Little Shag Lake
Marquette County, T45N, R25W and 26W, several sections
Escanaba River watershed

Darren Kramer

Environment

Little Shag Lake is located in south-central Marquette County, about 2.5 miles southwest of the village of Gwinn. It is 103 acres in size and has a maximum depth of approximately 35 feet (Figure 1).

The area surrounding Little Shag Lake lies within the Dickinson subsection of the Northern Lacustrine-Influenced Upper Michigan and Wisconsin regional landscape ecosystem classified by Albert (1995), and is characterized by features identified in the Gwinn sub-subsection. This area is a poorly drained, broad outwash plain, but also includes areas of droughty outwash. Exposed bedrock can be found at the margins of the outwash plain on the western edge of the sub-subsection. Soils found in the southern section of the Gwinn sub-subsection have thick, acidic, organic soils over sand or sandy loam, while soils found in the northern part surrounding Little Shag Lake are characterized by excessively-drained sandy soils. Principle soil associations found in the vicinity of Little Shag Lake are the Rubicon and Kalkaska sands, Amasa very fine sandy loam, and Karlin sandy loam (United States Department of Agriculture 2008).

Prior to modern settlement, white pine and hemlock stands were locally dominant along the margins of kettle lakes. Accordingly, pre-settlement vegetation in the vicinity of Little Shag Lake consisted of white and red pine with some northern hardwoods located along the steeply sloped channels of outwash plain. The immediate shoreline surrounding Little Shag Lake today consists of wooded uplands and a mixture of low and steep slopes that support a birch, maple, and pine-hemlock forest community.

The perimeter of Little Shag Lake has been extensively developed with seasonal and summer dwellings. Natural riparian zone habitat, such as downed trees and brush (deadwood), has been removed for several decades to improve swimming, boat dockage, and aesthetics. A public-access boat launch is located on the southern shoreline and is maintained by the Michigan Department of Natural Resources (MDNR)(Figure 1). Little Shag lake does not have any inlets or outlets.

Limnological characteristics were last measured on August 21, 2007 (Table 1). The water was clear with a Secchi disk reading of 20 feet. Temperature varied from 74 F at the surface to 50 F near the bottom. Dissolved oxygen ranged from 7.2 ppm to 13.5 ppm, which is sufficient to support aquatic life throughout the entire water column during the summer. The pH ranged from 7.2 to 8.2, indicating that the water is slightly basic. Alkalinity was 14 mg/L, while ammonia-N, chlorophyll-a, nitrate/nitrite, and total phosphorus were below limits of detection. Therefore, water quality is considered to be very good.

Little Shag Lake supports a two-story fishery, which includes a warm- and coolwater fish community (e.g. bluegill and smallmouth bass) in the shallow areas of the lake and a coldwater population of rainbow trout in the deeper locations. The littoral zone is limited, and steep drop-offs to deeper water

are common. The lake bottom consists of mostly sand with some gravel and larger rock scattered along the shoreline. Very little aquatic vegetation is present but some pondweed (Potamogeton spp.), water-nymph or naiad (Najas spp.), and muskgrass (Chara spp.) have been observed.

History

Little Shag Lake has a long history of fisheries management by the MDNR. File records indicate that Little Shag Lake was stocked once with northern pike fry in 1934, while largemouth bass, smallmouth bass, and bluegill fingerlings were stocked from 1934-1943. In subsequent years, Little Shag Lake developed a reputation for providing above average to good sport fishing for bluegill, yellow perch, and bass.

A cursory habitat survey in 1973 resulted in a discussion about the possibility of stocking a trout species to diversify the angling experience. Subsequent requests from local citizens and riparians prompted a survey of the fish community in 1976. Survey results indicated a fish community consisting of smallmouth bass, largemouth bass, bluegill, pumpkinseed, yellow perch, green sunfish, and a large population of white suckers. Bluegills and sunfish were common and of an acceptable size to anglers, but the average length of yellow perch was considered to be on the small side (7.8 inches). Largemouth bass and smallmouth bass were captured in approximately even numbers. A manual removal of white suckers was completed in May 1978 and 2,500 rainbow trout yearlings were stocked shortly thereafter (Table 2).

Other fish community assessments have occurred on Little Shag Lake in 1979, 1985, 1991, 1996, and more recently in 2001. These assessments documented the presence of 13 fish species (Table 3). Another manual removal of suckers was undertaken in the spring of 1986 after the 1985 survey indicated a growing white sucker population.

Rainbow trout were primarily stocked from 1978 until results of the 1991 fisheries survey indicated a declining rainbow trout population (consistent with angler reports) and increasing minnow and yellow perch populations. Management direction changed in 1992 with cessation of rainbow trout stocking. Instead, splake and brown trout stocking was implemented with the intent that these fish would prey upon the growing yellow perch and minnow populations. Splake were stocked from 1992 to 2001, and brown trout were stocked from 1997-2006 (Table 2).

The 1996 fisheries survey indicated only fair splake and bluegill fisheries, and by 2001, the splake fishery had declined in concert with the greater-than expected decline in numbers of yellow perch and minnows. At the same time, the smallmouth bass population appeared to be increasing. Thus, splake stocking was discontinued and the rainbow trout stocking resumed. Yearling rainbow trout have since been stocked from 2002-2007 at an average rate of 35 fish/acre.

Current Status

In June and August of 2007, Fisheries Division conducted a Status and Trends survey on Little Shag Lake. Five fyke nets were fished at 9 locations for 3 nights from June 16-18. In addition, two experimental gill nets were fished at 4 locations for 2 nights, two mini-fyke nets were fished at two

locations for 1 night, and four 25-foot seine tows were made at 4 locations near the shoreline during the same 3-day period. The three ten-minute night electrofishing runs on August 1 were also conducted at 3 separate locations around the shoreline. Each fish captured during the survey was measured for length, and a sample of scales was collected from common sportfish for age and growth analysis. All fish were then returned to the lake.

A total of 2,252 fish representing 9 species were collected during the combined June and August efforts. Bluegill (N=797) and bluntnose minnow (N=715) were the most abundant fish, comprising 85% of the total catch by number and 59% by weight (Table 4). Only 1 white sucker (18.5 inches long) was caught.

Three panfish species were captured during the survey. Bluegill averaged 5.8 inches in total length and comprised 54% of the total survey catch by number (Table 4). They ranged from 1 to 10 inches in length, with 46% of the fish meeting or exceeding the acceptable harvest length of 6 inches (Tables 4 and 5). Age-growth data indicate that bluegills are growing close to the state average with a mean growth index of -0.4 (Table 6). The age distribution indicates sufficient recruitment with good representation of fish from 1 to 8 years old (Table 6). Bluegill longevity peaks at age 7 in Little Shag Lake, with fewer older fish surviving due to either natural mortality or angler harvest. Green sunfish (N=54) averaged 5.1 inches in total length and comprised 2% of the total survey catch by number (Table 4). Green sunfish ranged from 2 to 7 inches, with 24% of the fish meeting or exceeding the acceptable harvest length of 6 inches (Table 5). Only one rock bass (12.5 inches long) was captured.

The thirty-nine yellow perch caught during the survey averaged 8.5 inches in total length and comprised 4% of the total survey catch by number (Table 4). These fish ranged from 4 to 11 inches, with 85% meeting or exceeding the acceptable harvest length of 7 inches (Tables 4 and 5). Age-growth data indicate that yellow perch are growing close to the state average with a mean growth index of +0.6. The age distribution indicates good representation of yellow perch from 2 to 5 years old (Table 6), with longevity peaking at age 8.

Largemouth bass (N=93) and smallmouth bass (N=81) averaged 7.7 and 8.6 inches in total length, respectively, and when combined comprised 8% of the total survey catch by number (Table 4). Largemouth bass ranged from 4 to 18 inches with 3% of the fish meeting or exceeding the minimum harvest length of 14 inches, while none of the smallmouth bass ranging from 3 to 12 inches met the minimum length limit (Tables 4 and 5). Age-growth data indicate that both bass species are growing well under the state average. Mean growth index was -2.2 for largemouth bass and -3.5 for smallmouth bass. The age distribution indicates sufficient recruitment with good representation of bass from ages 2 through 7 (Table 6). Similar to bluegills, few bass in Little Shag Lake survive to older age classes as a result of either natural or angling mortality.

A total of 23 rainbow trout were caught during the survey. These stocked fish averaged 11.5 inches in total length and comprised 1% of the total survey catch by number (Table 4). Rainbow trout ranged from 8 to 18 inches, with 35% meeting or exceeding the minimum harvest length of 10 inches (Tables 4 and 5). Age-growth data indicate that these fish are growing above the state average with a mean growth index of +1.2. The age distribution indicates good representation of rainbow trout ages 1 through 3 (Table 6). Rainbow trout longevity in Little Shag Lake appears to peak at age 3 due to natural mortality or angler harvest. No brown trout were captured during the 2007 survey.

Analysis and Discussion

Bluegill can play a key role in fish community structure and overall sportfishing quality in Michigan waters (Schneider 1981). Schneider (1990) suggested that indices of bluegill population characteristics can be used to classify populations. The "Schneider Index" uses size scores from survey length frequency and growth data and relates them to an objective ranking system from "very poor" to "superior". Using the Schnieder Index to classify the bluegill population, Little Shag Lake scored 6.75 for a "superior/excellent" rank (Table 7). Low numbers of bluegills captured in the 1996 and 2001 surveys preclude the comparison of the Schneider Index between the populations in 1996, 2001 and 2007.

Total numbers of bluegill captured, as well as catch-per-effort, increased several-fold from the 1996 and 2001 surveys as compared to the 2007 survey. Bluegill growth rates for the population have remained relatively constant since 1996 but finer analysis of growth rates from the 2007 survey indicate that age groups 1-4 are experiencing slow growth (approximately 1 inch below the state average), while bluegill age 5-8 are experiencing growth at or slightly above the state average. Since growth of bluegill is typically density-dependent, it is reasonable to assume that there is intense competition for prey (i.e., zooplankton) among the smaller age-classes of bluegill. Over time, both natural and angling mortality will remove larger and older bluegill from the lake, and the reduced population of larger and older fish will express satisfactory growth as long as sufficient forage is available. Currently, bluegills up to 10 inches are available, and sufficient numbers of fish above 6 inches are present for anglers to harvest. However, this may change if large numbers of slow-growing bluegill survive to the older age-classes.

The yellow perch population appears to be fairly small, but length-frequency characteristics indicate that fish from 7-11 inches long are available to the angler. The majority of the population sampled was in the 8-9 inch classes and ages 4-5.

The largemouth bass and smallmouth bass populations are similar to those found in previous fisheries surveys. Both populations are supported through natural reproduction although some year's reproduction is more successful than others, as is typical with most fish species due factors such as but not limited to year-to-year variability in weather conditions. Growth rates for largemouth and smallmouth bass are 2.3 and 3.7 inches below state average, and negative growth rates for both species has been a persistent problem in Little Shag Lake for more than 35 years. Habitat deficiencies relating to the bass populations were identified in the early 1970's.

Rainbow trout stocking is providing an attractive fishery and angling diversity in Little Shag Lake and the Northern Lake Michigan Management Unit. Rainbow trout are growing well at 1.2 inches over the state average, and are of legal size when they are 2-3 years old. Larger-size fish are also available to the angler; several fish 15-18 inches in length were captured during the 2007 survey.

Management Direction

Little Shag Lake has maintained a good reputation for bluegill and rainbow trout fisheries, and management should continue to focus on these species. Yellow perch, while low in number, are growing well and providing fish up to 11 inches. Slow-growing largemouth and smallmouth bass populations have been a persistent problem for many years and fish are still recruiting slowly to harvestable size limits. Largemouth and smallmouth bass are top predators that are needed to maintain the size structure of the panfish population, thus preventing over-population of these species.

There is no natural reproduction of rainbow trout to sustain the fishery, therefore the current stocking program should continue. Given the past and current success of the stocking program, increasing the stocking rate is not recommended. Currently, growth rates for bluegill and rainbow trout are acceptable, and increasing the rainbow trout stocking rate could add additional pressure to the forage base (i.e., zooplankton and macroinvertebrates), in turn negatively affect growth rates. Reduced growth rates of species that anglers target would result in a longer period for fish to recruit to harvestable sizes, causing a reduction in fish available for harvest. Management recommendations are to continue stocking yearling rainbow trout at an annual rate of 35 fish/acre.

Trout are typically stocked on an annual basis to provide a fishery for anglers. Brown trout were stocked in 2003 and 2006 at a rate of 7-10 fish per acre to provide angling diversity and utilize the minnow forage base. No brown trout were captured during the 2007 survey. Given the already intense competition for small forage by the native smallmouth and largemouth bass populations, the stocking program for brown trout should be discontinued to reduce the pressure on the forage base and put the brown trout hatchery stock to use in a better location.

Future management should focus on improving physical habitat deficiencies that are likely having a negative effect upon the fish community. Information from the Little Shag Lake file indicates that biologists considered the near-shore habitat (i.e., deadwood) for largemouth bass and smallmouth bass to be in a degraded state in 1973 due to lot clearing for cottage and home development. Natural lakes can have deadwood (2-inch and larger) abundances of 470 to 1,545 pieces per mile, but aggressive logging practices and development of lake shorelines have reduced inputs of deadwood to Michigan lakes for over 100 years (O'Neal and Soulliere 2006). Deadwood is a vital component of a healthy and diverse habitat in the littoral zone because it provides habitat for a multitude of animals including invertebrates, reptiles, birds, mammals, and fish. Rehabilitation programs designed to compensate for loss of deadwood in Little Shag Lake should be considered. Staff from the MDNR and riparian landowners should work cooperatively to implement a habitat rehabilitation program for the littoral zone.

References

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Figure 1.-Hydrographic contour map of Little Shag Lake, Marquette County.

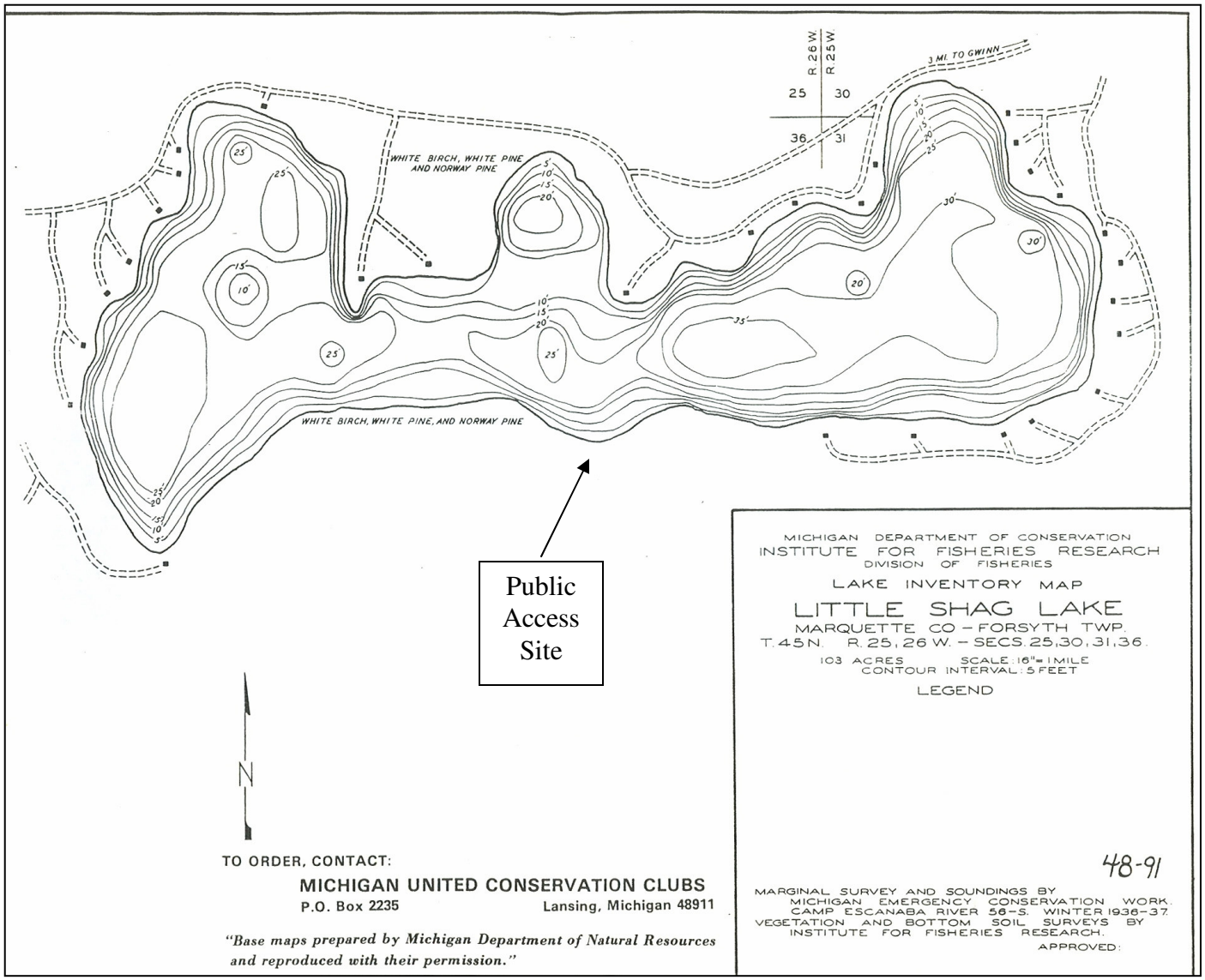

Table 1.-Temperature, dissolved oxygen, and pH profile from Little Shag Lake, Marquette County. Data collected August, 2007 by MDNR, Fisheries Division.

Depth (ft.)	Temperature (F)	Dissolved Oxygen (ppm)	pH
1	74	9.9	7.8
3	74	9.4	
6	73		
9	72		
12	70	10.4	8
15	66	11.2	
18	61	12.9	8.2
21	57	13.5	8
24	55		
27	53		
30	52		
33	50	11.8	
35	50	7.2	7.2

Table 2.-Fish stocked into Little Shag Lake, Marquette County (1978 to 2007). Data from MDNR, Fisheries Division records.

Year	Species	Number	Rate (#/acre)	Size (in.)
1978	Rainbow trout	2,500	24	7.2
1980	Steelhead	2,500	24	3.9
1981	Rainbow trout	2,500	24	8.4
1983	Rainbow trout	2,500	24	7.2
1985	Rainbow trout	2,500	24	5.8
1987	Rainbow trout	3,500	34	6.4
1989	Rainbow trout	2,000	19	8.1
1991	Rainbow trout	3,100	30	7.5
1992	Splake	2,340	23	6.5
1993	Splake	2,000	19	7.4
1994	Splake	3,500	34	6.4
1995	Splake	2,810	27	7.3
1996	Splake	3,150	31	7.0
1997	Splake	2,570	25	6.7
	brown trout	750	7	7.1
1998	Splake	2,840	28	6.2
	brown trout	24	0.2	28.6
1999	Splake	3,050	30	7.7
2000	Splake	2,500	24	8.1
	brown trout	700	7	7.3
2001	Splake	2,650	26	8.0
2002	Rainbow trout	3,500	34	7.2
2003	Rainbow trout	3,300	32	7.1
	Brown trout	750	7	6.0
2004	Rainbow trout	3,500	34	6.1
2005	Rainbow trout	4,850	47	6.6
2006	Rainbow trout	2,800	27	6.7
	Brown trout	1,000	10	7.9
2007	Rainbow trout	3,400	33	6.7

Table 3.-List of fishes (1978 to present) in Little Shag Lake, Marquette County. Origin: Native=N, I=Introduced. Status: P=recent observations. Data from MDNR, Fisheries Division records.

Common Name	Scientific Name	Origin	Status
Rock bass	*Ambloplites rupestris*	N	P
White Sucker	*Catostomus commersonii*	N	P
Iowa Darter	*Etheostoma exile*	N	P
Green sunfish	*Lepomis cyanellus*	N	P
Pumpkinseed	*Lepomis gibbosus*	N	P
Bluegill	*Lepomis macrochirus*	N, I	P
Smallmouth bass	*Microptorus dolomieu*	N, I	P
Largemouth bass	*Microptorus salmoides*	N, I	P
Yellow perch	*Perca flavescens*	N	P
Bluntnose minnow	*Pimephales notatus*	N	P
Brown trout	*Salmo trutta*	I	
Rainbow trout	*Oncorhynchus mykiss*	I	P
Splake	*Salvelinus namaycush x S. fontanalis*	I	

Table 4.-Number, weight, and length range of fishes collected with fyke net, gill net, seine, and electrofishing gear from Little Shag Lake, Marquette County in June and August, 2007. Data from MDNR, Fisheries Division records.

Common name	Number	Weight (lbs.)	Average length (in.)	Length range (in.)	Percent by Number	Percent by weight	Percent legal size
Bluegill	1205	144.0	5.8	1-10	54	59	46 (≥6.0")
Bluntnose Minnow	715	<1	2.5	2-3	31	<1	100
Green sunfish	54	6.0	5.1	2-7	2	2	24 (≥6.0")
Largemouth Bass	93	30.0	7.7	4-18	4	12	3 (≥14.0")
Rainbow trout	23	16.0	11.5	8-18	1	7	35 (≥10.0")
Rock bass	1	1.5	12.5	12.5	<1	<1	100 (≥6.0")
Smallmouth bass	81	32.2	8.6	3-12	4	13	0 (≥10.0")
White sucker	1	2.5	18.5	18.5	<1	1	100
Yellow perch	39	11.0	8.5	4-11	4	5	85 (≥7.0")

Table 5.-Length range of fishes collected with fyke net, gill net, seine, and electrofishing gear from Little Shag Lake, Marquette County in June and August, 2007. Data from MDNR, Fisheries Division records.

	Species							
Inch group	Bluegill	Green sunfish	Largemouth bass	Rainbow trout	Rock bass	Smallmouth bass	White sucker	Yellow Perch
0								
1	1							
2	50	2						
3	53	7				1		
4	231	14	4			1		2
5	98	18	15			13		
6	92	12	34			14		4
7	156	1	12			5		3
8	102		6	5		5		14
9	13		6	10		11		14
10	1		3			16		1
11			5	1		12		1
12			3		1	3		
13			2					
14			2					
15				3				
16				1				
17				2				
18			1	1			1	

Table 6.-Weighted mean length (inches) at age, and growth relative to the State average for fish sampled from Little Shag Lake with fyke nets and gill nets, June 2007. Number of fish aged is in parentheses. Data from MDNR, Fisheries Division records.

	Age/Length															
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Mean growth index[1]
Bluegill	1.4 (11)	2.6 (11)	4.3 (11)	5.2 (23)	7.3 (17)	8.1 (8)	8.7 (11)	9.5 (1)								-0.4
Largemouth Bass		6.5 (38)	8.2 (10)	11.3 (2)	12.8 (1)	13.8 (1)									18.5 (1)	-2.0
Rainbow trout	8.9 (13)	9.9 (3)	16.2 (6)	17.5 (1)												+ 1.2
Smallmouth bass		5.9 (17)	8.5 (4)	9.3 (5)	10.4 (17)	11.0 (6)	11.8 (6)									-3.5
Yellow perch		6.0 (4)	7.6 (3)	8.7 (15)	9.4 (12)	9.8 (1)		11.9 (1)								+ 0.6

[1]Mean growth index is the average deviation from the State average length at age.

Table 7.-Little Shag Lake bluegill classification using fyke net data and the Schneider Index. Size score is given in parentheses. Data from MDNR, Fisheries Division records.

Sample Date	06/11/2007
Sample Size	667
Average Length (inches)	6.3 (7)
% ≥ 6 inches	53 (7)
% ≥ 7 inches	40 (7)
% ≥ 8 inches	17 (6)
Schneider Index	6.75
Rank[1]	Excellent/Superior

Rank[1]: 1=Very poor, 2=Poor, 3=Acceptable, 4=Satisfactory, 5=Good, 6=Excellent, 7=Superior