

### **Chain Lake**

Iosco County, T24N, R05E, Section 8  
Au Sable River watershed, last surveyed 2018

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### **Environment**

Chain Lake is a 72-acre natural lake located approximately two miles northeast of the town of South Branch, Michigan in northwestern Iosco County (Figure 1 and 2). There is a small inlet on the west shore, and a small outlet on the east shore that drains to a series of small ponds and eventually the South Branch River and then Au Sable River. There is no formal lake level control structure except for the outlet drain pipes which may have some influence on water levels. Chain Lake has ample shoal habitat which is surrounded by six relatively deeper basins (Figure 3). The deepest spot in the lake is approximately 15 feet. Bottom substrate is primarily sand and marl, with peat in deeper water. A temperature and dissolved oxygen profile was measured by Michigan Department of Natural Resources (MDNR) personnel in late-August 2018 (Table 1). The lake showed some thermal stratification in the deeper water, with dissolved oxygen declining precipitously below 12 feet. Invasive zebra mussels have been found recently in Chain Lake according to lake residents. The invasive species certainly lowers the overall productivity of its waters. Recently, alkalinity was 130 mg/L and chlorophyll-a was 1.6 micrograms/L, which is very low. This lake has limited access with private land all around the shore. A recent survey of the shoreline found it to have 84 small docks off the shore during the summer, while 3% of the shoreline was armored. An unimproved boat launch is located on the east shore on Chain Lake Drive, but it does not have adequate parking for trailers. The land surrounding the lake is hilly, and with pine and oak dominant riparian zones. According to the lake association, the lake has been treated chemically for vegetative milfoil on many occasions from 2013 through 2018.

### **History**

The history of fisheries and aquatic management at Chain Lake is not extensive but does date back to the 1940s. A comprehensive aquatic survey was completed by the Michigan Department of Conservation (MDOC) in July 1949. Surveyors found a very shallow lake with little thermal stratification and limited access. There were 35 cottages on the lake at the time (compared to 105 dwellings today). Bottom substrate consisted of marl and sand nearshore, and peat offshore. The lake was considered to have minimal amounts of cover for fish outside of some pockets of aquatic vegetation. MDOC used traditional gill-netting and seining to examine the fish community and found Yellow Perch, Bluegill, Pumpkinseed, and Largemouth Bass common. Other species known to inhabit Chain Lake were Blackchin Shiner, Bluntnose Minnow, killifish species, and Iowa Darters.

The first known stocking records for Chain Lake date back to the 1930s. Smallmouth Bass, Largemouth Bass, Yellow Perch, and Bluegill were all stocked into Chain Lake in varying numbers and sizes between 1939 and 1945. This was a period when MDOC fish stocking efforts for warm- and cool-water species was common statewide, regardless of the demonstrated need for supplementation. The only other known stocking efforts are from the local lake association that has been stocking relatively small numbers of Black Crappie, Bluegill, and Yellow Perch by special permit since 2012.

### Current Status

The most recent fish community survey of Chain Lake was conducted from May 21-24, 2018. This survey was conducted under the MDNR Fisheries Division Status and Trends sampling protocol which randomly selects lakes to be surveyed statewide and where sampling effort is a product of lake size (Wehrly et al. 2015). Effort consisted of: 4 experimental gill-net lifts, 3 large-mesh trap-net lifts, 9 large-mesh fyke-net lifts, 2 small-mesh fyke-net lifts, 3 shoreline seine hauls, and 30 minutes of nighttime direct current electrofishing. Surface water temperature during the survey was 61-65 degrees Fahrenheit. A total of 565 fish were captured during the survey (Table 2). The most abundant species in the catch was Bluegill, followed by Rock Bass and Largemouth Bass. Panfish made up 64% of the survey catch by number and 21% by weight. Largemouth Bass and Northern Pike were the only predators collected and comprised 19% of the total catch by number, and 54% by weight. The remaining catch composition was typical for a small isolated northern Michigan natural lake.

Bluegills are currently the most abundant panfish in Chain Lake, but only small proportion (7%) are 7 inches or larger (Table 3), which is considered a desirable size for most anglers. Most of the Bluegill were small (6 inches or less) while growth rates were about average. Eight year classes were found. On average, it would take a Bluegill about nine years to reach 9 inches in Chain Lake. Pumpkinseed sunfish are also found in Chain Lake and supplement the fishery to some degree. Larger specimens of this species can be found, and while they generally grow faster than Bluegill, they don't live as long (Table 4).

Additional panfish found in Chain Lake are Black Crappie and Yellow Perch, and both are fairly common. Five year classes of Black Crappie were found, ranging from age 2 to age 6 (Table 4). While there is natural reproduction of Black Crappie, the population is supplemented by stocking by the lake association. The percentage of wild versus stocked fish is unknown. This species can grow to acceptable sizes in Chain Lake, but growth is average compared to the statewide growth index. Fair numbers of Yellow Perch were captured in the survey, but most were small fish less than 6 inches long. It is questionable whether they are a significant part of the fishery.

The predator population is restricted to Largemouth Bass and Northern Pike, both of which are the typical predator component of most northern Michigan natural lakes. Both species were found to be common in the lake, but Largemouth Bass appear to be the primary predator. Good numbers of legal and sub-legal bass were captured, and they were represented by a healthy eleven year classes (Tables 3 and 4). Bass growth is average to slightly below average compared to statewide indexes. The Northern Pike population of Chain Lake is dominated by sub-legal (less than 24 inches long) pike which demonstrate very slow growth and a limited age structure. This slow growth is likely a product of the limited summer coolwater refugia available in Chain Lake (Table 1).

The remaining fish community of Chain Lake is typical of a marl and muck bottom natural lake, and is dominated by bullhead species and Rock Bass.

The diversity of non-game fish collected in Chain Lake was low, with only bullheads captured. Species such as White Sucker and Bowfin, often captured in other northern Michigan natural lakes, were not captured and likely not present.

### **Analysis and Discussion**

Chain Lake is a small natural lake in northeast Michigan with moderate productivity. It has limited summer coolwater refugia for certain game fish, and has declining dissolved oxygen levels in its deeper zones. Overall, the lake is relatively shallow.

The current fish community of the lake can be generally characterized as having:- 1) a panfish community of good diversity and acceptable sizes; 2) a naturally-reproducing predator population consisting primarily of slow-growing Northern Pike and Largemouth Bass with acceptable growth; and 3) a non-game fish community low in species diversity and abundance.

Chain Lake exhibits an acceptable-quality panfish community and offers anglers the opportunity to catch Bluegill, Pumpkinseed, Black Crappie, Rock Bass, and Yellow Perch. Largemouth Bass of a variety of sizes and ages can be found and are vital in helping balance the panfish community through predation. The slow growth rates and stunted size structure of Northern Pike suggest growth deficiencies based on water temperatures and depths, not forage limited.

The non-game fish community of Chain Lake is low in diversity and consists primarily of bullheads.

### **Management Direction**

1. Chain Lake has a typical fish community for a northern Michigan waterbody. The panfish community appeared a bit more diverse compared to other Michigan lakes, and is partially supplemented through private stocking efforts. It is unknown whether the periodic and low-level stocking of panfish by the lake association is actually having any benefits. Panfish have high fertility rates and can produce enough wild fish annually to meet the natural carrying capacity of any lake, let alone a small lake such as Chain Lake. The exception to this might be Black Crappie which have erratic natural reproduction cycles in most lakes. It is recommended that Yellow Perch and Bluegill are no longer stocked by the lake association. Growth rates of these fish are already average to slightly below average, so adding stocked fish only limits growth rates further through competition.

2. Regardless of what is stocked, the lake association should continue to consult the local MDNR Fisheries Biologist on private stocking efforts. Excessive stocking can have negative consequences on some species. At the very least, the lake association should continue to acquire their stocking permits annually through MDNR since they are free and ensure a measure of quality control to species management. Currently, the species are stocked within reasonable numbers and after consultation with a MDNR fisheries biologist. In addition, the lake association should report actual stocking numbers back to the DNR each year for future tracking purposes.

3. The best way for anglers to determine the value of their stocking efforts is to ask anglers. Fish stocking can be expensive, and should be evaluated the same way one may evaluate purchasing something for a household. There is some simple information that can be gathered from residents and local anglers as to the effectiveness of the stocking efforts. This information can be ascertained through discussions with the local MDNR fisheries biologist.

4. Consideration should be given to change the Northern Pike size limit at Chain Lake. Currently, there is a 24-inch minimum size and 2-fish daily bag limit. This is the standard State of Michigan pike

regulation. There are waterbody exceptions to this statewide where pike abundance is high and growth rates are poor, such as in Chain Lake. Chain Lake could be placed in this "exceptions list" and have the regulation liberalized to encourage harvest of some sub-legal pike. The regulation would be a daily possession limit of 5 fish of any size, with no more than one fish greater than 24-inches allowed in the daily possession. This liberal regulation has worked at some Michigan lakes to reduce pike numbers, which reduces pressure on the panfish community while allowing for some additional pike harvest. The lake association should discuss this and let the DNR know if this is a regulation they would like to pursue.

5. Chain Lake has always been a relatively infertile lake. The aquatic vegetation that is found in the lake offers some amount of primary productivity to the base of the food chain when it decays. The vegetation also provides dissolved oxygen to fish, not to mention cover for many species. Some species, such as Pumpkinseed, are heavily reliant on aquatic vegetation for feeding on preferred snails and mussels, while others require it for spawning (perch, crappie). The lake association should further scrutinize its vegetation treatments and reconsider how much chemicals are being stored within the lake sediments.

### **References**

Wehrly, K. E., D. B. Hayes, and T. C. Wills. 2015. Status and trends of Michigan inland lake resources 2002-2007. Michigan Department of Natural Resources Fisheries Report 08. Institute for Fisheries Research, Ann Arbor.

Figure 1. General location of Chain Lake in the northern Lower Peninsula of Michigan. General location indicated by red arrow.

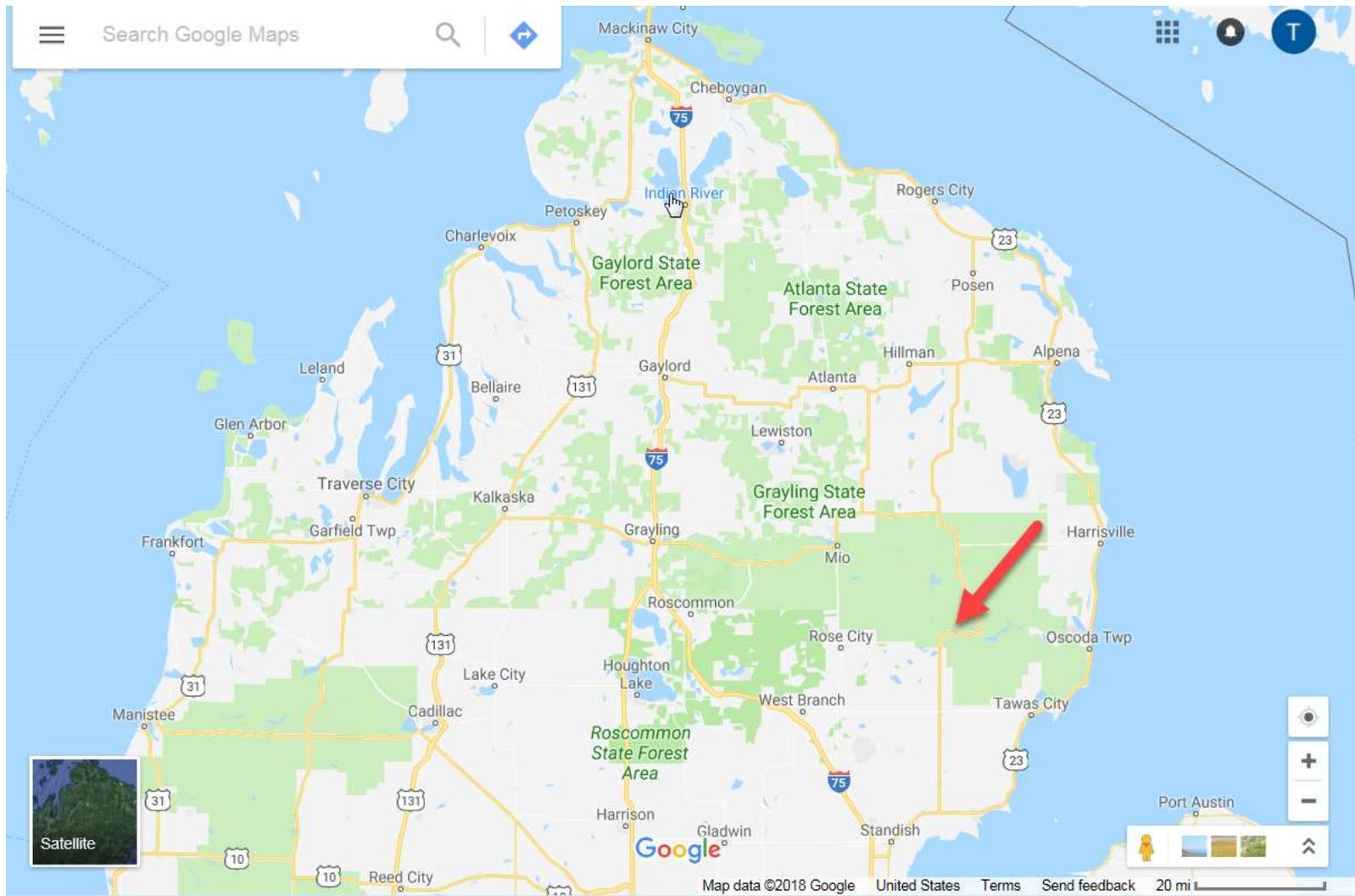


Figure 2. Chain Lakes and surrounding area in Iosco County.



Figure 3. Original bathymetric map for Chain Lakes.

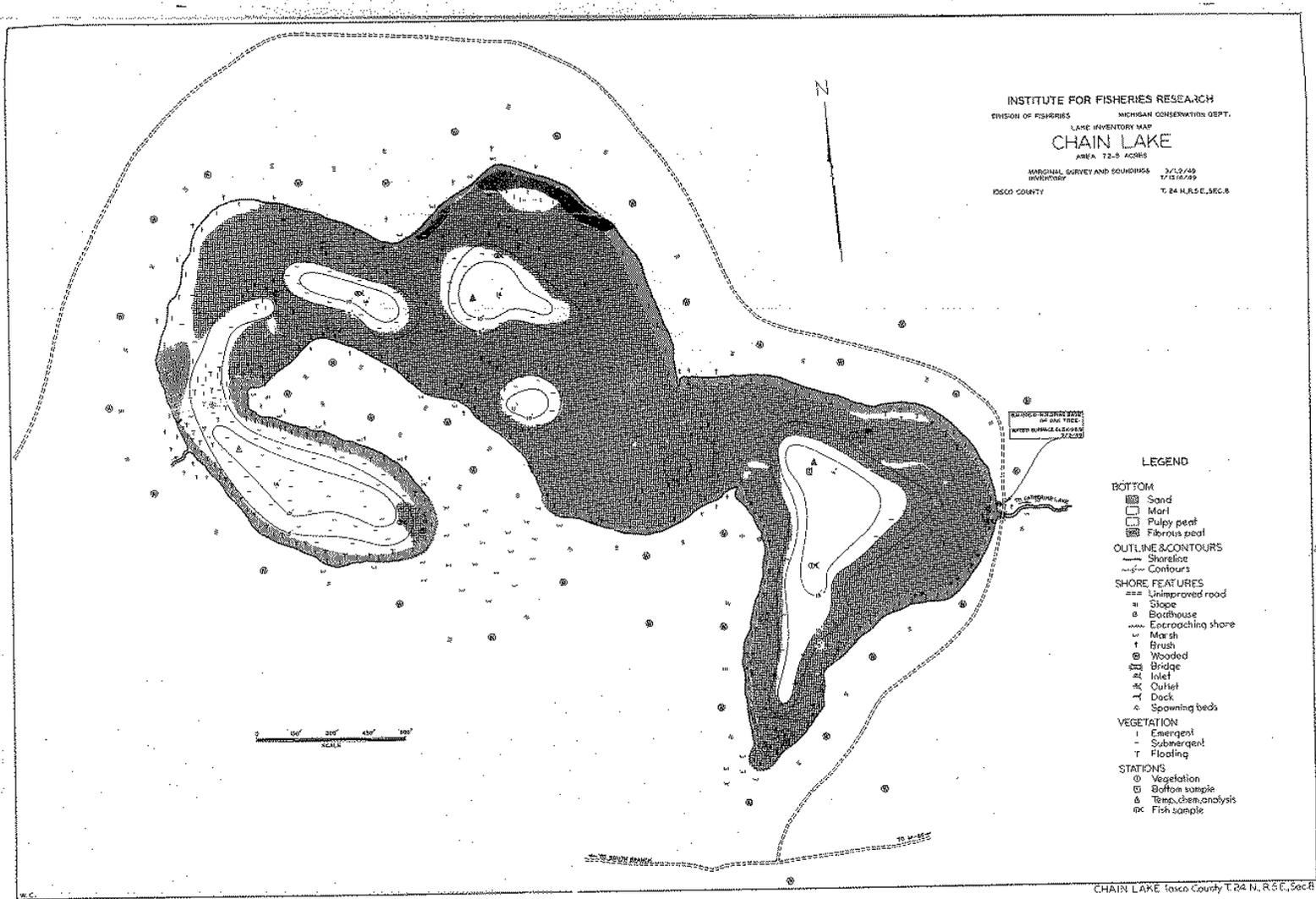


Table 1.-Water temperature and dissolved oxygen profile for Chain Lake, August 28, 2018.

Depth (ft)	Temperature (F)	Dissolved Oxygen (ppm)
Surface	74	8.2
1	75	8.2
2	75	8.2
3	75	8.2
4	75	8.1
5	75	8.2
6	74	7.9
7	73	8.0
8	73	7.8
9	73	7.7
10	73	7.8
11	72	7.3
12	72	6.7
13	72	5.3
14	71	4.1
15	70	2.5
16	68	1.6
17	66	0.3
18	64	0.0

Table 2.-Species and relative abundance of fishes collected with survey gear at Chain Lakes, May 21-24, 2018.

Common Name	Number	Percent by number	Length Range (inches)	Weight (lbs)*	Percent by weight	Growth** (inches)
Bluegill	174	30.8	1 - 9	15.7	6.0	-0.2
Rock Bass	70	12.4	1 - 10	12.2	4.6	
Largemouth Bass	69	12.2	1 - 19	59.1	22.4	-0.7
Brown Bullhead	53	9.4	9 - 14	38.6	14.7	
Black Crappie	47	8.3	5 - 12	17.5	6.6	-0.3
Yellow Perch	42	7.4	1 - 8	2.8	1.1	+0.3
Northern Pike	39	6.9	15 - 28	83.7	31.8	-2.6
Black Bullhead	34	6.0	7 - 14	26.8	10.2	
Pumpkinseed	25	4.4	2 - 9	6.9	2.6	+1.3
Green Sunfish	8	1.4	1 - 3	0.1	0.0	
Iowa Darter	3	0.5	1 - 2	0.0	0.0	
Golden Shiner	1	0.2	6	0.1	0.0	
<b>TOTAL</b>	<b>565</b>			<b>263.6</b>		

\* calculated based on length-weight relationships

\*\*based on a comparison to statewide growth for that species (inches)

Table 3.-Length-frequency distribution of certain game fishes collected during the late-May 2018 survey at Chain Lakes.

<b>Length (in)</b>	<b>Bluegill</b>	<b>Black Crappie</b>	<b>Pumpkinseed</b>	<b>Largemouth Bass</b>	<b>Northern Pike</b>	<b>Yellow Perch</b>
1	18			1		1
2	26		1	1		
3	44		1	16		1
4	24		3	8		14
5	28	5	5	6		18
6	22	6	5	8		5
7	2	12	4	1		2
8	7	8	5	1		1
9	3	5	1	1		
10		6		1		
11		4				
12		1		1		
13				2		
14				5		
15				4	2	
16				8		
17				2	3	
18				1	3	
19				2	3	
20					6	
21					8	
22					6	
23					4	
24					2	
25					1	
26						
27						
28					1	
29						
30						
31						
32						
33						

Table 4. Weighted mean length and age composition of selected species in the Jose Lake survey, May 2018.

	No. Aged	Length range (in.)	State average length (in.)	Weighted mean length (in.)
<b>Bluegill</b>				
I	2	2.2 – 2.5	1.8	2.3
II	9	2.6 – 4.1	3.8	3.2
III	14	4.2 – 5.3	5.0	4.8
IV	9	5.6 – 7.5	5.9	6.0
V	10	5.7 – 8.6	6.7	6.5
VI	3	7.7 – 8.4	7.3	8.1
VII	2	8.5 – 9.1	7.8	8.8
VIII				
IX	1	9.4	8.6	9.4
<b>Pumpkinseed</b>				
I	2	3.5 – 4.9	1.8	4.5
II	3	5.2 – 5.5	3.8	5.3
III	1	5.9	4.9	5.9
IV	9	5.9 – 8.4	5.6	6.8
V	4	6.5 – 8.5	6.2	7.6
VI	2	8.8 – 9.1	6.6	8.9
<b>Black Crappie</b>				
II	11	5.2 – 6.9	6.0	6.1
III	4	7.2 – 8.2	7.5	7.6
IV	9	7.2 – 9.5	8.6	8.1
V	9	7.3 – 10.1	9.4	8.1
VI	13	9.6 – 12.0	10.2	10.7
<b>Yellow Perch</b>				
I	5	4.0 – 4.6	3.3	4.3
II	7	5.0 – 5.5	5.2	5.2
III	6	5.3 – 6.8	6.5	6.1
IV	2	7.7 – 8.4	7.5	7.9
<b>Largemouth Bass</b>				
I	12	3.1 – 5.3	4.2	3.9
II	10	4.7 – 6.7	7.1	6.0
III	3	8.3 – 10.2	9.4	9.2
IV	1	13.2	11.6	13.2
V	3	12.9 – 14.2	13.2	13.7
VI	6	13.2 – 16.1	14.7	14.7
VII	3	15.3 – 15.8	16.3	15.5
VIII	3	16.0 – 16.3	17.4	16.1
IX	3	16.8 – 17.4	18.3	17.1
X	1	16.8	19.3	16.8
XI	3	18.8 – 19.4		19.1
<b>Northern Pike</b>				
III	12	15.6 – 24.1	20.8	19.5
IV	16	18.7 – 23.5	23.4	21.6

V	9	17.4 – 25.1	25.5	20.8
VI				
VII	3	21.8 – 28.0	29.3	24.7