Results of a Fall Walleye Index Netting Survey Conducted on Three Mile (Hodson) Lake in 2006

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Three Mile Lake, also known as Hodson Lake, is located in Armour Township, in the Bracebridge administrative area. It is a moderately large (360 ha) and deep (mean=4.1m, max=7.9 m) lake with high water clarity (secchi = 5.5 m) and low productivity (TDS = 28 mg/l). It is a headwater lake with a small watershed and no significant tributaries. It discharges via a small stream to the South Magnetawan River.

The native fish community included brook trout (*Salvelinus fontinalis*), lake herring (*Coregonus artedii*) and probably white sucker (*Catostomus commersoni*), pumpkinseed (*Lepomis gibbosus*) and possibly yellow perch (*Perca flavescens*). The lake was stocked with brook and lake trout (*Salvelinus namaycush*) periodically until the mid 1950's. The transformation to a cool water community occurred with the stocking of walleye (*Sander vitreus*) and smallmouth bass (*Micropterus dolomieui*) in the late 1950's. Self-sustaining populations of both species are now present. Northern pike (*Esox lucius*) became established approximately 20 years ago, through an unauthorized introduction.

A Fall Walleye Index Netting (FWIN) survey was conducted on Three Mile Lake in 2006. A previous FWIN survey was conducted in 2001. Index trap netting was done in 1988 (Arnett 1988). The purpose of this project was to obtain estimates of walleye abundance and population structure in order to describe the current population status and to compare results with previous assessments.

The zone-wide catch limit for walleye was changed, beginning in 2008. This assessment may provide useful background data for a future assessment of the impact of the new regulation.

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 when 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.

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

Tissue samples were collected from walleye and pike and forwarded to the Ministry of the Environment for analysis of mercury content.

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

Data is stored as FISHNET3 project IA06_THR.

Results

Netting was conducted between October 12 and 18, 2006. Weather conditions were generally unsettled with windy conditions, precipitation and a rapid decrease in water temperature. Net set details are shown in Table 1 and Figure 1.

A total of 15 net sets were completed, six in the shallow stratum and nine in the deep; roughly proportional to the surface area in each stratum (Figure 1). A total of 136 fish of 7 species were caught. Rock bass (*Amblopites rupestris*) dominated the catch with 75 being caught in 13 different nets. White sucker (25), walleye (13), smallmouth bass (11), northern pike (6), yellow perch (5) and burbot (Lota lota) (1) comprised the remainder of the catch (Table 2, Figure 2).

The walleye catch rate was 0.87/net (SE=0.24) in 9 different nets. The geometric mean catch rate was 0.68/net (SE=0.13)

The walleye ranged in size from 244 to 622 mm TL with a mean of 436.3 mm (SE=33.5). The 350-400 mm size class was most common but the catch was well distributed amongst the size classes represented, despite the small sample size (Table 3, Figure 3).

The walleye ranged in age from 1 to 10 years old, with a modal age of 2, and 7 year classes represented (Table 4, Figure 4). Because of the small sample size, sexes and years were combined for calculating size-at-age. Walleye reached almost 300 m TL by age 1 (two growing seasons complete) and 500 mm by age 4; after which growth slowed due to the onset of maturity.

Again, the small sample size limits analysis, but male walleye began to mature at 2 years old (350-400 mm) and were fully mature at age 4 (450 mm) (Table 5 and 6). Females began to mature at age 3 (450-500 mm) and were fully mature by age 5 (500-500 mm).

Burbot were found in the stomachs of two walleye and rock bass in one.

Discussion

Catches in 2006 were generally similar to the 2001 FWIN. The most significant change was the large catch of rock bass in 2006. Based on discussion with local residents, rock bass have become established in the past few years. They now are a dominant component of the fish community. Conversely, no pumpkinseeds were caught in 2006, compared to a catch rate of almost one/net in 2001. The perch catch was also somewhat lower in 2006. The decline in perch and pumpkinseed may be a direct result of competition with or predation by the high abundance of rock bass. Rock bass have the potential to influence walleye populations through predation on juveniles (Krishka et al 1996). This may be particularly true in Three Mile Lake because of the limited areas of cover and high water clarity.

The walleye total catch was similar between years. In the context of FMZ 15 and Bracebridge Area a catch of one walleye per net is considered low, just above the 25th percentile for the region and among the lowest catch rate for FWIN surveys done in the Parry Sound District (Table 8, Figure 5). Regionally, the median catch rate was 1.7/net.

The total catch of walleye was only 13 fish in 2006; therefore all of the results presented on the biological characteristics should be interpreted with caution.

The size and age composition of walleye from the 2001 survey indicated that recruitment may be poor, with only one fish younger than age 4 being caught. The 2006 survey did catch a wider range of sizes and ages; showing that recruitment is occurring; although it may be irregular. As a small lake with relatively low population density, the size and age structure of the population can be expected to vary as strong and weak year classes cycle through the population.

Several indicators of population status are presented in Table 7. The GM-CUE>450 is a measure of the abundance of larger, mature walleye in the population. The value of 1.0, in 2001, was well above average for the region, but fell to 0.3 in 2006.

The Shannon Index of Diversity is a measure of the number and age diversity of mature females. The values observed (0.29 and 0.56) vary just above and below the median for the region. This indicator is related to the average catch >450 mm. Together they show that the mature component of the population varies greatly. This variation is due to the small sample of measured walleye and the cycling of year classes through 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 number and maximum 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 and, correspondingly, vary between years in Three Mile Lake. The values observed are reasonable considering the small sample size.

A trap net survey was conducted in 1988. A total of 173 walleye were caught for a catch rate of 5.9 walleye/tap net night. Trap net catches are not directly comparable to FWIN; however, the trap net catch suggests that walleye density was much higher at that time. Anecdotal reports also indicate the same. The reason for a decline, if real, is unknown. Three Mile Lake would not be expected to support a high density population based on its physical characteristics. A less diverse fish community and environmental conditions that favoured walleye in that period are possible explanations for higher walleye abundance in the past.

Three Mile Lake provides only modest habitat for walleye. It is of moderate size, clear, low in nutrients and has an increasingly complex fish community. Detailed shoreline mapping has not been done, but casual observations during the netting survey suggest that juvenile habitat, in the form of areas of aquatic vegetation are in limited supply. From two years of sampling it appears that a reasonable population structure exists, with regular recruitment and survival to maturity occurring. The low density observed appears to be a direct result of the natural limitations of the habitat and fish community.

Exploitation has not been measured in Three Mile Lake. The extent to which it may be contributing to the current population abundance is unknown. A new FMW-wide catch and size limit for walleye was implemented in 2008. Based on the abundance (and expected angler catch rate) and size distribution of walleye observed, the limit of 4 walleye, of which only one may be longer than 46 cm, will result in only a very modest decline in harvest from the lake.

Conclusion

Three Mile Lake supports a viable self-sustaining population of walleye. Abundance is relatively low and is probably limited by the physical characteristics of the lake and the fish community. Periodic recruitment is occurring as evidenced by several year classes observed in the 2001 and 2006 surveys. The structure of the population and fishing quality can be expected to vary as these year classes age. As an introduced population with limited potential; consideration could be given to allow private supplemental stocking with walleye fingerlings, if requested. All stocking should be assessed for effectiveness.

References

Arnett, Gray. 1988. Trapnetting assessment of walleye populations in Pickerel, Three Mile and Deer Lakes, 1988. File Report, Ontario Ministry of Natural Resources, Bracebridge.

Krishka, B.A., R.F. Cholmondeley, A.J. Dextrase, and P.J. Colby. 1996. Impacts of introductions and removals on Ontario percid communities. Percid Community Synthesis Introductions and Removals Working Group. Ontario Ministry of Natural Resources, Peterborough.

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 Net Set Summary, Three Mile Lake FWIN, 2006.

sample number	sample site	index effort status code	effort duration	start date	start time	end date	end time
1	8	1	23.6	2006/10/12	11:43	2006/10/13	11:20
2	4	1	24.0	2006/10/12	12:22	2006/10/13	12:20
3	16	2	24.0	2006/10/12	13:25	2006/10/13	13:25
4	19	1	24.2	2006/10/16	11:00	2006/10/17	11:10
5	17	1	24.1	2006/10/16	11:45	2006/10/17	11:50
6	11	1	24.0	2006/10/16	12:35	2006/10/17	12:35
7	2	1	24.0	2006/10/16	13:20	2006/10/17	13:20
8	9	1	23.8	2006/10/17	11:05	2006/10/18	10:55
9	7	1	24.0	2006/10/17	11:40	2006/10/18	11:40
10	18	1	23.8	2006/10/17	13:05	2006/10/18	12:55
11	3	1	24.0	2006/10/17	13:45	2006/10/18	13:45
12	20	1	24.3	2006/10/18	10:30	2006/10/19	10:50
13	10	1	23.9	2006/10/18	11:35	2006/10/19	11:30
14	6	1	24.0	2006/10/18	12:40	2006/10/19	12:40
15	13	1	24.0	2006/10/18	13:40	2006/10/19	13:40

sample number	utm start	gear depth min	gear depth max	water temp	crew at net lift
1	176324375050812	6.4	6.7	12.0	Thomas, Scholten, Readman
2	176317025051163	1.8	3.4	12.0	Thomas, Scholten, Readman
3	176312435049298	1.8	3.6	12.0	Thomas, Scholten, Readman
4	176326425049333	1.8	4.0	10.0	Thomas,Readman, McCarthy
5	176316955049428	4.9	7.3	10.0	Thomas,Readman, McCarthy
6	176317275050244	4.9	7.9	10.0	Thomas,Readman, McCarthy
7	176307695051265	2.1	4.0	10.0	Thomas,Readman, McCarthy
8	176326495050635	4.9	5.5	9.0	Scholten, Readman, Eggers
9	176316715050905	1.8	4.9	9.0	Scholten, Readman, Eggers
10	176321815049248	4.9	7.9	9.0	Scholten, Readman, Eggers
11	176311775051368	2.1	4.0	9.0	Scholten, Readman, Eggers
12	176324795048878	5.2	7.0	9.5	Scholten, Thomas
13	176312195050460	5.5	5.5	9.5	Scholten, Thomas
14	176311635050866	5.5	5.5	9.5	Scholten, Thomas
15	176312165049849	5.5	5.5	9.5	Scholten, Thomas

Table 2 Catch summary, Three Mile Lake FWIN, 2006.

Sample	Burbot	Northern Pike	Rock Bass	Smallmouth Bass	Walleye	White Sucker	Yellow Perch
1	0	0	2	0	0	0	0
2	0	1	9	0	0	0	1
3	0	0	2	1	0	0	1
4	0	0	2	0	1	0	0
5	1	0	28	1	3	0	1
6	0	0	1	0	1	0	0
7	0	2	0	2	0	21	0
8	0	1	5	0	1	0	1
9	0	0	8	4	1	0	0
10	0	1	5	1	1	0	0
11	0	0	1	1	2	1	0
12	0	0	3	0	1	0	0
13	0	0	8	1	0	2	1
14	0	0	1	0	0	0	0
15	0	1	0	0	2	1	0
Total	1	6	75	11	13	25	5
Mean	0.07	0.40	5.00	0.73	0.87	1.67	0.33
Geo. Mean	0.05	0.29	2.90	0.51	0.68	0.45	0.26
St. Error	0.05	0.11	0.27	0.14	0.13	0.24	0.09

Table 3 Total length composition, by species, Three Mile Lake FWIN, 2006.

TL	Northern Pike	Smallmouth Bass	Walleye
151-175		1	
176-200			
201-225			
226-250			1
251-275			
276-300			1
301-325			1
326-350			
351-375		1	1
376-400			3
401-425		3	
426-450	1	3	
451-475		2	
476-500			2
501-525	1		1
526-550	1		
551-575			1
576-600			
601-625			2
626-650			
651-675	2		
Total	5	10	13

Table 4 Age composition and mean total length-at-age, Three Mile Lake FWIN, 2001 and 2006.

	n		Mean Total Length		
Age	2001	2006	2001	2006	All
0	1		126.0		126.0
1		3		287.0	287.0
2		4		382.0	382.0
3		1		480.0	480.0
4	6	2	474.0	501.0	480.8
5	3		503.0		503.0
6	3		495.7		495.7
7		1		622.0	622.0
8					
9		1		618.0	618.0
10		1		561.0	561.0
11					
12	1		580.0		580.0
13					
14	1		555.0		555.0

Table 5 Walleye maturity, by total length, Three Mile Lake FWIN, 2001 and 2006 combined.

	Male		Female	
TL	Imm	Mat	Imm	Mat
201-250	1			
251-300			1	
301-350			1	
351-400	1	1	2	
401-450				
451-500		5	1	5
501-550		1		3
551-600		3		
601-650				2

Table 6 Walleye maturity, by age, Three Mile Lake FWIN, 2001 and 2006 combined.

	Male		Female	
Age	Imm	Mat	Imm	Mat
1	1		2	
2	1	1	2	
3				1
4		3	1	4
5				3
6		3		
7				1
8				
9				1
10		1		
11				
12		1		
13				
14		1		

Table 7 Selected population status indicators, Three Mile Lake FWIN, 2001 and 2006.

	2001	2006
Average Catch	1.0	0.7
Catch SE	0.15	0.13
Proportion of Nets with Walleye	0.75	0.60
GM-CUE > 450	1.0	0.3
Number of Age Classes	3	7
Maximum Observed Age	14	10
Shannon Index of Mature Females	0.29	0.56
Average Size (TL)	473	436

Table 8 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

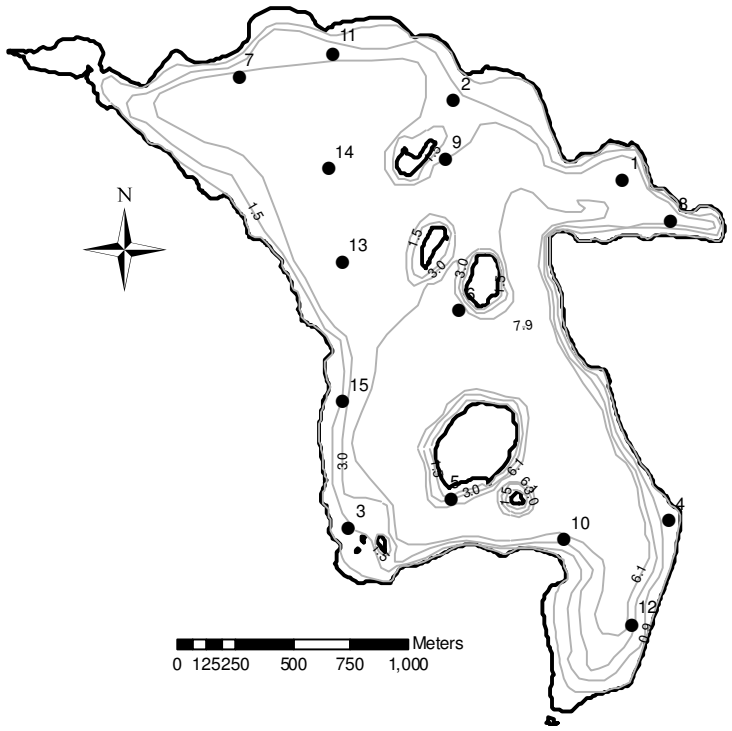


Figure 1 Three Mile Lake net set locations and bathymetry, FWIN, 2006. Depths in metres.

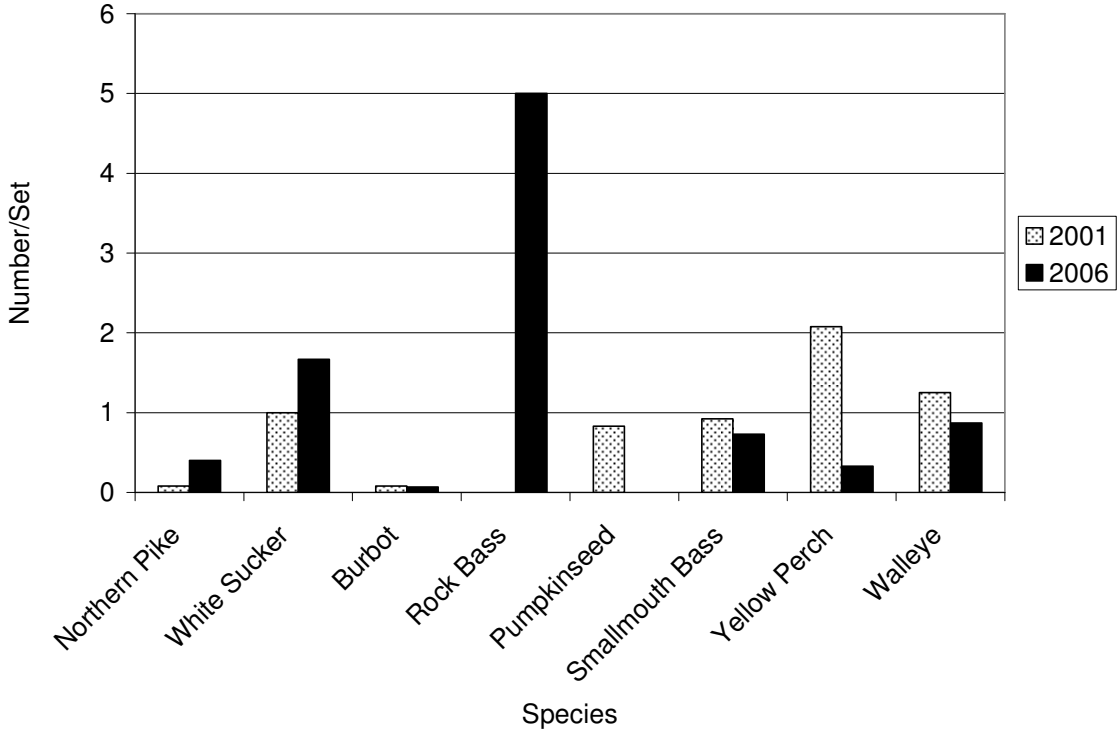


Figure 2 Catch composition (arithmetic mean catch-per-net), Three Mile Lake FWIN, 2001 and 2006.

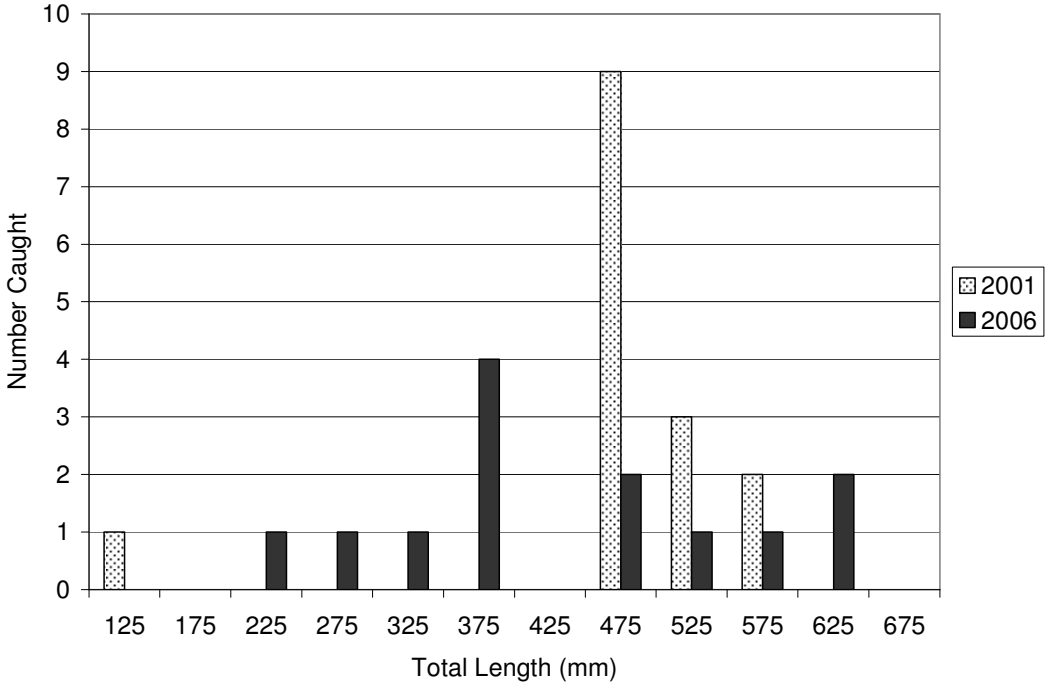


Figure 3 Total length distribution of walleye, Three Mile Lake FWIN, 2001 and 2006.

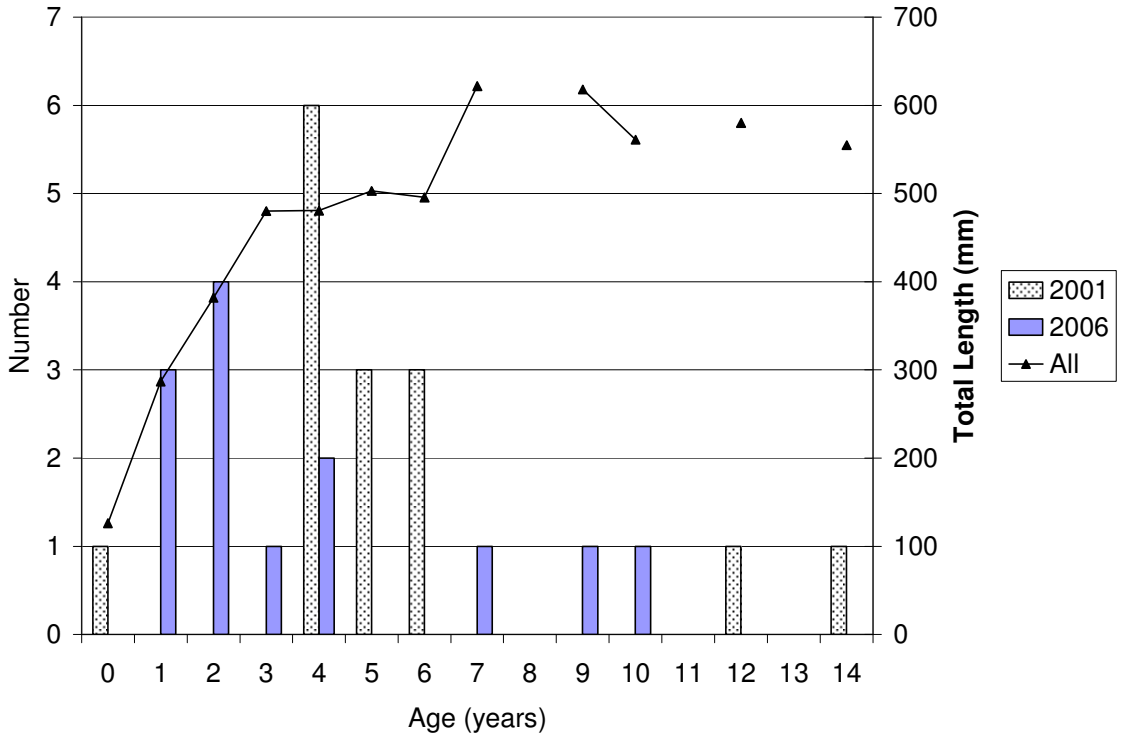


Figure 4 Age distribution and mean total length-at-age of walleye, Three Mile Lake FWIN, 2001 and 2006.

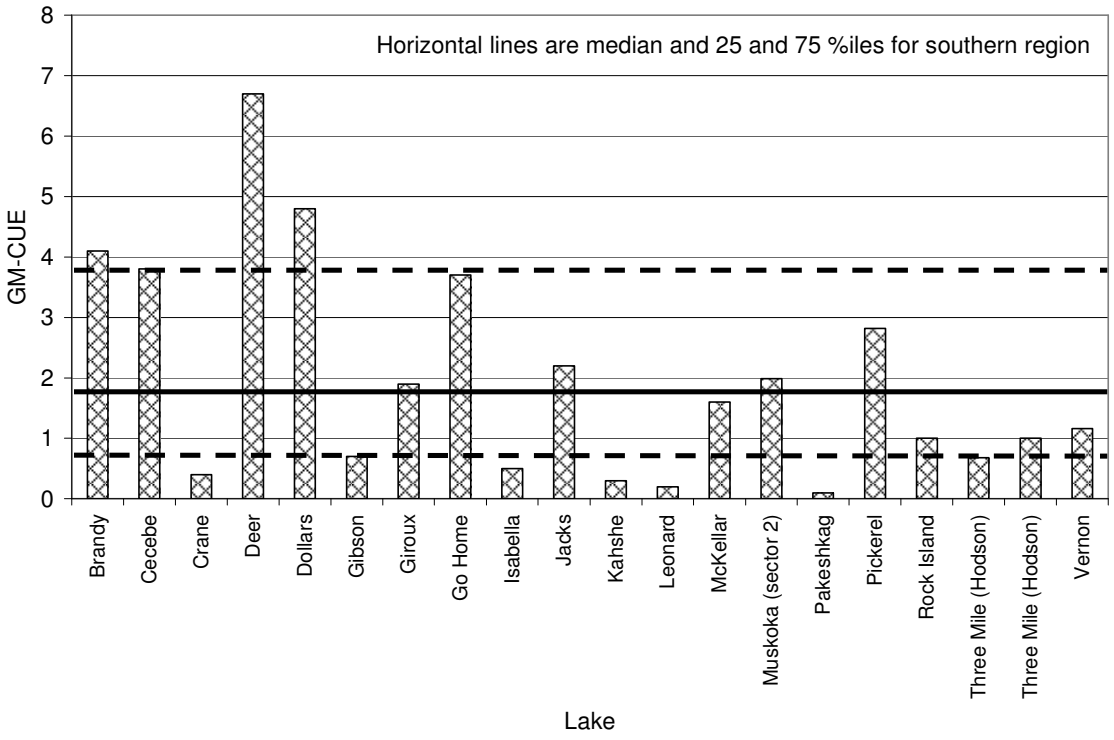


Figure 5 Geometric mean CUE for walleye from FWIN surveys conducted in Parry Sound District, 2001-2007.

Appendix 1 Fish data.

YEAR	SAM	EFF	SPC	FISH	FLEN	TLEN	RWT	AGE	SEX	MAT
2001	8	999	131	38	587	621	1704	6	1	2
2001	1	999	163	7	454	490				
2001	1	999	163	8	500	543				
2001	1	999	163	9	503	538				
2001	1	999	163	10	455	486				
2001	1	999	163	11	455	485				
2001	1	999	163	12	435	464				
2001	2	999	163	14	535	567				
2001	3	999	163	18	463	502				
2001	3	999	163	19	448	480				
2001	3	999	163	20	434	462				
2001	5	999	163	22	269	284				
2001	9	999	271	48		412				
2001	1	999	313	5	99	103				
2001	1	999	313	6	91	96				
2001	5	999	313	23	225	229				
2001	6	999	313	28	192	195				
2001	6	999	313	29	157	162				
2001	6	999	313	30	164	171				
2001	7	999	313	33	173	179				
2001	8	999	313	39	220	231				
2001	8	999	313	40	203	210				
2001	8	999	313	41	159	164				
2001	1	999	316	3	319	337	609	3	1	2
2001	1	999	316	4	307	325	539	3	1	2
2001	5	999	316	24	373	395	1004	6	2	2
2001	5	999	316	25	333	350	594	3	2	2
2001	5	999	316	26	321	338	522	3	1	2
2001	5	999	316	27	314	330	564	3	1	2
2001	8	999	316	42	417	445	1308	10	1	2
2001	8	999	316	43	390	413	1156	9	2	2
2001	8	999	316	44	422	443	1496	9	2	2
2001	8	999	316	45	362	383	837	4	2	2
2001	8	999	316	46	337	352	625	3	2	2
2001	1	999	334	1	451	475	1071	4	2	2
2001	1	999	334	2	443	467	947	4	2	1
2001	2	999	334	13	531	555	1295	14	1	2
2001	3	999	334	15	474	500	1375	5	2	2
2001	3	999	334	16	467	492	1246	6	1	2
2001	3	999	334	17	445	474	1095	4	1	2
2001	5	999	334	21	481	512	1348	6	1	2
2001	6	999	334	31	481	505	1314	5	2	2
2001	6	999	334	32	458	483	1109	6	1	2
2001	7	999	334	34	116	126	14	0	9	9
2001	7	999	334	35	446	466	1049	4	1	2
2001	7	999	334	36	447	472	1054	4	1	2
2001	8	999	334	37	464	490	1090	4	2	2
2001	9	999	334	47	480	504	1222	5	2	2

2001	10	999	334	49	556	580	2053	12	1	2
2006	2	7	131	1	957			10		
2006	7	5	131	10	622	654	1625	6	1	2
2006	7	5	131	9	621	665	1750	6	1	2
2006	8	5	131	13	494	525	1050	3	9	9
2006	10	4	131	21	415	444	550	1	9	9
2006	15	4	131	29	499	532	960	2	2	2
2006	3	7	316	2	405	430	1100	7	9	9
2006	5	2	316	4	156	163	50	1	9	9
2006	7	7	316	12	390	416	975	6	2	2
2006	7	7	316	11	408	430	1200	7	2	2
2006	9	4	316	15	389	406	800	5	9	9
2006	9	7	316	17	400	420	1100	7	9	9
2006	9	7	316	16	435	456	1450	7	9	9
2006	10	7	316	19	404	427	1080	9	9	9
2006	11	7	316	24	425	455	1300	10	9	9
2006	13	6	316	26	349	369	640	4	9	9
2006	4	3	334	3	235	244	120	1	1	1
2006	5	6	334	5	452	480	1020	3	2	2
2006	5	6	334	6	484	512	1140	4	2	2
2006	5	6	334	7	590	622	2750	7	2	2
2006	6	5	334	8	365	380	480	2	1	1
2006	8	6	334	14	370	392	550	2	2	1
2006	9	7	334	18	525	561	1600	10	1	2
2006	10	4	334	20	305	321	275	1	2	1
2006	11	5	334	22	351	374	470	2	1	2
2006	11	5	334	23	465	490	1125	4	2	2
2006	12	3	334	25	280	296	230	1	2	1
2006	15	5	334	28	361	382	490	2	2	1
2006	15	7	334	27	594	618	2750	9	2	2