Results of a Fall Walleye Index Netting (FWIN) Survey Conducted on Pickerel Lake in 2007

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Pickerel Lake is located in Armour Township within the Bracebridge administrative area. It is a moderately large (520 ha) and deep ($Z_{max.}$=38 m, Z_{mean}= 8.6 m) lake comprised of a single basin with relatively low shoreline diversity and bottom structure (Table 1, Figure 1). The lake is located in the watershed of the North Magnetawan River. The large watershed delivers a large amount of dissolved organic matter resulting in relatively low water clarity (3.0 m, MOE lake partner data, 2003). The river itself provides fast-water spawning habitat upstream of the lake.

The native fish community of the lake was probably dominated by brook trout and cisco (lake herring). Walleye were stocked from 1946 to 1955 and smallmouth bass were stocked from 1947 to 1965. Self-sustaining populations of both species were established and no stocking currently occurs. Northern pike became established some time before the 1973 lake survey. White sucker, burbot, brown bullhead and yellow perch also occur.

Past assessments include the 1973 lake survey, 1982 contaminant sampling and a trap net survey in 1988 (Deyne and Arnett 1988). All of these surveys have indicated a healthy walleye population.

As almost 20 years had passed since the last assessment, a Fall Walleye Index Netting project was completed on Pickerel Lake in 2007 to obtain information on the current status of the walleye population.

Methods

The FWIN protocol (Morgan 2002) was followed. Gear consisted of gill net gangs comprised of 8 panels, each 1.8 m (6 ft) deep and 7.6 m (25 ft) long. Mesh sizes were 25, 38, 51, 64, 76, 102, 127 and 152 mm stretched measurement, sequentially arranged.

Nets were set in the fall. The target surface water temperature was between 15 and 10 C. Nets were set for 24 hours periods. Effort was allocated, proportional to area, in two depth strata: 2-5 and 5-15 m deep. The 5-15 m stratum was divided into 5-10 m and 10-15 m sub-strata to ensure that the full depth range was sampled proportionally (Table 2).

Sport fish were sampled for length, round weight, gender and maturity. Scales, dorsal spines and otoliths were collected for age determination. Stomach contents were described. All other species were counted and measured for length.

Tissue samples were collected from a sample of walleye, smallmouth bass and northern pike and forwarded to the Ministry of the Environment for analysis of mercury content.

Ages reported are the assessed age at the time of sampling. One year can be added to reflect the number of growing seasons completed.

Data are stored as FISHNET3 project IA07_PIC.

Results

Netting was conducted between October 9 and 12, 2007. Water temperature during netting ranged from 16.0 to 16.5 C, slightly above the upper limit specified in the protocol (15 C). Netting was started early to accommodate a second survey within the available time window. The lake was thermally stratified at the time of sampling. Net set details are shown in Table 3 and Figure 1. Six nets were set in the 2-5 m stratum, five between 5-10 m and four between 10 and 15 m deep.

A total of 670 fish of eight different species were caught (Table 4, Figure 2). A total of 64 walleye were caught in 12 different sets resulting in a catch rate of 4.3 (S.D.=4.0) per set. The geometric mean catch

rate was 2.8 walleye set. Walleye catch varied with depth; fifteen (2.5/net) were caught in the 2-5 m. stratum, 39 (7.8/net) in 5-10 m and ten (2.5/net) in 10 -15 m.

Cisco were most numerically abundant in the catch; with 374 being caught. All but three were caught in the four nets set in the 10-15 m stratum.

A total of 69 rock bass were caught. This was the first time rock bass have been documented in Pickerel Lake.

White sucker (55 caught), yellow perch (47), smallmouth bass (36), brown bullhead (13) and northern pike (12) comprised the remainder of the catch. All of these species were caught primarily in the 2-5 and 5-10 m depths.

The walleye ranged from 189 to 691 mm TL and averaged 355 (S.D = 150) mm (Table 5 and 6). Most size classes within the range were well represented, with 201-250 mm being the modal size (Figure 3). Ages ranged from 1 to 18 and averaged 4.7 (S.D.=4.5) years old. Fourteen different age classes were represented; with age 1, 3 and 9 occurring most often (Table 7, Figure 4). Growth of walleye was slow. At one year old fish averaged 210 mm TL (S.D.=13) and by age 3 they averaged 333 mm TL (S.D.=52). The limited sample sizes precludes robust analysis of the size and age of maturity, but size and age at which 50% of females are mature were about 450 mm TL and 5 or 6 years old (Table 8 and 9). The concentration of mercury in tissue samples varied with the species and size of fish (Figure 5). Generally, walleye less than 30 cm long had less than 0.6 ug/g of mercury, the level at which consumption advisories for the general population begin.

Discussion

Netting was conducted slightly outside of the prescribed temperature window. The affect that this might have on the size and composition of the catch, particularly for walleye has not been analyzed provincially. Given that the temperature was only slightly higher than prescribed and the lake was still thermally stratified, it is expected that the impact was minimal. Netting later in the season when the water temperature is changing quickly, some species are becoming less active and whole lake mixing is occurring would probably have a larger impact on catches.

The species occurrence in the catch differed from the 1988 assessment. Rock bass were not present in the lake in 1988, but now are a major component of the community. It is not known how they became established. Immigration from other lakes in the watershed or accidental introduction, possibly through dumping of bait fish are possible routes. Their presence is considered to be undesirable as they have a limited sport fish value and potentially compete with and prey on more desirable species. Cisco were not caught in 1998 because of the gear used and season of capture. Trap nets set during the summer will not catch cisco which are a cold water species that is confined to the area in and below the thermocline at that time. Burbot were caught in 1998 but not in 2007. Burbot are not very vulnerable to trap or gillnets. Their abundance in the lake has probably been under estimated by both types of gear.

The walleye catch rate was relatively high in comparison to other FWIN surveys conducted in Parry Sound District and the rest of the Southern Region (Figure 6, Appendix A). This result is consistent with the 1998 assessment. Although the gear was different, that survey also indicated a moderately high level of abundance. The time between assessments was considerable, but it appears that the walleye population has been relatively stable at a healthy level of abundance.

Similarly, the size and age range and distribution indicate a healthy population structure. Recruitment is occurring regularly, with several large year classes currently in the population and a range of sizes and ages of mature fish present.

Walleye growth was very slow; slower than the 25% percentile for the Southern Region (Figure 7). Again, this is consistent with the 1988 survey but is somewhat unexpected given the abundance of cisco in the

lake. Apparently the walleye are taking a long time to grow large enough to take advantage of the cisco; even though small cisco, less than 20 cm long comprised a significant proportion of the catch. Yellow perch, are probably a major food source as well. Their abundance was relatively low. Rainbow smelt, another potential forage species does not appear to be present in the lake. None were caught in the nets or found in stomachs. It is not desirable to have smelt in the lake as they can affect walleye recruitment by preying on fry.

The slow growth results in delayed maturation of female walleye; 50% are mature at 5 or 6 years old, compared to the regional mean of 3.6 years. The slow growth and delayed maturation are not necessarily concerns as long as the abundance and population structure remain healthy.

Several indicators of population status are presented in Table 10. The GM-CUE>450 is a measure of the abundance of larger, mature walleye in the population. The value of 0.77 was well above average for the region. The Shannon Index of Diversity is a measure of the number and age diversity of mature females. The value observed (0.76) is also well above the median for the region. This indicator is related to the average catch >450 mm. Together they indicate that there is healthy abundance and number of age classes in the mature component of the population. It is important to maintain an adequate stock of mature fish in the population to ensure adequate egg deposition occurs during those years when conditions are good for recruitment.

The maximum age and number of age classes observed are indicators of recruitment and mortality. A healthy population with regular recruitment and a sustainable level of mortality will have more age classes and older fish. These indicators are sensitive to sample size; as the number of fish sampled increases, so does the chances of encountering fish of different ages. The values observed are near the top 5% of lakes in the Southern Region.

Pickerel Lake is stained a yellow-brown colour because of a high level of organic matter originating from the large watershed. Methyl-mercury, the toxic form, is formed under these conditions, resulting in relatively high concentrations in fish. Results for the 2007 samples are published in The Guide to Eating Ontario Sport Fish (MOE 2009) which provides guidance on the amount of fish that should be consumed. The consumption limits from the 2007 samples are modestly less restrictive than from the 1982 sample, but are still quite restrictive. It is not known if the guidelines are a significant deterrent to angling effort or harvest.

We have no information on the status of the fishery. As the walleye population appears relatively healthy, the long term average level of effort must be sustainable. Pickerel Lake is a significant resource in the Almaguin area of the District. An effort should be made to quantify the fishery.

The catch and possession limit for walleye in Fisheries Management Zone 15 was changed to a limit of four walleye of which only one may be longer than 46 cm, beginning in 2008. It is not likely that the previous or the current regulation limit total harvest to a large degree. The ‘one-over’ component of the limit may help conserve the large adult portion of the population; which is important considering the slow growth and late maturation.

Regular recruitment is occurring gin the population. Typical of walleye populations, several large year classes, produced when environmental conditions were favourable, are dominating the population. Supplemental stocking of walleye is not necessary and should not occur.

Casual observations during the survey suggest that a considerable amount of nearshore habitat alteration is occurring, in the form of removal of aquatic vegetation. The extent of it should be investigated in more detail.

Summary

Pickerel Lake supports an introduced, self-sustaining population of walleye. Fall Walleye Index Netting was conducted in 2007. The catch rate of walleye (mean:4.3/net, geometric mean: 2.8/net) is moderately high in comparison to other lakes in MNR's Parry Sound District and Southern Region. The size and age composition were well balanced, with a wide range observed and several large year classes currently dominating the population. Walleye growth was very slow, resulting in a late age of maturation for female walleye. However, several indices of population status, including the abundance and age diversity of mature fish were all above average for the region. Mercury concentrations in walleye, smallmouth bass and northern pike were relatively high, resulting in restrictive consumption guidelines. Rock bass were caught; the first records for the lake. Pickerel Lake also supports an abundant population of small cisco. Recommendations are to not supplementally stock walleye, to quantify the angling fishery and examine near shore aquatic vegetation loss.

References

Deyne, G. and G. Arnett. 1988. Trapnetting assessment of walleye populations in Pickerel, Three Mile and Deer Lakes 1988. Ont. Min. Nat. Resourc, Bracebridge, Ontario.

Ministry of the Environment. 2009. Guide to eating Ontario sport fish 2009-2010. Ministry of the Environment, Toronto.

Morgan, G. 2002. Manual of instructions: fall walleye index netting (FWIN). Percid Community Synthesis, Diagnostics and Sampling Standards Working Group. Ontario Ministry of Natural Resources, Peterborough.

Morgan, G.E., M.D. Malette, R.S. Kushneriuk and S.E. Mann. 2003. Regional summaries of walleye life history characteristics based on Ontario's Fall Walleye Index Netting (FWIN) program 1993 to 2001. Diagnostics and Sampling Standards Working Group, Percid Community Synthesis. Ont. Min. Nat. Resourc. Peterbourough.

Table 1 Physical characteristics of Pickerel Lake based on 1973 inventory.

ARU_LID	17-6320-50600	Littoral Area (%)	42
Watershed	2EA21	Elevation (m asl)	320
Inventory year	1973	Total dissolved Solids (mg/l)	25.8
Surface area (ha)	513.0	Morpho-edaphic index	3.0
Perimeter (km)	13.0	Crown land (%)	6
Island shoreline (km)	0.0	Resorts	2
Maximum depth (m)	38.1	Cottages	77
Mean Depth (m)	8.6		

Table 2 Depth stratum areas, Pickerel Lake.

Depth (m)	Area (ha)
0-5	180
5-10	118
10-15	109
>15	113
Total	520

Table 3 Net set summary, Pickerel Lake, FWIN 2007.

Sample	Start Date	Start Time	End Date	End Time	Effort Duration (hr)	Location (UTM, NAD 83)	Gear Depth min. (m)	Gear Depth Max. (m)	Water Temp. at Net Set (C)
1	2007/10/09	11:15	2007/10/10	10:50	23.6	176327005058700	2.1	4.7	16.5
2	2007/10/09	11:55	2007/10/10	11:45	23.8	176328925060009	5.0	7.5	16.5
3	2007/10/09	12:35	2007/10/10	12:45	24.2	176317095060625	12.8	13.7	16.5
4	2007/10/09	13:15	2007/10/10	13:20	24.1	176304995060934	8.8	10.0	16.5
5	2007/10/09	13:50	2007/10/10	14:10	24.3	176313815059920	2.0	3.7	16.5
6	2007/10/10	10:18	2007/10/11	10:45	24.5	176320125059146	5.6	7.5	16.5
7	2007/10/10	11:20	2007/10/11	11:48	24.5	176331545060504	2.8	3.7	16.5
8	2007/10/10	12:20	2007/10/11	12:45	24.4	176322625060867	5.8	9.3	16.5
9	2007/10/10	13:31	2007/10/11	13:55	24.4	176314735060334	12.8	13.6	16.5
10	2007/10/10	14:40	2007/10/11	15:35	24.9	176301615060624	2.1	4.8	16.5
11	2007/10/11	10:35	2007/10/12	10:25	23.8	176326025059566	12.5	14.5	16.0
12	2007/10/11	12:00	2007/10/12	12:00	24.0	176312385061001	5.8	7.5	16.0
13	2007/10/11	12:55	2007/10/12	12:55	24.0	176320145061030	2.1	5.8	16.0
14	2007/10/11	14:44	2007/10/12	14:00	23.3	176317825059111	2.5	5.5	16.0
15	2007/10/11	15:45	2007/10/12	14:40	22.9	176318255059798	13.6	14.6	16.0

Table 4 Catch summary, Pickerel Lake FWIN, 2007.

Set	Brown Bullhead	Cisco	Northern Pike	Rock Bass	Smallmouth Bass	Walleye	White Sucker	Yellow Perch
1	1	0	2	31	0	2	2	4
2	0	0	3	11	3	4	4	4
3	0	40	0	0	0	1	0	6
4	7	0	0	1	0	12	2	15
5	1	0	1	5	2	0	6	0
6	0	0	1	0	3	7	6	3
7	0	0	0	1	0	4	3	3
8	0	0	1	6	15	12	1	1
9	1	138	0	0	0	4	0	1
10	2	2	1	12	0	1	9	1
11	0	73	0	0	0	0	0	0
12	0	1	0	0	6	4	5	8
13	1	0	3	1	6	0	8	0
14	0	0	0	1	1	8	9	0
15	0	120	0	0	0	5	0	1

Total	13	374	12	69	36	64	55	47
Mean	0.9	24.9	0.8	4.6	2.4	4.3	3.7	3.1
S.D.	1.8	47.1	1.1	8.3	4.1	4.0	3.3	4.1
S.E.	0.5	12.2	0.3	2.2	1.0	1.0	0.8	1.0
Lower 95% CL	0.0	1.1	0.2	0.4	0.3	2.2	2.0	1.1
Upper 95% CL	1.8	48.8	1.4	8.8	4.5	6.3	5.4	5.2
Median	0	0	0	1	0	4	3	1
Geo. Mn.	0.5	2.7	0.6	1.7	1.1	2.8	2.4	1.8

Mean (2-5 m)	0.8	0.3	1.2	8.5	1.5	2.5	6.2	1.3
Mean (5-10 m)	1.4	0.2	1.0	3.6	5.4	7.8	3.6	6.2
Mean (10-15 m)	0.3	92.8	0.0	0.0	0.0	2.5	0.0	2.0

Table 5 Total length composition, by species, Pickerel Lake FWIN, 2007.

Total Length (mm)	Brown Bullhead	Cisco	Northern Pike	Rock Bass	Smallmouth Bass	Walleye	White Sucker	Yellow Perch
101-125		2		1				12
126-150		1		6				5
151-175		10		9				19
176-200		54		19		6		7
201-225	1	10		23	3	16		3
226-250	1	7		10	10	5	8	1
251-275		8		1	5	1	4	
276-300	4	10					5	
301-325	3					4	10	
326-350	3	1			2	4	4	
351-375	1	2			5	1	6	
376-400		3			3	4		
401-425		1			1	3	2	
426-450					3		3	
451-475					2	3	7	
476-500					2	3	4	
501-525						4	1	
526-550						2		
551-575						2	1	
576-600			5			2		
601-625			1			1		
626-650			1			1		
651-675						1		
676-700						1		
701-725			2					
726-750								
751-775								
776-800			1					
801-825								
826-850			1					
851-875								
876-900								
901-925								
926-950			1					

Table 6 Descriptive statistics of biological attributes, by species, Pickerel Lake FWIN, 2007.

Fork Length	Brown Bullhead	Cisco	Northern Pike	Rock Bass	Smallmouth Bass	Walleye	White Sucker	Yellow Perch
n	13	109	12	69	36	64	55	47
min	222	103	555	109	198	174	214	91
max	368	365	890	254	465	665	508	220
mean	295	192	648	190	310	335	332	147
S.D.	40	51	112	30	87	143	81	32

Total Length

n	13	109	12	69	36	64	55	47
min	225	110	588	114	207	189	227	102
max	371	403	935	266	495	691	559	227
mean	302	216	685	197	325	355	355	155
S.D.	41	56	118	31	92	150	88	32

Round Weight

n			11		35	63		
min			1300		155	60		
max			4400		2000	3300		
mean			2150		662	689		
S.D.			1008		548	816		

Age

n			12		34	63		
min			3		1	1		
max			7		10	18		
mean			4.3		3.9	4.7		
S.D.			1.3		2.5	4.5		

Table 7 Age composition and total length-at-age, Pickerel Lake FWIN, 2007.

Age	Northern Pike					Smallmouth Bass					Walleye				
	n	min	max	mean	S.D.	n	min	max	mean	S.D.	n	min	max	mean	S.D.
1						1	247	247	247		23	189	239	210	13
2						15	220	270	245	15	4	226	312	263	37
3	4	594	605	597	5	1	340	340	340		9	231	401	333	52
4	4	588	720	635	61	8	342	395	369	16	4	350	535	420	80
5	2	794	846	820	37	1	398	398	398		4	343	517	418	73
6	1	935	935	935		4	423	444	435	9	1	379	379	379	
7	1	715	715	715							1	533	533	533	
8															
9						2	470	486	478	11	9	451	595	502	41
10						2	467	495	481	20	1	589	589	589	
11											1	621	621	621	
12											2	567	635	601	48
13											1	490	490	490	
14															
15															
16											1	691	691	691	
17															
18											2	570	675	623	74

Table 8 Walleye maturity, by sex and total length, Pickerel Lake FWIN, 2007.

	Male			Female		
Total Length (mm)	Immature	Mature	% mature	Immature	Mature	% mature
151-175						
176-200	3		0	3		0
201-225	9		0	7		0
226-250	2		0	2		0
251-275	1		0			
276-300						
301-325	1		0	1		0
326-350	1	1	50	2		0
351-375		1	100			
376-400		2	100	2		0
401-425				3		0
426-450						
451-475		2	100		1	100
476-500		3	100			
501-525		3	100		1	100
526-550				1	1	50
551-575		1	100		1	100
576-600					2	100
601-625						
626-650						
651-675						
676-700					1	100

Table 9 Walleye maturity, by age, Pickerel Lake FWIN, 2007.

	Female		Male	
Age (years)	Immature	Mature	Immature	Mature
1	11		12	
2			3	
3	4		2	1
4	3			1
5	2	1		1
6				1
7		1		
8				
9		2		7
10		1		
11				
12		1		
13				1
14				
15				
16		1		
17				
18				1

Table 10 Selected population status indicators, Pickerel Lake FWIN, 2007.

Proportion of Nets with Walleye	0.86
GM-CUE > 450	0.77
Number of Age Classes	14
Maximum Observed Age	18
Shannon Index of Mature Females	0.76

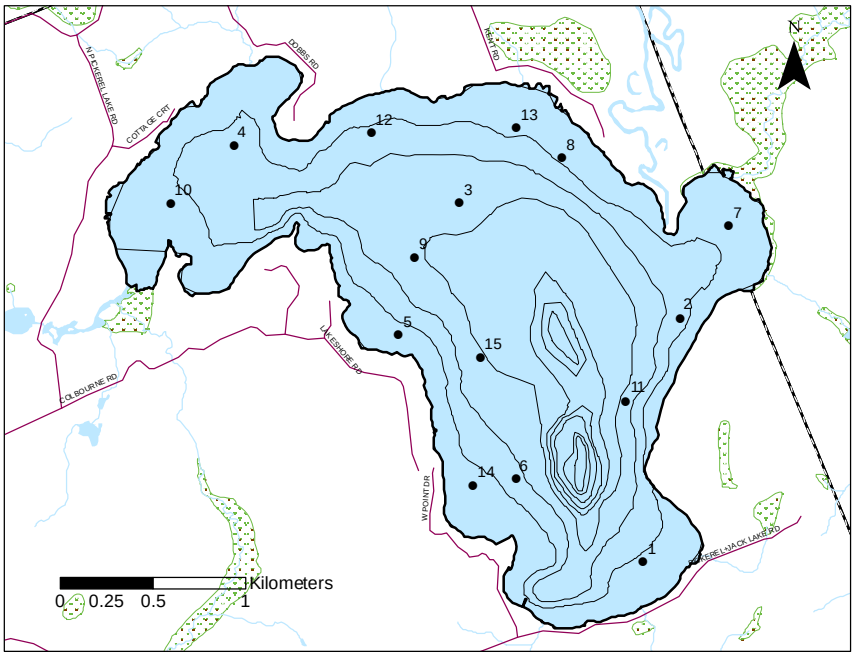


Figure 1 Net set locations, Pickerel Lake FWIN, 2007. Contour interval: 5 m.

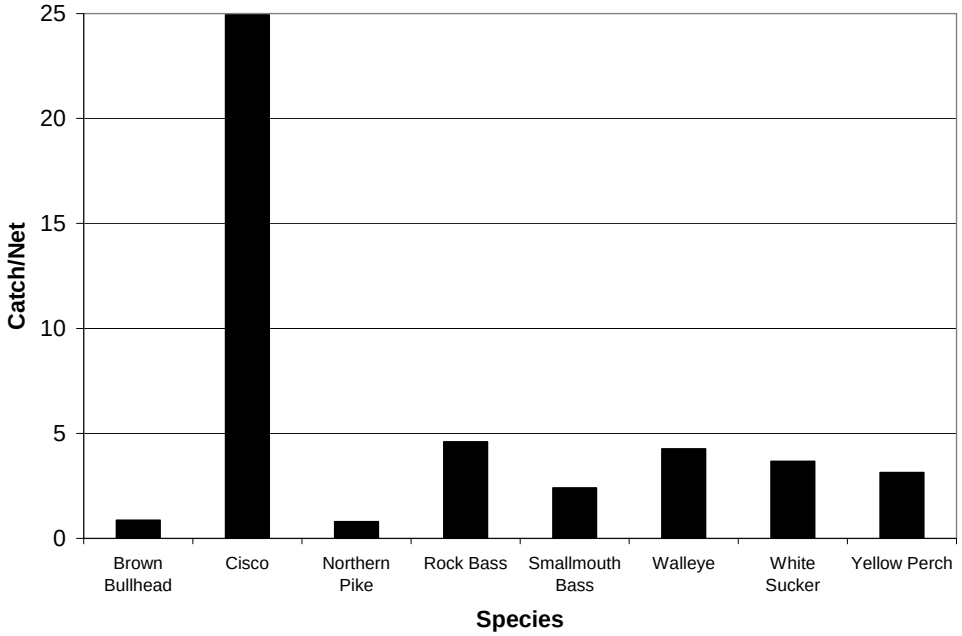


Figure 2 Catch composition, mean number/set, by species, Pickerel Lake FWIN, 2007.

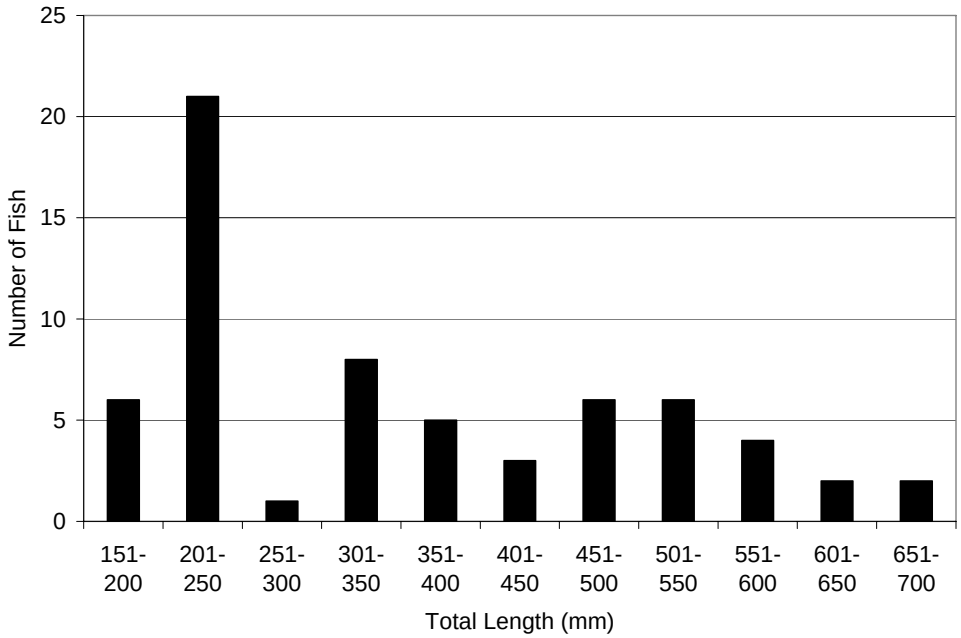


Figure 3 Walleye total length distribution, Pickerel Lake FWIN, 2007.

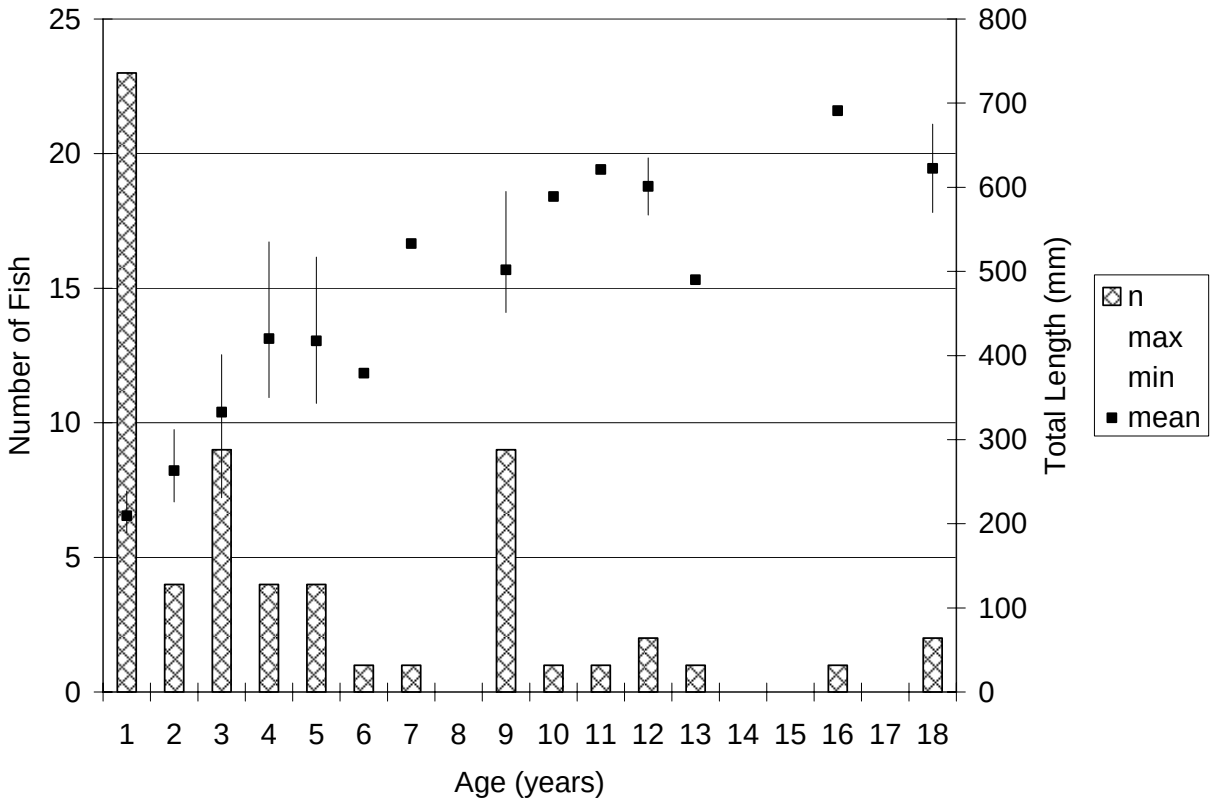


Figure 4 Walleye age composition and total length-at-age, Pickerel Lake FWIN,

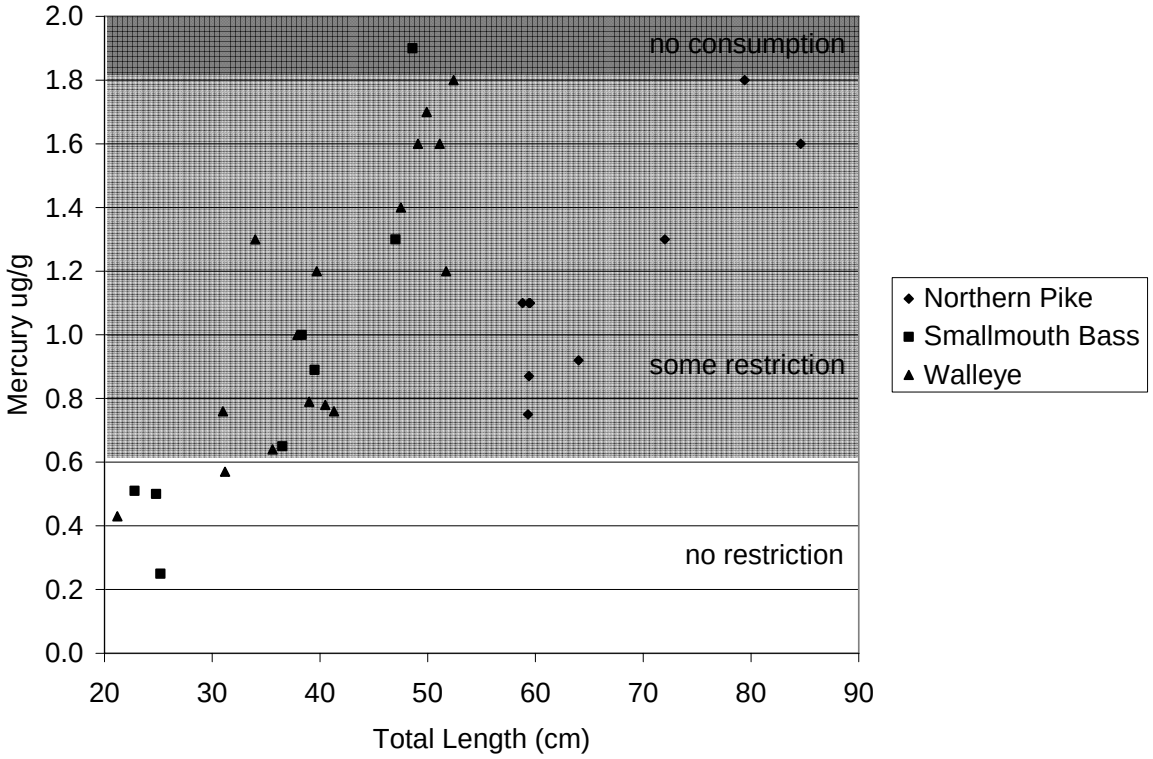


Figure 5 Concentration of mercury in the tissue of fish, Pickerel Lake FWIN, 2007. Shading indicates level of consumption advisory for general population (MOE 2009). Guidance is more restrictive for children and reproductive women.

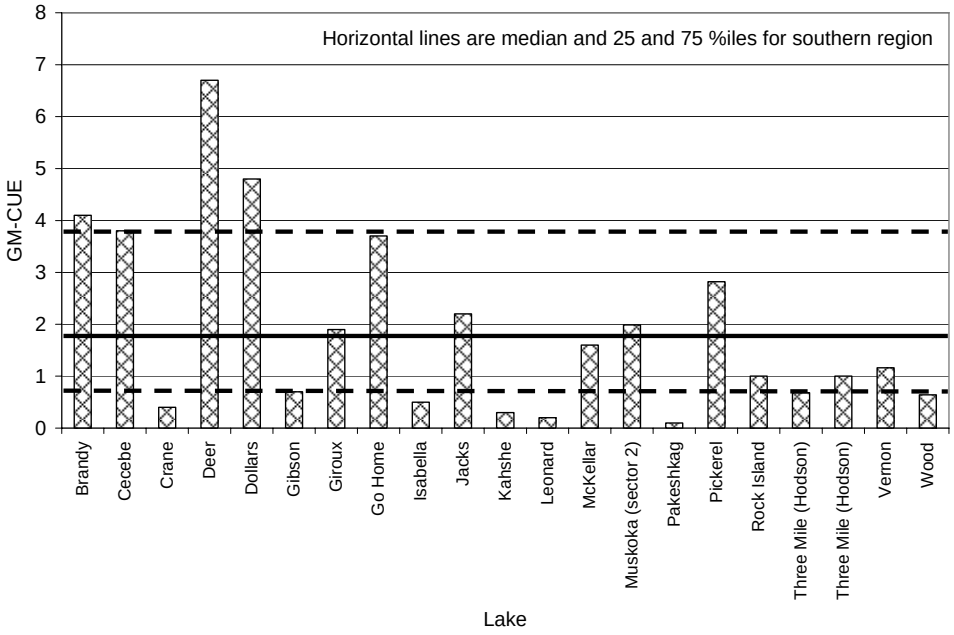


Figure 6 Geometric mean catch per net of walleye in FWIN surveys conducted in Parry Sound District, 2001- 2008.

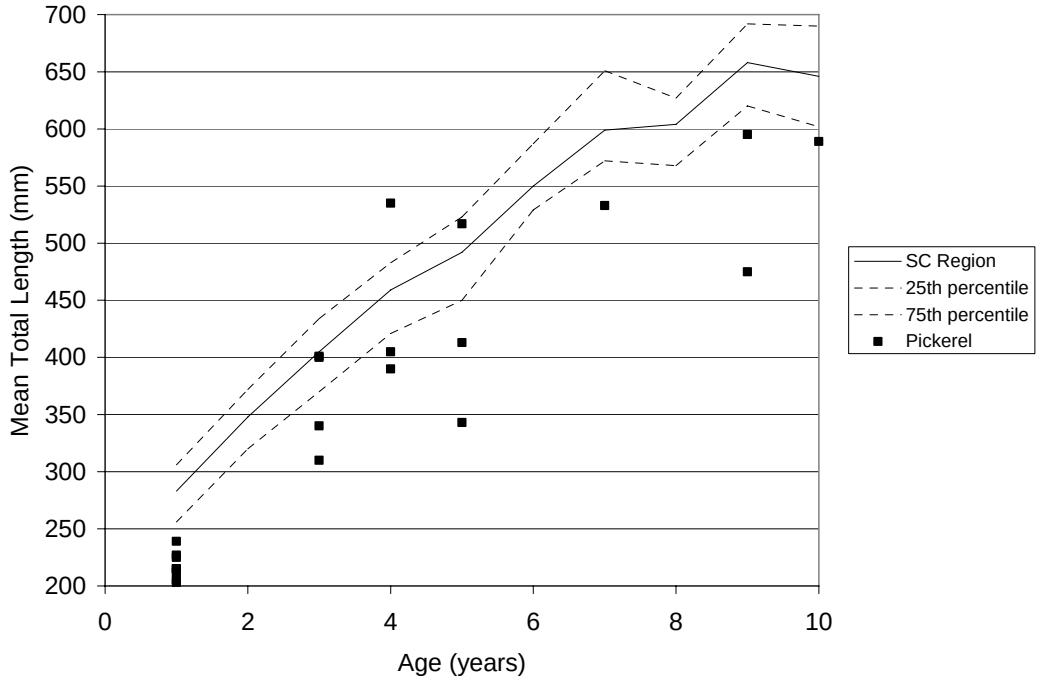


Figure 7 Total length-at-age of walleye from Pickerel Lake, compared to benchmarks for Southern Region.

Appendix A Selected descriptive statistics for Southern Ontario walleye, based on 1993-2001 FWIN database (Morgan et al 2003).

		Mean	Minimum	Maximum	Median	5th percentile	25th percentile	75th percentile	95th percentile	Sample size
Surface Area (ha)		1209	45	13598	513	68	138	1219	5349	99
Mean Depth (m)		6	0.9	24.3	5.5	1.8	3.9	7.7	10.7	94
Max. Depth (m)		19.6	2.3	87.5	18.3	6.1	11.8	25	39.6	96
Secchi Depth (m)		3.6	0.2	7.3	3.5	1.1	2.4	4.6	6.7	96
Average Catch		2.8	0	27.7	1.7	0.1	0.7	3.8	8.3	100
GM-CUE > 450		0.6	0.0	8.1	0.4	0.1	0.2	0.7	1.8	98
Age Classes		5.6	1.0	13.0	5.0	1.0	4.0	7.0	11.0	95
Max Age		11.5	2.0	26.0	11.0	5.0	8.3	14.0	19.0	98
Shannon Index of Mature Females		0.43	0.00	0.96	0.45	0.00	0.29	0.63	0.84	90.00
Average Size (TL)		406	265	634	393	296	348	442	574	96
Female Total Length at Age	1	283	271	373	286	234	256	306	365	31
	2	348	286	482	337	300	320	372	429	51
	3	405	316	542	403	340	370	434	493	48
	4	459	378	590	460	401	421	483	566	26
	5	492	417	591	490	417	450	523	591	15
	6	550	477	644	542	477	529	587	644	13
	7	599	513	680	590	513	572	651	680	9
	8	604	538	682	612	538	568	627	682	8
	9	658	620	692	661	620	620	692	692	3
	10	646	567	701	658	567	602	690	701	4
Male Total Length at Age	1	275	226	364	271	231	245	301	347	30
	2	352	271	448	351	294	325	375	441	55
	3	394	318	505	388	336	368	416	480	62
	4	429	337	526	425	358	399	456	513	39
	5	444	363	529	442	363	416	474	529	16
	6	475	425	590	464	425	444	500	590	13
	7	479	429	619	475	429	451	494	619	15
	8	528	486	570	520	486	513	554	570	5
	9	517	486	585	497	483	492	565	585	7
	10									
Female Maturity by Age	10%	2.8	0.8	4.4	2.7	1.1	2.3	3.3	4.0	43
	50%	3.6	2.0	5.4	3.7	2.1	3.0	4.3	4.8	43
	90%	4.4	2.4	7.8	4.4	3.1	3.6	5.2	5.9	43
Female Maturity by Size	10%	413	292	532	420	345	392	434	472	43
	50%	445	368	557	441	374	417	475	491	43
	90%	477	382	581	477	419	441	512	540	43
Female Condition	350	389	355	439	387	359	368	402	436	33
	400	598	539	670	597	549	569	615	669	33
	450	876	778	976	877	785	842	901	973	33
	500	1231	1077	1369	1236	1080	1180	1276	1359	33
	550	1676	1435	1859	1694	1455	1591	1757	1845	33