inches in size. Growth rates were well above state average and recruitment was very good.

Northern pike are reproducing well in this system. Five age classes were collected, and growth was well above state average. Recruitment rates were good, and over 60% of the collection was of legal size. Northern pike also appear to be more prominent in the community than they were 40 years ago. Most pike populations in southwestern Michigan show the opposite (a declining) trend.

Only five smallmouth bass were collected. These were represented by age groups I and V. Our sampling was probably not representative of the overall population, although based on previous surveys it would be safe to assume that they are not nearly as abundant as largemouth bass.

Other fish species available to anglers include rock bass and bullheads. Bullheads were collected up to 15 inches in size. Black crappie are also available, but not many were collected during the survey. Growth rates for black crappie were well above state average, and age classes I-IV were present.

Overall, Donnell Lake contains a productive fishery that offers anglers an excellent opportunity for a quality angling experience. There are no outstanding problems with the present fishery. This lake compares equally to many Cass County lakes with similar fish communities. However, for unknown reasons, the fish tend to be difficult for anglers to catch.

## Management Direction

Donnell Lake should continue to be managed for a warmwater fishery. The physical environment of the lake is such that a two-story fishery with trout should be possible, but high abundance of northern pike and marginally low dissolved oxygen in the thermocline may not allow trout to survive (if stocked).

I believe that the extirpation of the ciscoe, a cold-water species, was due to low oxygen levels within the thermocline. Latta (1995) in a review of the status of all ciscoe lakes in Michigan, concluded they were extirpated from Donnell Lake for "causes unknown." Ciscoe were actually netted in 1887, but only reported to be present in 1947 when the lake was mapped. In the 1940s and 1950s, Donnell Lake was included on a list of lakes open to gill netting and spearing for ciscoe. This suggests ciscoe were present at that time and raises the possibility that excessive gill netting could have been a factor in their demise.

Water quality issues are being addressed at this time through funding by MDEQ, SWQD, Act 319 program. Considerable progress is currently being made in improving existing water quality problems, primarily in groundwater (MSU 1994).

The Fisheries Division's goal for Donnell Lake is to maintain the excellent warmwater fishery well into the next century. Development along the shores of the lake is about at saturation, and with continued improvement in water quality the aquatic environment should be even better than it is today. A survey needs to be conducted in fall (November) to verify extirpation of the ciscoe population. This is part of a plan to evaluate the status of all known ciscoe populations in the district over the next 10 years.

Potential obstacles to maintainance of the excellent fishery include increasing public use of Donnell Lake by jet skis and power boats, and lack of implementation of water quality study findings to improve groundwater. There has been consistent concern voiced by lake riparians regarding "overuse" of this lake by power boats and jet skis. There has also been concern that jet skis are out on the lake earlier each year, perhaps harming spawning by certain species of fish. However, that was not confirmed by 1992 survey data on fish recruitment.

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## References

Latta, W. C. 1995. Distribution and abundance of the lake herring (*Coregonus artedii*) in Michigan. Michigan Department of Natural Resources, Fisheries Research Report 2014, Ann Arbor.

Michigan State University and Western Michigan University, 1994. Cass County studies: Surface and Groundwater, Central Cass County, Michigan. Executive summary. Lansing.

Schneider, J.C., 1990. Classifying bluegill population from lake survey data. Michigan Department of Natural Resources, Fisheries Technical Report 90-10, Ann Arbor.

Water Quality Investigators. 1994. Fusilier's Atlas and Gazetteer of Michigan Lakes, Volume IV, Dexter.

**Table 1** Number, weight, and length (inches) of fish collected from Donnell Lake with trap, gill, and fyke nets and DC boomshocker, June 1-3, and June 9, 1992.

Species	Number	Percent by number	Weight (pounds)	Percent by weight	Length range (inches) <sup>1</sup>	Average length	Percent legal size <sup>2</sup>
Bluegill	1790	61.1	184.1	34.6	2-10	5.8	51 (6)
Pumpkinseed	112	3.8	25.1	4.7	2-8	6.3	71 (6)
Yellow perch	78	2.7	14.3	2.7	3-12	6.8	42 (7)
Black crappie	16	.5	6.2	1.2	4-12	8.5	81 (7)
Hybrid sunfish	9	.3	1.2	.2	3-6	5.6	33 (6)
Rock bass	34	1.2	5.8	1.1	2-8	5.7	47 (6)
Green sunfish	72	2.5	5.7	1.1	2-6	4.4	14 (6)
Largemouth bass	351	12.0	78.8	14.8	3-19	6.3	5 (12)
Smallmouth bass	5	.2	2.4	.4	5-15	7.9	20 (12)
Brown bullhead	11	.4	11.7	2.2	10-15	13.0	100 (7)
Yellow bullhead	35	1.2	22.8	4.3	7-12	10.7	100 (7)
Northern pike	14	.5	33.5	6.3	13-29	21.0	64 (20)
Warmouth	53	1.8	9.8	1.8	3-8	6.0	53 (6)
Golden shiner	5	.2	.9	.2	7-8	8.3	-
White sucker	6	.2	11.4	2.1	13-19	16.5	-
Spotted gar	12	.4			18-29	23.8	-
Longnose gar	48	1.6	101.0	19.0	18-36	28.2	-
Bowfin	5	.2	17.3	3.3	15-24	20.9	-
Grass	1	.0	-	-	9	9.5	-

pickerel										
Fathead minnow	2	.1	-	-	2	2.5	-			
Common shiner	1	.0	-	-	7	7.5	-			
Sand shiner	254	8.7	-	-	1-2	2.2	-			
Bluntnose minnow	18	.6	0.1	-	2	2.5	-			
Brook silverside	12	.4	-	-	3	3.5	-			
Logperch	4	.1	-	-	3	3.5				
Total	2948	100.0	532.1	100.0						

<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 parenthesis in inches.

**Table 2** Average total weighted length (inches) at age, and growth relative to the state average, for fish sampled from Donnell Lake with all gear, June 1992. Number of fish aged is given in parentheses.

Species	Age										Mean growth index <sup>1</sup>
	I	II	III	IV	V	VI	VII	VIII	IX	X	
Bluegill	1.9 (12)	2.8 (10)	4.0 (16)	5.9 (25)	7.1 (15)	8.4 (7)	9.3 (1)	9.5 (6)	9.8 (2)	9.8 (1)	-0.6
Largemouth bass	4.3 (32)	6.5 (17)	9.3 (21)	10.9 (14)	11.6 (7)	14.0 (1)	-	-	-	-	-1.6
Yellow perch	4.2 (21)	6.0 (11)	8.3 (14)	9.8 (12)	10.8 (4)	12.4 (1)	9.7 (1)	-	-	-	+1.0
Northern pike	14.6 (4)	17.2 (2)	25.0 (5)	22.9 (3)	21.1 (1)	-	-	-	-	-	+3.2
Smallmouth bass	5.9 (4)	-	-	-	15.5 (1)	-	-	-	-	-	-

Black crappie	4.7	7.9	9.4	-	-	-	12.5	-	-	-	+1.4
	(1)	(7)	(6)				(1)				

<sup>1</sup>Mean growth index is the average deviation from the state average length at age.

**Table 3** Estimated age frequency (percent) of fish caught from Donnell Lake with all gear, June 1992.

Species	Age								Number caught
	I	II	III	IV	V	VI	VII	VIII	
Bluegill	2	7	14	50	22	5	0	1	1119
Largemouth bass	60	13	12	10	5	0	-	-	351
Yellow perch	42	16	18	16	5	1	2	-	78
Northern pike	21	14	36	21	7	-	-	-	14
Smallmouth bass	80	-	-	-	20	-	-	-	5
Black crappie	6	44	38	-	-	-	6	-	16

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