

Sofie Lake

Sofie Lake is a small 35 acre lake located on the west side of County Road 25, and north of Hwy 210 in Carlton County. It is a relatively stained lake (mean filtered color = 115 PtCo units), with a maximum depth of 16 feet, and moderate hardness (86.75 mg/l CaCO₃). It is moderately productive or mesotrophic, with a calculated Carlson's Trophic State Index = 50.4, based upon total phosphorus, chlorophyll a, and secchi depth. It has a diverse zooplankton community that includes summer population peaks of *Holopedium gibberum*.

Trap net and gill net locations were established in 2008 (Figure 1). Nine trap nets (TN) and two gill nets (GN) were set July 20-22. The purpose of this survey was to collect base line data of fish communities, and to use this data for future management decisions. Fish species observed in the 2008 survey included black bullhead (BLB), black crappie (BLC), bluegill (BLG), largemouth bass (LMB), northern pike (NOP), pumpkinseed sunfish (PMK), and yellow perch (YEP) (Table 1).

Catch rates for black crappie were 2.0 / GN and 0.9 / TN (Table 1). Lengths were observed between 123 mm and 251 mm (Figure 2). Year classes observed ranged from 2 to 8 years old (Table 2). Length-at-age estimates for black crappie in Sofie Lake appear to be slower than the Duluth Area average established by the Minnesota Department of Natural Resources (MNDNR) (Table 3). While there were not a lot of individuals observed in this survey, initial results suggest that the older year classes may not be present in large numbers. Possible explanations may be overharvest by angling. Additional surveys will be necessary to gather additional data on the crappie population in Sofie Lake.

Bluegill catch rates were 3.5 / GN and 116.6 / TN (Table 1). Lengths were observed from 89 mm to 216 mm (Figure 3). Bluegill ages were observed from 2 to 10 years old (Table 4). Length-at-age estimates were comparable to the Duluth area average (Table 5). The PSD value for this bluegill population was 77.3 ± 2.5 , which may be a bit higher than a "normal" population. However, the majority of these fish were in the 6.5 to 7.0 inch group, which is only a "quality" sized bluegill. Only nine individuals were collected larger than 7.8 inches ("preferred" length for bluegills), resulting in an RSD-P value of 0.8 ± 0.5 , which is low for a fish population. Even though there seems to be plenty of older individuals (Table 4), it does appear that individuals that reach 7.5 inches may be subjected to higher exploitation, and are being removed from the population. Creel surveys and additional population surveys may be necessary to determine what may be influencing the size and age structure of this population. Five composite samples of five individual bluegill sunfish were analyzed for mercury, and their total mercury wet weight

concentrations would indicate a safe consumption advisory of one meal/week for both the general and sensitive populations (composite mean of 0.229 $\mu\text{g/g}$ total mercury).

Yellow perch were observed between 139 mm and 233 mm (Figure 4). Catch rates for yellow perch were 15.5 / GN and 0.8 / TN (Table 1). Age classes were observed from 2 to 6 years old (Table 6), and length-at-age estimates were comparable to the MNDNR area average (Table 7). The PSD value for this population was 21.0 ± 13.0 , which is low and characteristic of a population characterized by small individuals. Additional population surveys may be necessary to determine what may be influencing the size and age structure of this population.

Pumpkinseed sunfish were observed between 145 mm and 206 mm (Figure 5). Catch rates were 0.0 / GN and 1.4 / TN (Table 1). Age distribution ranged from 3 to 7 years (Table 8), and growth rates appear slower compared to the Duluth area average (Table 9). Only 13 individuals were sampled, which makes it difficult to conclude much for this population.

A total of 7 northern pike were sampled from Sofie Lake, with catch rates of 3.0 / GN and 0.1 / TN (Table 1). All northern pike collected from the gill nets were used for mercury analysis (Table 11). All northern pike collected using trap nets were measured and released. Total mercury wet weight concentrations for the 5 NOP analyzed were typical for this region, ranging from 0.306 – 0.877 $\mu\text{g/g}$, and consumption advisories would suggest one meal/week for the general population (one meal/month for NOP greater than 30”), and one meal/month for the sensitive population.

One largemouth bass at 200 mm was also observed in the 2008 Sofie Lake survey.



Figure 1. Map of Sofie Lake, Carlton County, with the gill net and trap net locations set in 2008.

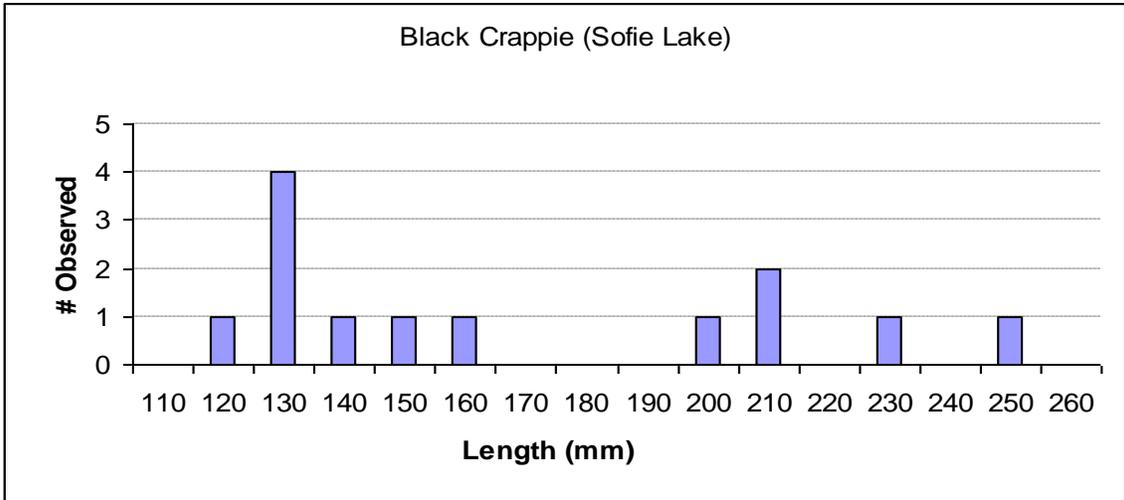


Figure 2. Length frequency distribution of black crappie observed in Sofie Lake 2008.

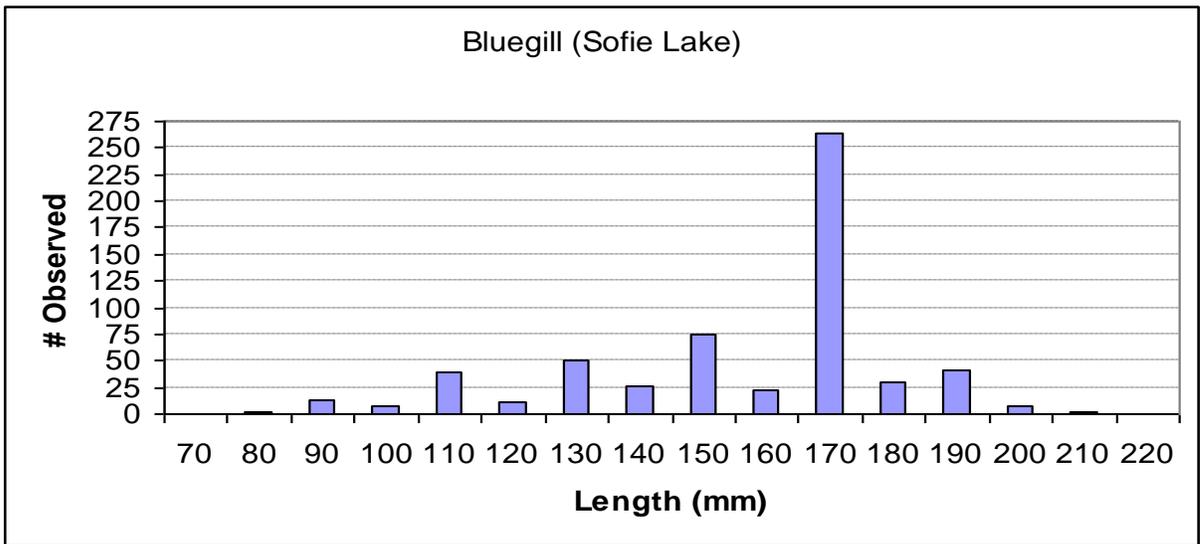


Figure 3. Length frequency distribution of bluegill observed in Sofie Lake 2008.

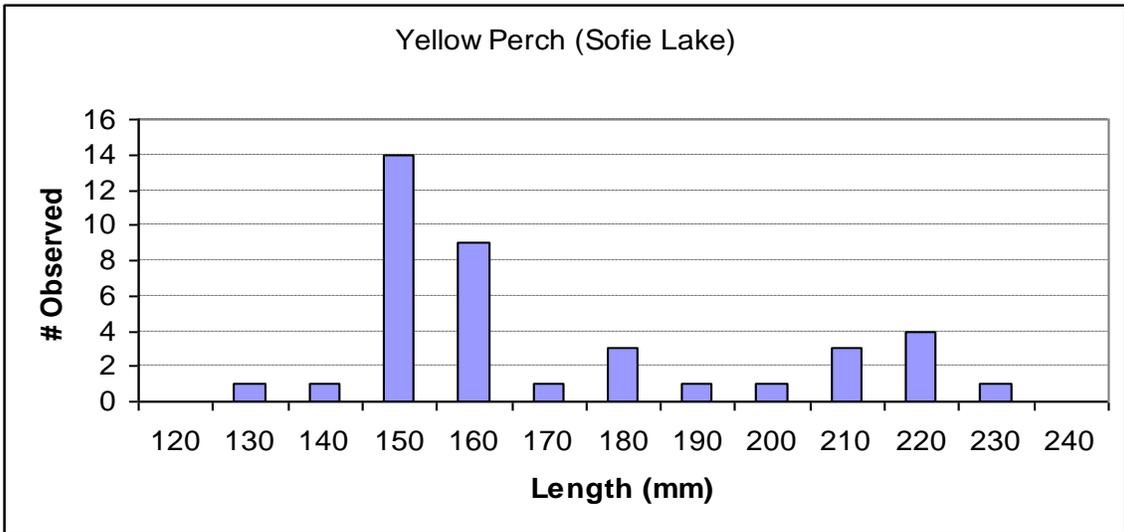


Figure 4. Length frequency distribution of yellow perch observed in Sofie Lake 2008.

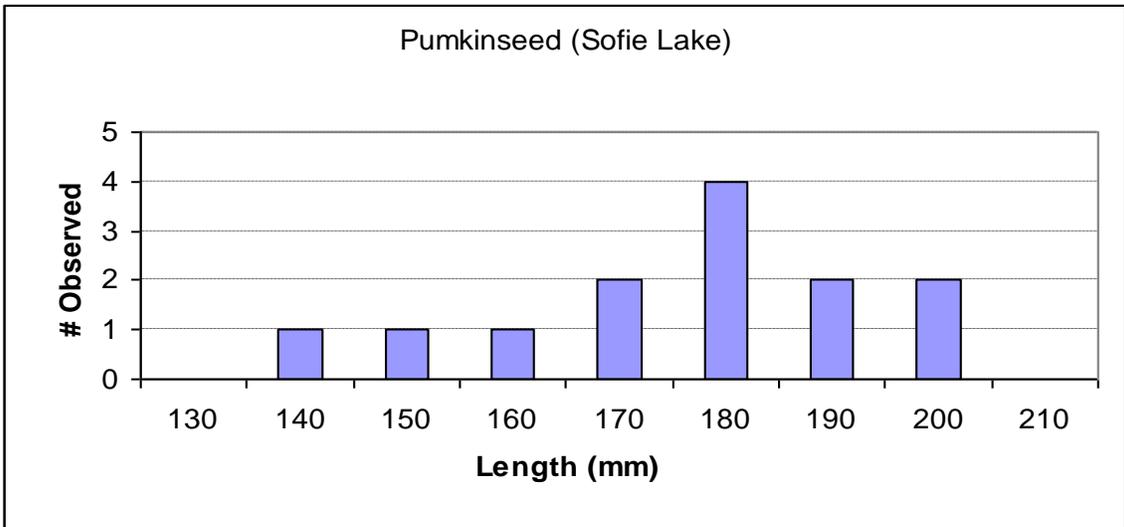


Figure 5. Length frequency distribution of pumpkinseed sunfish in Sofie Lake 2008.

Table 1. Number of fish sampled in Sofie Lake July 20-22, 2008 by gear type and by gear ID. Catch per effort, reported as the # fish / net type, is reported at the bottom of the table for the 2008 data.

Gear Type	Species Code								Grand Total
	BLB	BLC	BLG	GOS	LMB	NOP	PMK	YEP	
GN 1		3	5			4		7	19
GN 2		1	2	2		2		24	31
TN 1		1	13				1	2	17
TN 2			153				2	1	156
TN 3		1	195		1		5		202
TN 4		3	232			1	1	2	239
TN 5		1	67					1	69
TN 6			58	1					59
TN 7	1		81				1		83
TN 8			145				1		146
TN 9		2	105				2	1	110
Grand Total	1	12	1056	3	1	7	13	38	1131
Unknown Gear		1						1	
# Fish / GN	---	2.0	3.5		---	3.0	---	15.5	
# Fish / TN	0.1	0.8	116.5		0.1	0.1	1.4	0.7	

Table 2. Age frequency distribution for black crappie observed in Sofie Lake 2008.

Length (mm)	Length (in)	# Observed	2	3	4	5	6	7	8
120	4.7	1	1						
130	5.1	4	4						
140	5.5	1	1						
150	5.9	1		1					
160	6.3	1		1					
210	8.3	2				1		1	
220	8.7								
230	9.1	1							1
240	9.4								
250	9.8	1					1		
Total		12	6	2		1	1	1	1

Table 3. Length at age estimates for black crappie sampled from Sofie Lake in 2008, compared to the area averages established by the Minnesota Department of Natural Resources. N is the sample size used for the estimates.

Age Class	N	Length (mm)	Length (in)	Area Average Length (mm)	Area Average Length (in)
1	12	59	2.3	46	1.8
2	12	105	4.1	100	3.9
3	6	130	5.1	155	6.1
4	4	155	6.1	196	7.7
5	4	183	7.2	227	8.9
6	3	206	8.1	242	9.5
7	2	212	8.4	247	9.7
8	1	222	8.7	258	10.2

Table 4. Age frequency distribution for bluegill observed in Sofie Lake 2008.

Length (mm)	Length (in)	# Observed	2	3	4	5	6	7	8	9	10
80	3.1	1	1								
90	3.5	14	14								
100	3.9	7	3	3							
110	4.3	39		39							
120	4.7	101		101							
130	5.1	51	6	38	6						
140	5.5	27		5	5	11	5				
150	5.9	74			44	15	15				
160	6.3	220				176	44				
170	6.7	263			53	157	53				
180	7.1	209				84	125				
190	7.5	41			7		7	20	7		
200	7.9	8				1	1	2	1	2	1
210	8.3	1						1			
		1056	24	186	115	444	250	23	8	2	1

Table 5. Length at age estimates for bluegill sampled from Sofie Lake in 2008, compared to the area averages established by the Minnesota Department of Natural Resources. N is the sample size used for the estimates.

Age Class	N	Length (mm)	Length (in)	Area Average Length (mm)	Area Average Length (in)
1	69	45	1.8	36	1.4
2	69	78	3.1	64	2.5
3	61	107	4.2	97	3.8
4	40	130	5.1	127	5.0
5	33	149	5.9	152	6.0
6	20	164	6.5	170	6.7
7	11	178	7	181	7.1
8	5	179	7.1	191	7.5
9	3	186	7.3		
10	1	194	7.6		

Table 6. Age frequency distribution for yellow perch observed in Sofie Lake in 2008.

Length (mm)	Length (in)	# Observed	2	3	4	5	6
130	5.1	1		1			
140	5.5	1	1				
150	5.9	14		14			
160	6.3	9		7	2		
170	6.7	1			1		
180	7.1	3			2	1	
190	7.5	1				1	
200	7.9	1			1		
210	8.3	3		1			2
220	8.7	4				3	1
230	9.1	1				1	
Total		39	1	23	6	6	3

Table 7. Length at age estimates for yellow perch sampled from Sofie Lake in 2008, compared to the area averages established by the Minnesota Department of Natural Resources. N is the sample size used for the estimates.

Age Class	N	Length (mm)	Length (in)	Area Average Length (mm)	Area Average Length (in)
1	25	70	2.7	60	2.4
2	25	112	4.2	100	3.9
3	24	144	5.7	136	5.4
4	13	165	6.5	156	6.1
5	8	187	7.3	192	7.6
6	3	196	7.7	214	8.4

Table 8. Age frequency distribution for pumpkinseed sunfish observed in Sofie Lake in 2008.

Length (mm)	Length (in)	# Observed	2	3	4	5	6	7
140	5.5	1		1				
150	5.9	1			1			
160	6.3	1			1			
170	6.7	2				2		
180	7.1	4				4		
190	7.5	2					2	
200	7.9	2						2
Total		13		1	2	6	2	2

Table 9. Length at age estimates for pumpkinseed sunfish sampled from Sofie Lake in 2008, compared to the area averages established by the Minnesota Department of Natural Resources. N is the sample size used for the estimates.

Age Class	N	Length (mm)	Length (in)	Area Average Length (mm)	Area Average Length (in)
1	11	51	2	46	1.8
2	11	82	3.2	104	4.1
3	11	112	4.4	130	5.1
4	10	140	5.5	165	6.5
5	8	165	6.5	196	7.7
6	3	182	7.2	244	9.6
7	2	197	7.8		

Table 10. Age frequency distribution for northern pike observed in Sofie Lake in 2008.

Length (mm)	Length (in)	# Observed	3	4	5	6	7	8	9
520	20.5	1	1						
570	22.4	1							
660	26.0	1		1					
720	28.3	1						1	
740	29.1	1						1	
790	31.1	2			1				1
	Total	7	1	1	1			2	1

Table 11. Mercury analysis results for northern pike and bluegill, measured in micrograms of mercury per gram of fish tissue ($\mu\text{g/g}$), for Sofie Lake, 2008.

Species	Length (mm)	Length (in)	$\mu\text{g/g}$ Tissue
NOP	571	22.5	0.414
NOP	526	20.7	0.306
NOP	727	28.6	0.792
NOP	790	31.1	0.877
NOP	663	26.1	0.345
BLG	170	6.7	0.247
BLG	186	7.3	0.255
BLG	175	6.9	0.228
BLG	173	6.8	0.201
BLG	190	7.5	0.216