Results of Fall Walleye Index Netting (2001) and Spring Trap Netting (2009) Surveys Conducted on Kahshe Lake

File Report

Stephen Scholten

Ontario Ministry of Natural Resources

Bracebridge, Ontario

2012

Contents

Introduction 2
Fall Walleye Index Netting, 2001 3
Results 3
Spring Spawning Survey 2009 7
Methods 7
Results 8
Walleye 8
Walleye Tag Returns 11
Other Species 12
Discussion 13
References 16

Tables

Table 1 Summary of historic stocking activity, Kahshe Lake. 3
Table 2 Summary of recent walleye stocking activity, Kahshe Lake. 3
Table 3 Sampling summary, Kahshe Lake FWIN, 2001. 4
Table 4 Catch summary, Kahshe Lake FWIN 2001. 5
Table 5 Fork length composition, by species, Kahshe Lake FWIN, 2001 6
Table 6 Trap net set locations and configurations, Kahshe and Bass Lake, 2009. 7
Table 7 Daily average (hourly readings) water temperature recorded during spring trap netting in Kahshe and Bass Lakes, 2009. 8
Table 8 Number of fish caught, by species and set number and trap net location, Kahshe and Bass Lake, 2009 9
Table 9 Fork length distribution of fish species, all sets combined, caught in spring trap netting survey, Kahshe Lake, 2009. 10
Table 10 Observed and estimated age composition and descriptive statistics of fork length, by age and sex, for walleye, Kahshe Lake spring trap netting, 2009. 10
Table 11 Date and location of recapture of walleye tagged in the spring of 2009 at Houseys Rapids Site 3) and the mouth of the Kahshe River in Bass Lake (Site 2). 12
Table 12 Observed age composition and descriptive statistics of fork length, by age and sex, for northern pike, Kahshe Lake spring trap netting, 2009. 12
Table 13 Catch summary for netting projects conducted on Kahshe Lake, 1975 – 2001. 14

Figures

Figure 1 Bathymetric map of Kahshe Lake. 2
Figure 2 Map showing FWIN net set sites, 1991. Locations are approximate (+500m). 4
Figure 3 Catch summary, Kahshe Lake FWIN, 2001. 5
Figure 4 Comparison of geometric mean catch per net of walleye from FWIN surveys conducted in Parry Sound District, 2001-2007. 6
Figure 5 Map of locations of trap net sets in Kahshe and Bass Lake, 2009. 8
Figure 6 Estimated age composition and mean fork length, by age and sex, for walleye, Kahshe Lake spring trap netting, 2009. 11
Figure 7 Observed age composition and mean fork length, by age and sex, for northern pike, Kahshe Lake spring trap netting, 2009. 13

Introduction

Kahshe Lake is a large (830 ha) lake located in southern Muskoka (Figure 1). It is moderately deep (Z_{max}= 20 m, Z_{mean} = 5 m) and physically diverse with many bays and islands. Water clarity and nutrient levels are moderate (Secchi depth = 3.0 m, TP = 12 ug/l, DMM 2008). The lake thermally stratifies; by late summer the hypolimnion is essentially anoxic. Kahshe Lake is connected to Bass Lake, upstream, by a channel (Houseys Rapids) that has been deepened for navigation. Two main tributaries, Kahshe River and Gartersnake River, flow into Bass Lake. There is a historic walleye spawning area on the Gartersnake River, about one km upstream from Bass Lake. Spawning also occurs in the narrows between the two lakes. Physically, Kahshe Lake appears to provide good habitat for walleye.

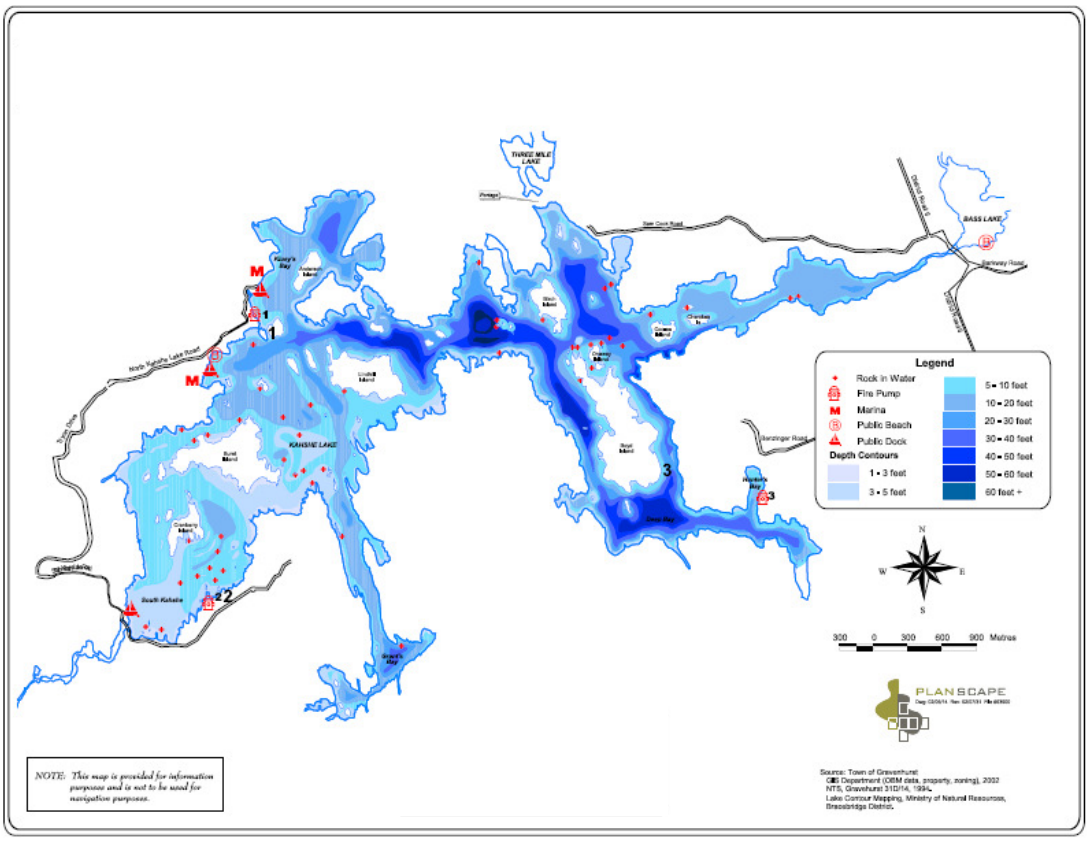


Figure 1 Bathymetric map of Kahshe Lake.

There is not good documentation of which fish species were native to the lake. A 1929 report suggests that smallmouth bass may have been the only native sport fish species, although they were stocked as early as 1914. Other native species likely included lake herring (cisco), white sucker, yellow perch, burbot, brown bullhead, pumpkinseed and several small fish species. Walleye were stocked beginning in 1939 and continued intermittently until 1956. Muskellunge and largemouth bass were introduced in the 1940's, 50's and 60's. Walleye were again stocked in 1984, 1988 and 1989 as part of an enhancement effort. Rock bass, northern pike (first reported 1992) and black crappie (1991) have become established more recently, probably as a result of intentional, but unauthorized stocking. Grass pickerel, listed by COSEWIC as Special Concern, have been documented several times since the 1950's; their origin, distribution and abundance are uncertain. The fish community today is diverse and bears little resemblance to the natural state. This diversity has probably placed limitations of the potential productivity of the walleye population.

An attempt was made to enhance the walleye population in the late 1980's. An area of spawning habitat was created at Houseys Rapids, between Kahshe and Bass Lakes and supplemental stocking was done (Table 1,Table 2). These efforts were not formally followed with assessment. Notes on file indicate that the spawning area did not have enough water velocity over it to attract spawning walleye.

Table 1 Summary of historic stocking activity, Kahshe Lake.

Species	First Year	Last Year	Number Yrs Stocked
smallmouth bass	1915	1959	19
largemouth bass	1952	1965	3
muskellunge	1945	1967	24
walleye	1939	1956	13

Table 2 Summary of recent walleye stocking activity, Kahshe Lake.

Year	Development Stage	Mean Weight (g)	Number	Stocking Site	Source Waterbody
1984	Fingerling	1	5925	Houseys Rapids	Three Mile Lake
1984	Fingerling	1	21168	Klueys Bay	Three Mile Lake
1984	Fingerling	1	6016	NE of Birch Is.	Three Mile Lake
1988	Sub-adults	667	182	Houseys Rapids	Lake Huron
1988	Sub-adults	667	90	Houseys Rapids	Lake Huron
1989	Sub-adults	1,381	197		Lake Erie

Several assessments of the fish community have been done including the original lake survey (1975), contaminant sampling (1978) and a walleye trap net assessment (Baker 1987).

This report presents the results of a Fall Walleye Index Netting (FWIN) survey done in 2001 and a spring trap net survey of spawning activity completed in 2009. The status of the walleye population is reviewed and management recommendations are presented.

Fall Walleye Index Netting, 2001

The Fall Walleye Index Netting (FWIN) was done as part of a region-wide project to obtain a point-in-time estimate of the status of the overall southern Ontario walleye resource. Approximately 60 lakes were randomly selected for sampling. FWIN gear consists of a gang of eight panels of 7.6 m (25ft) gillnet of mesh sizes ranging from 25 mm (1 in.) to 152 mm (6 in.), Nets are set for 24 hours in two depth strata (2-5 m, 5-15 m) with effort allocated proportional to the area in each stratum. Netting is done in the fall when the water temperature is between 10 and 15°C (Morgan 2002). Data are archived in FISHNET2 as project IA01_KAH.

Results

Netting occurred from October 15-17, 2001. A total of 12 nets were set over a two day period (Table 3). Six sets were in the shallow stratum (2-5 m) and six in the deep stratum (5-15 m). Water temperature at the time was 13° C. Net set locations were chosen randomly based on a 1 km grid. Approximate locations are shown in Figure 2.

A total of ten species were caught with cisco (38) and yellow perch (59) dominating the catch (Table 4, Figure 3). Seventeen northern pike were caught; the first documented catch of this species, although anecdotal reports had been received since 1992. Black crappies were also caught; the first records for the lake, though, like pike, they have been reported to be present for over a decade. One muskellunge was caught, confirming that the species is still present in the lake in small numbers.

Table 3 Sampling summary, Kahshe Lake FWIN, 2001.

Sample	Area	Grid	Set Date	Set Time	Water Temp. (oC)	Gear Depth (min)	Gear Depth (max)	Lift Date	Lift Time
1	2	2	15/10/2001	15:25	13	9	12	16/10/2001	12:38
2	2	14	15/10/2001	15:40	13	8	15	16/10/2001	13:02
3	1	7	15/10/2001	15:47	13	4	8	16/10/2001	13:17
4	2	15	15/10/2001	15:55	13	10	10	16/10/2001	13:31
5	1	16	15/10/2001	16:05	13	3	6	16/10/2001	14:05
6	1	26	15/10/2001	16:12	13	4	5	16/10/2001	14:25
7	2	6	16/10/2001	12:54	13	11	15	17/10/2001	10:50
8	2	24	16/10/2001	14:00	13	11	19	17/10/2001	11:20
9	1	19	16/10/2001	15:15	13	3	6	17/10/2001	12:15
10	1	11	16/10/2001	15:30	13	3	4	17/10/2001	12:30
11	1	10	16/10/2001	15:48	13	3	3	17/10/2001	12:48
12	2	1	16/10/2001	16:08	13	5	7	17/10/2001	13:10

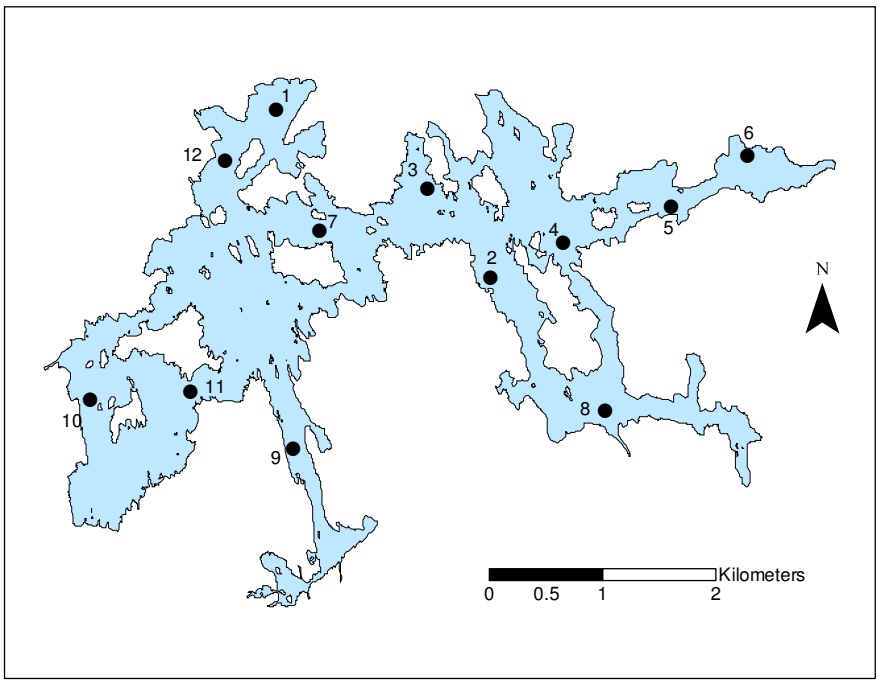


Figure 2 Map showing FWIN net set sites, 1991. Locations are approximate (±500m).

Only five walleye were caught, resulting in a catch rate of 0.4 (±0.4) fish/net set. The catch rate was significantly lower than the average for lakes sampled in FMZ 15 (2.5±0.8) from 1996 to 2003. Compared to lakes sampled within Parry Sound MNR District, the catch rate for Kahshe was among the lowest sampled to date (Figure 4).

Four of the five walleye were relatively large (> 55 cm TL) (Table 5). The fifth walleye was smaller (21 cm TL). The small sample size precluded further analysis of the individual fish data.

In summary, in 2001, the abundance of walleye in Kahshe Lake was very low. The sample size was very small but the population appeared to be dominated by large, old fish, indicating that recruitment of young fish into the adult population was chronically poor. No information is available on the fishery, specifically the amount of harvest, but it is doubtful that it is significant or that it is the primary cause of low abundance. It is likely a function of aspects of the habitat and or fish community interactions.

Table 4 Catch summary, Kahshe Lake FWIN 2001.

Sample	Lake Herring	Northern Pike	Muskellunge	Rock Bass	Pumpkin-seed	Smallmouth Bass	Largemouth Bass	Black Crappie	Yellow Perch	Walleye
1	6	1	0	0	0	0	0	1	2	0
2	0	2	0	0	0	1	0	0	3	0
3	0	2	0	0	0	3	0	0	1	0
4	4	0	0	1	1	0	0	3	18	1
5	1	1	0	6	0	5	0	0	1	0
6	6	0	0	0	4	0	1	1	19	2
7	20	1	1	0	0	0	0	0	1	2
8	0	0	0	0	0	0	0	0	0	0
9	0	1	0	3	0	0	0	0	1	0
10	0	2	0	1	0	0	0	0	3	0
11	0	5	0	0	0	0	1	0	0	0
12	1	2	0	0	0	0	0	2	10	0
Total	38	17	1	11	5	9	2	7	59	5
Mean	3.2	1.4	0.1	0.9	0.4	0.8	0.2	0.6	4.9	0.4
St. Dev.	5.8	1.4	0.3	1.8	1.2	1.6	0.4	1.0	6.9	0.8
St Err.	1.7	0.4	0.1	0.5	0.3	0.5	0.1	0.3	2.0	0.2
95% Con. Limit	3.3	0.8	0.2	1.0	0.7	0.9	0.2	0.6	3.9	0.4
Geo. Mean	1.3	1.1	0.1	0.5	0.2	0.4	0.1	0.4	2.5	0.3
Median	0.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0

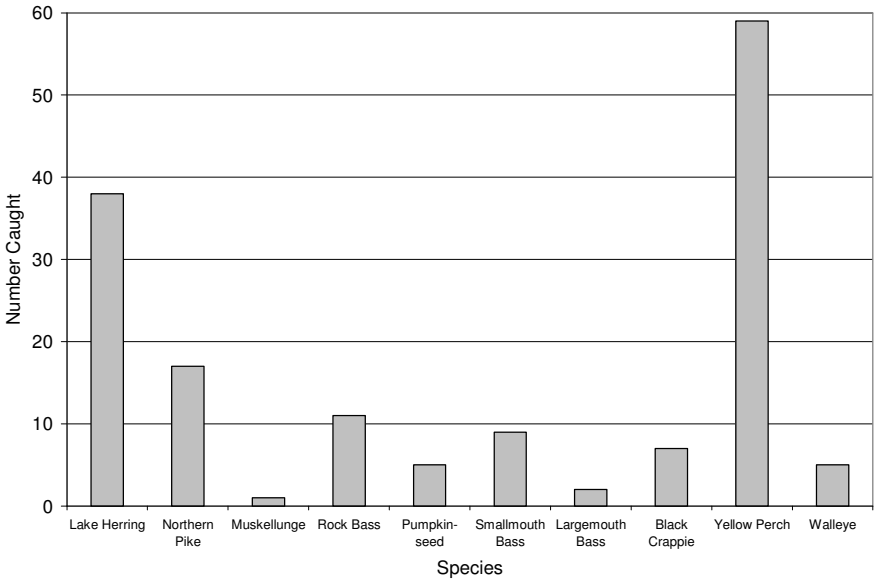


Figure 3 Catch summary, Kahshe Lake FWIN, 2001.

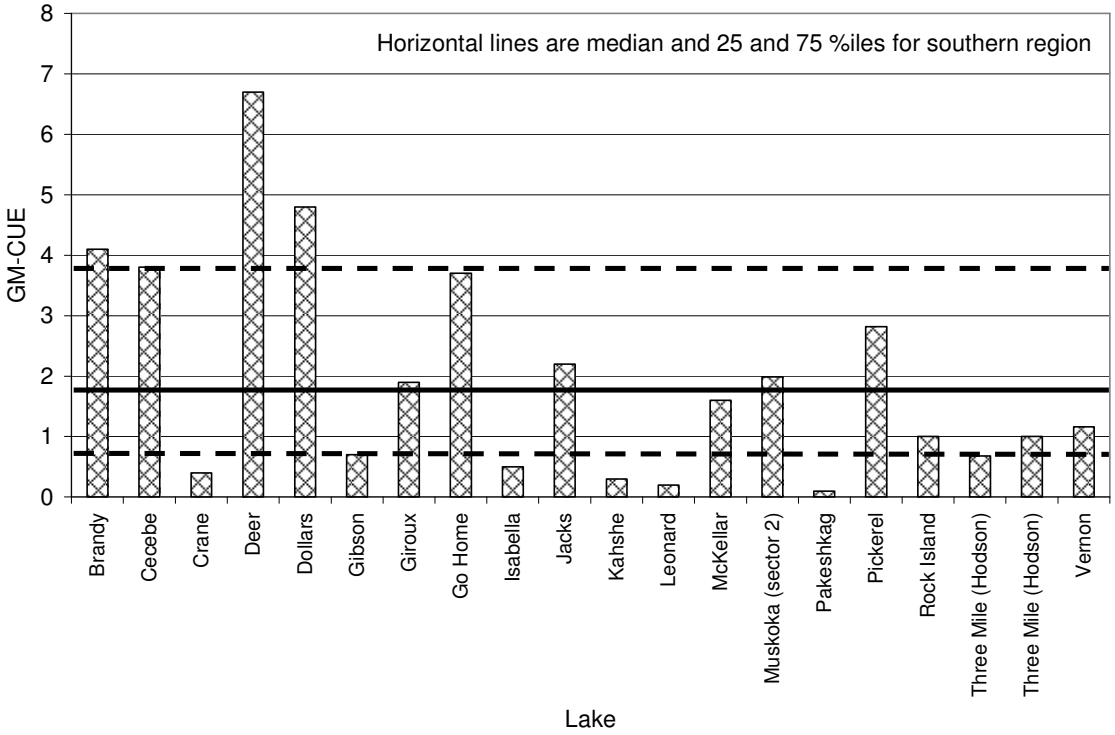


Figure 4 **Comparison of geometric mean catch per net of walleye from FWIN surveys conducted in Parry Sound District, 2001-2007.**

Table 5 **Fork length composition, by species, Kahshe Lake FWIN, 2001.**

Fork Length	Black Crappie	Lake Herring	Large-mouth Bass	Muskel-lunge	Northern Pike	Pumpkin-seed	Rock Bass	Smallmouth Bass	Walleye	Yellow Perch
51-100										4
101-150	2	4				2	1	1		20
151-200	1	32				2	7	2	1	13
201-250	1		2				3	3		
251-300	2				1					
301-350										
351-400					1			2		
401-450					1					
451-500					4					
501-550					2				2	
551-600					2				1	
601-650					3					
651-700					1				1	
701-750					2					
851-900				1						
Grand Total	6	36	2	1	17	4	11	8	5	37

Spring Spawning Survey 2009

The 2001 FWIN found a low abundance of walleye, in contrast to the apparently good habitat provided by the lake, but perhaps in consistent with the occurrence of a diverse community of predator and competitor species.

As a follow up, in 2008, an investigation was made into the status of the spawning run into the Gartersnake River. Historically, a run of several hundred fish occurred there (D. Marshall, retired conservation officer, pers. comm.); significant enough that it was a site of regular enforcement efforts and a spring sanctuary was regulated. Staff changes resulted in loss of knowledge of status of the run by 2008. The sanctuary was repealed in 2008, as the dates fell fully within the regular closed season for walleye and there were no known compliance issues at the site.

Field observations found that the Gartersnake River upstream of Bass Lake had two significant blockages; a beaver dam at the mouth of the river and a build up of beaver and other debris under a narrow bridge on private land. Two nights of observations during the expected walleye spawning window revealed no walleye at the traditional spawning site. It was speculated that the blockages were impeding the movement of walleye to the spawning area and possibly affecting population abundance. As nothing was known of spawning activity on the rest of the lake, it was not possible to know how much the Gartersnake site contributed to recruitment in the whole lake, and therefore, how important it was to maintain this spawning stock.

An effort was made to work with landowners to have the blockages removed; however the owner of the private bridge preferred to keep the blockage as it provided greater water depth upstream, for recreation. Trap netting was done in the spring of 2009 in order to try to get information on the importance of providing passage to the traditional spawning area.

Methods

Three standard 6 ft trap nets were used. Nets were set in the spring immediately after ice-out. The nets were set at the mouth of the Gartersnake River, the mouth of the Kahshe River (also in Bass Lake) and just downstream of Houseys Rapids. Nets were set non-randomly at locations where it was thought that they would be most likely to catch walleye that would be entering the streams to spawn (Table 6, Figure 5).

Table 6 Trap net set locations and configurations, Kahshe and Bass Lake, 2009.

Site	Location	UTM	Leader Length (m)	Angle to Shore	Start Depth (m)	Mid Depth (m)	Gap Depth (m)
1	Bass Lake at Kahshe River mouth	17 642111 4970710	46	90	0	1.1	2.1
2	Kahshe L downstream of Houseys Rapids	17 641278 4970638	46	90	0	1.5	2.2
3	Bass Lake at Gartersnake River mouth	17 640692 4969706	40	45	0	1.4	2.0

Nets were set on April 16 and lifted daily until April 27, 2009; initial warm temperatures were followed by a cooling trend then warming again (Table 7). Each trap was lifted 11 days. All captured fish were counted. Non-game species were fork length tallied (sub-sampled for large catches) and walleye and some pike were detail sampled, including length, weight, sex, maturity and spawning status. Dorsal fin spines (walleye) or pectoral rays (pike) were collected for age determination. Walleye were tagged with either a Floy spaghetti tag or oval disc tag, tied using a suture needle and monofilament to determine potential movements between the three trap net locations.

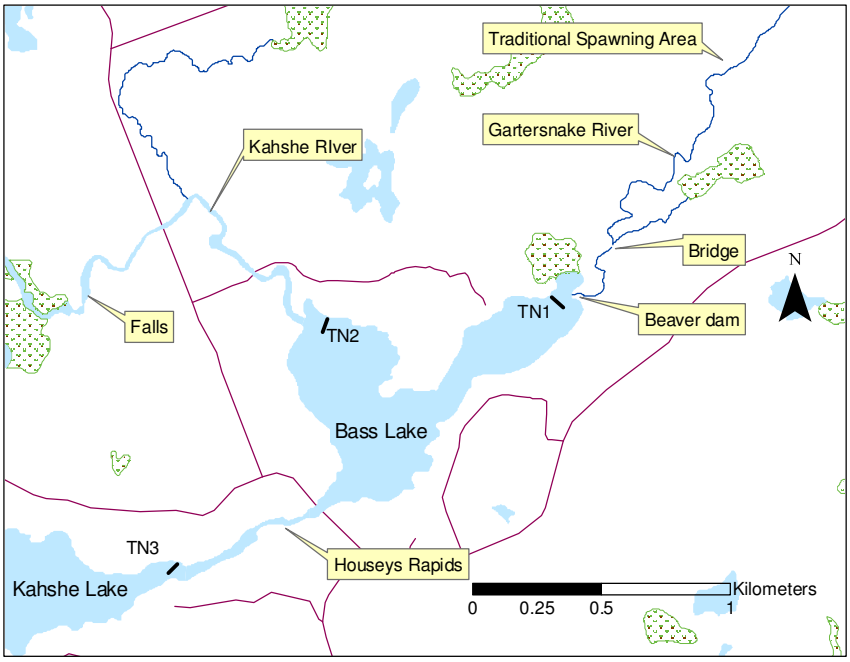


Figure 5 **Map of locations of trap net sets in Kahshe and Bass Lake, 2009.**

Table 7 **Daily average (hourly readings) water temperature recorded during spring trap netting in Kahshe and Bass Lakes, 2009.**

	Gartersnake River	Kahshe River	Kahshe Lake @ TN 3
18-Apr-09	9.9	6.6	9.4
19-Apr-09	9.2	7.0	8.4
20-Apr-09	8.2	6.3	7.8
21-Apr-09	7.2	5.6	7.2
22-Apr-09	6.7	5.8	6.8
23-Apr-09	6.6	6.2	6.9
24-Apr-09	7.9	7.6	7.3
25-Apr-09	10.0	9.1	8.7
26-Apr-09	10.8	8.7	9.6
27-Apr-09	9.9	8.1	9.1

Data are archived in FISHNET3 as project IS09_KAH.

Results

Walleye

At trap net Site 1, mouth of the Gartersnake River, only 6 walleye were caught (Table 8). Of the six walleye, 4 were deemed by external examination to be spent females, one a spawning female and one a spawning male. It was apparent that there was virtually no spawning run or even an attempt at a run to the traditional spawning site; all of the fish could have spawned at another location.

Table 8 Number of fish caught, by species and set number and trap net location, Kahshe and Bass Lake, 2009.

Site	Set	Black Crappie	Brown Bullhead	Creek Chub	Large-mouth Bass	Northern Pike	Pumpkin-seed	Rock Bass	Small-mouth Bass	Walleye	White Sucker	Yellow Perch
1	1	414	37		7	54	36	1		1	3	
	4	77				5	7					1
	7	93	8		9	10	16	3		1		
	10	44	24		6	16	18	2	2		1	
	13	10	6			3	14	1		2	1	1
	16	6	5		1	2	10			1		
	19	7	2		1	3	5	1				1
	22	5	3			1	7					3
	25	30	17		2	7	14	3		1		1
	28	9	34		5	6	7	2				
	31	10	24		4	7	2	2	2			
Total		705	160		35	114	136	15	4	6	5	7
2	2	354	1		1	11	42	2		4	4	2
	5	76				1	23	3		6	4	1
	7									1		
	8	22	1			5	12			3		
	11	36	2			3	9			2	4	
	14	6	1				3			1	1	
	17	1	1				4	1		3	1	
	20	7				4	1	1		2	1	1
	23	20	2			1	5	1		10	1	
	26	20	9			6	9	1	1	11		3
	29	22	9		6		18	7		4	1	6
	32	26	4	1		1	3	5		6	1	2
Total		590	30	1	7	32	129	21	1	53	18	15
3	3	5	1		3	12	1	4		71		
	6	3	1		8	5	2	7		23		
	9	3	7		2	3	5	2	1	17		
	12	3			4	4		6		27		
	15	1			1	4	4	9		6		
	18				1	3	1	3		9	1	1
	21	1			2	2	5	2		11		
	24	1					3			15		
	27				4	1	4	3		9		
	30		2		7			2		19		
	33	2	1		17	4	1	6	1	13		
Total		19	12		49	38	26	44	2	220	1	1
Grand Total		1314	202	1	91	184	291	80	7	278	24	23

One walleye that was tagged at Site 1 was recaptured during the project. It was a spent female and was recaptured the next day at the Houseys Rapids site. No walleye tagged at the other sites were recaptured at Site 1.

At trap net site 2, mouth of the Kahshe River, 53 walleye were caught. This was an unexpected result as there was no knowledge of walleye spawning occurring in the river. A mix of pre-spawn, spawning and spent males and females were caught over the full duration of the project. Clearly walleye were spawning in the Kahshe River or immediately around the river mouth area. Where this activity is occurring was not determined. The river mouth area flows through a swamp and has a soft bottom, as does the lake bed in the area and no spawning habitat is available. An impassable falls occurs on the river upstream of Houseys Rapids Road on the Camp Teopoli property. Attempts were made to do visual observations but access to the fast water at the foot of the falls is difficult. No walleye were seen.

One walleye that was tagged at Site 2 was recaptured at the same site 9 days later. Three walleye that were tagged at the Houseys Rapids site were recaptured at Site 2, between 6 and 10 days later.

At trap net site 3, Kahshe Lake downstream of Houseys Rapids, 220 walleye were caught. The magnitude of this catch was unexpected. Houseys Rapids is being used a significant spawning area, more so than has been recognized, or perhaps occurred, in the past. Night time observations in 2009 confirmed fish present at the upstream end of the narrows. Stained and deep water precluded visual observations elsewhere.

Eight walleye that were tagged at Site 3 were recaptured at the same site between 0 and 10 days later.

Walleye ranged in size from 291 to 736 mm FL with an average of 508 mm. The length distribution is shown in Table 9. A sub-sample of walleye was aged and the results extrapolated to estimate the overall age composition of the catch. Ages ranged from 2 to 14 years old with all but one year class in that range represented and several relatively strong year classes occurring (Table 10, Figure 6). Males appear to be maturing for the first time primarily at age 3 and females at age 4 or 5. Early growth is quite rapid with fish reaching about 30 cm FL by age 2 and 50 cm by age 5.

Table 9 Fork length distribution of fish species, all sets combined, caught in spring trap netting survey, Kahshe Lake, 2009.

Fork Length (mm)	Black Crappie	Brown Bullhead	Large-mouth Bass	Northern Pike	Pumpkin-seed	Rock Bass	Small-mouth Bass	White Sucker	Yellow Perch	Walleye
<76										
76-100					1					
101-125	16				35	3				
126-150	104	2			96	2				
151-175	115	2		1	92	32			18	
176-200	52	7			24	12			4	
201-225	155	24	2		3	22				
226-250	40	19	1			4				
251-275	18	22	2	2		3				
276-300	10	22				1	1	1		1
301-325	4	45	9					1		2
326-350	1	2	7	1				1		
351-375	1	1	20	3			1	4		
376-400		1	15	3			1	2		4
401-425			15	8			4	3		6
426-450			10	11				5		13
451-475			6	18				4		45
476-500			3	8						58
501-525			1	19				3		62
526-550				17						23
551-575				23						20
576-600				15						11
601-625				15						6
626-650				15						8
651-675				12						2
676-700				4						1
701-725				3						1
726-750				3						1
926-950				1						
976-1000				1						
Total	516	147	91	183	251	79	7	24	22	264

Table 10 Observed and estimated age composition and descriptive statistics of fork length, by age and sex, for walleye, Kahshe Lake spring trap netting, 2009.

	Male						Female/Unknown					
Age	n (obs.)	p (est.)	mean	min	max	S.D.	n (obs.)	p (est.)	mean	min	max	S.D.
2	2	0.010	305	291	318	19	1	0.005	315	315	315	
3	7	0.071	414	385	452	24	1	0.014	471	471	471	
4	13	0.174	462	408	505	24	19	0.393	496	472	533	19
5	4	0.049	513	483	545	26	11	0.142	542	463	604	40
6	3	0.024	539	523	554	16		0.000				
7	2	0.016	543	525	560	25	9	0.046	599	573	628	15
8	1	0.008	562	562	562		2	0.010	626	608	644	25
9	1	0.005	591	591	591							
10	3	0.014	594	582	602	11						
11							2	0.010	653	636	670	24
12							1	0.005	736	736	736	
13												
14							1	0.005	720	720	720	

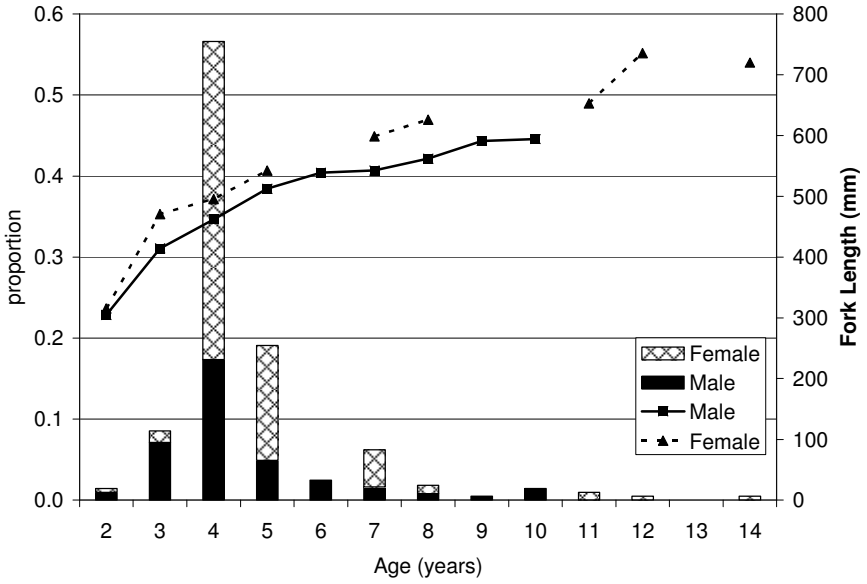


Figure 6 Estimated age composition and mean fork length, by age and sex, for walleye, Kahshe Lake spring trap netting, 2009.

Overall, the spawning population appears to be fairly robust with a range of sizes and ages being present. Population abundance can't be easily determined from the spring survey due to the non-random nature of the net sets. However, the number of walleye caught in the spring was higher than expected, considering the very low abundance found in the 2001 FWIN survey.

Walleye Tag Returns

The tags applied in the spring of 2009 were only intended to monitor movements of walleye between the trap net locations during the duration of the netting project. The tags did not have any contact information that anglers could use to report them. However, between May 2009 and January 2012, 18 tags were reported by anglers. Due to the lack of contact information, the non-reporting rate was probably high. Reported recapture locations included all areas of the lake (Table 11). That was not surprising as the lake is not particularly large and walleye are quite mobile and demonstrates that fish from all areas of the lake use the Houseys Rapids and Kahshe River areas for spawning. It is not known whether there are other areas in the lake where walleye may be spawning.

Table 11 Date and location of recapture of walleye tagged in the spring of 2009 at Houseys Rapids Site 3) and the mouth of the Kahshe River in Bass Lake (Site 2).

Tag	Tag Date	Tag Site	Recapture Date	Recapture Location
29423	20-Apr-09	3	18-May-09	Deep Bay; east side of Pine Island
			30-May-09	Sophers Bay; ~S shore ~ 1000yds E of dam
29448	18-Apr-09	3	30-May-09	near 600 Kahshe L Road
29407			07-Jun-09	Deep Bay
29490	20-Apr-09	3	05-Jun-09	near Anderson Island
29419	19-Apr-09	3	20-Jun-09	islands near portage to Three Mile Lake
BS0993	17-Apr-09	3	24-Jun-09	bottom of Deep Bay
29867	27-Apr-09	3	25-Jun-09	Bass L at narrows into east bay
BS0979	17-Apr-09	3	21-Jun-09	just W of Rose Is
29417	18-Apr-09	2	15-Jul-09	'Hens and Chickens' - north of Boyd Is
29884	26-Apr-09	2	18-Jul-09	Deep Bay
29460	17-Apr-09	2	07-Sep-09	
BS0956	17-Apr-09	3	17-Sep-09	SW end of lake
29820			26-May-10	North end past Rockhaven resort
29404	18-Apr-10	3	09-Aug-10	
29887	24-Apr-09	2	24-Aug-10	
29435	25-Apr-09	2	21-Nov-11	
BS0825	17-Apr-09	3	07-Jan-12	east end of lake

Other Species

Northern Pike were caught in the greatest numbers at Net 1. This net was adjacent to a wetland area that is probably used for spawning. Smaller numbers were caught at the other two sites. A portion of the pike catch was detail sampled while the remainder were measured for fork length only. The overall length distribution is shown in Table 9. The fish that were detail sampled ranged in age from 2 to 10 years old, with a remarkably regular observed age composition (Table 12, Figure 7). Male and female pike were mature at 2 year of age. Nets were not set specifically to target pike nor to obtain a random sample; therefore the catch rate data can't be used to make any conclusions about pike abundance. The population structure appears typical of a healthy population with a wide range of sizes and ages with many year classes represented.

Table 12 Observed age composition and descriptive statistics of fork length, by age and sex, for northern pike, Kahshe Lake spring trap netting, 2009.

	Male						Female					
Age	n (obs.)	p (obs.)	mean	min	max	S.D.	n (obs.)	p (obs.)	mean	min	max	S.D.
2	7	0.233	420	332	464	50	9	0.375	484	400	538	45
3	6	0.200	505	403	563	63	7	0.292	579	450	646	65
4	7	0.233	559	439	607	58	5	0.208	627	563	680	43
5	4	0.133	585	530	627	41	2	0.083	659	583	734	107
6	3	0.100	613	607	624	10	1	0.042	945	945	945	
7	1	0.033	668	668	668							
8												
9												
10	2	0.067	721	714	728	10						

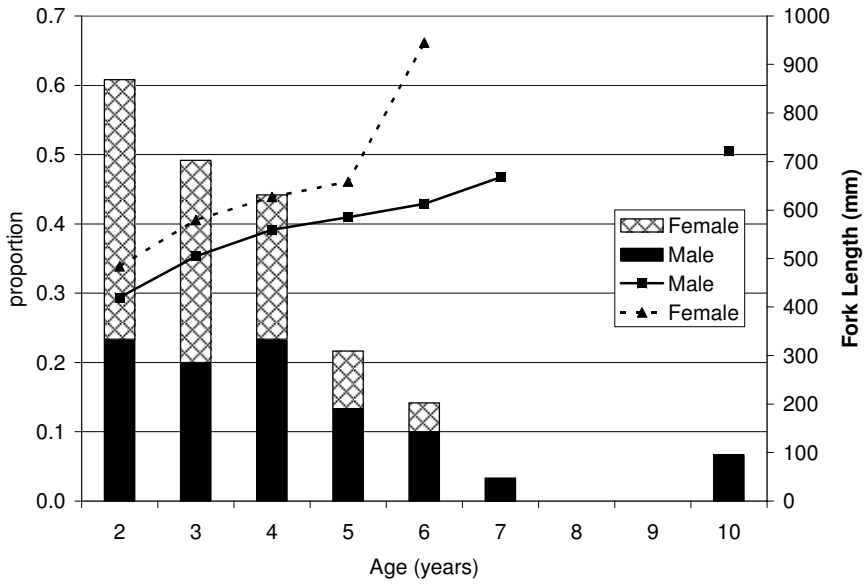


Figure 7 Observed age composition and mean fork length, by age and sex, for northern pike, Kahshe Lake spring trap netting, 2009.

Catches of black crappie, brown bullhead and yellow perch were higher at both sites in Bass Lake, and lower at the set at Houseys Rapids. All of these species congregate in shallow areas in the spring where the water temperature is slightly higher than the main lake. The very high numbers of black crappie caught indicate that at least some of them move seasonally into Bass Lake from Kahshe Lake.

Discussion

Lake-wide sampling since 1975 has consistently indicated that the walleye population density in Kahshe Lake is low (Table 13). Different gear and methods have been used which make direct comparisons invalid and there has probably been some variation in population size but the very small absolute numbers of fish caught make it clear that abundance has regularly been relatively low.

A retired Conservation Officer, whose patrol area included Kahshe Lake reports that in earlier years the lake had a moderate population, but it declined around the 1980's. He also reports that he observed that the average size of walleye increased during that time and attributed the cause to poor reproduction (few small fish entering the fishable population) caused by fish not being able to access the Gartersnake River spawning location. Other anecdotal reports suggest that the population was more abundant prior to the establishment of black crappie around 1991. Black crappies have been implicated for impacting walleye populations through depredation on early life stages (Kerr and Grant 2000). While these observations probably have some validity, the range of variation in abundance observed was probably still within the low range of abundance for walleye populations.

In the course of conducting the netting in 2009 and speaking to anglers who reported tags, there was a common belief that the walleye population had improved in recent years. Superficially, the higher than expected catch of walleye in 2009 might appear to support this belief. However, we don't know how a spawning run catch of 220 walleye relates to calibrated measures of abundance from random netting protocols. It may be that the catch in 2009 was consistent with the low lake wide-abundance measured by the FWIN project. A lake-wide assessment of the fish community composition and walleye abundance should be completed to determine this.

The Gartersnake River walleye spawning site has been abandoned. As it is not known what proportion of lake-wide annual recruitment the Gartersnake River site contributed historically, it is not possible to speculate whether the abandonment of the site had any impact on the overall population. It is possible that the spawning stock disappeared and the overall population decreased proportionally but is more likely that the fish that spawned

there moved to or were compensated by increased spawning somewhere else. Factors other than the amount of spawning substrate, such as fry survival, may be much more important in determining the adult population size.

The 2009 survey found that walleye are probably spawning in the Kahshe River. We don't know if they have traditionally spawned there or if the use of the site began or increased after the Gartersnake site became inaccessible. More observations should be done to determine where walleye are spawning in the Kahshe River. A tributary of the river which originates from Ben Lake and enters the river upstream of Bass Lake may also have suitable habitat and should be investigated as well.

Bass Lake was found to support a large number of potential predators of small walleye, notably black crappie. Walleye fry drifting off the Gartersnake River or Kahshe River spawning sites would enter Bass Lake while those emerging from the Houseys Rapids would drift directly into Kahshe Lake. It is possible that early survival of walleye and recruitment to the population would be poorer for fry that drift into Bass Lake than those that drift directly into Kahshe Lake because of the high abundance of predators in Bass Lake. Therefore, it may be better for the population to have spawning occur at Houseys Rapids or other locations in Kahshe Lake. Despite the absence of good estimates of abundance before and after the loss of the Gartersnake River run, the robust population structure measured in 2009 and the possibility of higher predation on fry in Bass Lake suggests that re-establishing the run into Gartersnake River would not be important. This idea could be reinforced if lake-wide assessment found that lake-wide abundance has actually increased as has been anecdotally reported.

Other than the locations netted in 2009 there are no other significant inflowing streams to Kahshe Lake where significant spawning may be occurring. It wasn't known if there were any potential shoal spawning locations in the lake so a shoreline cruise was completed in 2009 and 2010, to map existing substrate (unpublished file data). Very limited areas of potential habitat exist and it seems doubtful that significant lake spawning is occurring. A large proportion of the exposed shoreline is dominated by bedrock. It may be beneficial to add to the limited diversity of spawning locations that appear to be available. Use of additional spawning areas may not increase the walleye population directly, but could provide some resilience that would help sustain the population in the face of unforeseen changes to habitat. Creation of lake spawning shoals would serve to do this.

Table 13 Catch summary for netting projects conducted on Kahshe Lake, 1975 – 2001.

Year	1975	1978	1981	1981	1987	2001
Gear	multi-mesh gillnet		lake-wide trap net	small mesh gillnet	lake-wide trap net	multi-mesh gillnet (FWIN)
Number of Sets	5	4	4	2	~30	12
lake herring	13			133		38
northern pike						17
muskellunge		1	2			1
white sucker	11	1				
golden shiner					28	
brown bullhead	5	39			32	
burbot	4			1		
trout-perch	8					
black crappie						7
pumpkinseed	9	144	55		150	5
rock bass	13	132	76		252	11
smallmouth bass	8	90	103		65	9
largemouth bass		2			8	2
yellow perch	19	5		29	39	59
walleye	9	4	2		2	5

Kahshe Lake has an extensive history of attempts to improve the walleye population. Stocking has been one of the tools used. Assessment efforts have not been sufficient to conclude whether stocking has had any impact, positive or negative, on the population. The current scientific literature and MNR direction generally indicates that supplemental stocking usually doesn't contribute greatly to population abundance and may have negative impacts on the resident population through factors such as competition and loss of fitness. In general supplemental stocking is not recommended (OMNR 2002). This recommendation should be applied to Kahshe Lake.

Work was done to improve spawning habitat at Houseys Rapids in 1988 and 1989. Eighty tons of stone were placed in 1988. However, it appeared that flows over the site were not conducive to walleye spawning. The site was re-worked in 1989 but it appears that little follow-up was ever done. According to the former Conservation Officer for the area Houseys Rapids site was never a major site; fish seemed to continue upstream to the Gartersnake River site. The 2009 survey and visual observations show that the situation has changed; Houseys Rapids is an important spawning area although the spawning activity occurs in the narrow part of the channel upstream of the artificial shoal. As the channel is used for navigation and has shoreline residences on both sides, there are limited opportunities for making major changes to the spawning substrate. It may be possible to make alterations towards the downstream end of the channel that would deflect the current and increase velocity making the downstream end of the channel more attractive to spawning walleye.

Summary

Fall Walleye Index Netting (FWIN) netting conducted on Kahshe Lake in 2001 found that the abundance of walleye was low. Abundance appears to have been consistently low since the first assessment in 1975, although anecdotally some variation may have occurred possibly in response to lack of access to the Gartersnake River spawning area and the introduction of black crappie.

Trap netting at potential spawning locations in 2009 confirmed that the Gartersnake River spawning area had been abandoned, that some spawning is probably occurring in the Kahshe River and that most spawning is occurring at Houseys Rapids. It is not known how much, if any lake-spawning is occurring, other than suitable habitat appears to be extremely limited. Despite the loss of access to the Gartersnake River site, the spawning population currently has a fairly robust age and size structure. It is speculated that spawning at Houseys Rapids may have a benefit over Gartersnake River as the drifting fry would not be exposed to the high density of larval fish predators that occur in Bass Lake in the spring.

Recommendations are:

- do not pursue re-establishment of the Gartersnake River spawning run,
- investigate the feasibility of further enhancement of the Housey's Rapids spawning site,
- conduct a lake-wide assessment of the fish community composition and walleye abundance on a regular basis,
- determine where in the Kahshe River spawning is occurring and the quality of the habitat,
- consider creation a spawning shoal in Kahshe Lake to increase the diversity of spawning locations,
- do not conduct supplemental stocking.

References

Baker, J.A. and G. Deyne. 1987. Trapnetting assessment of walleye populations in Kahshe, Three Mile and Muldrew Lakes from Jun 4 to July 2, 1987. File Report, Ontario Ministry of Natural Resources, Bracebridge, ON.

DMM. 2008. Kahshe Lake lake data sheet. District Municipality of Muskoka, Bracebridge, Ontario.

Kerr, S.J. and R.E. Grant. 2000. Ecological impacts of fish introductions: evaluating the risk. Fish and Wildlife Branch, Ontario Ministry of Natural Resources, Peterborough, Ontario. 473 p.

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

OMNR. 2002. Guidelines for stocking fish in inland waters of Ontario. Fisheries Section, Fish and Wildlife Branch, Ontario Ministry of Natural Resources, Peterborough. 44p p.

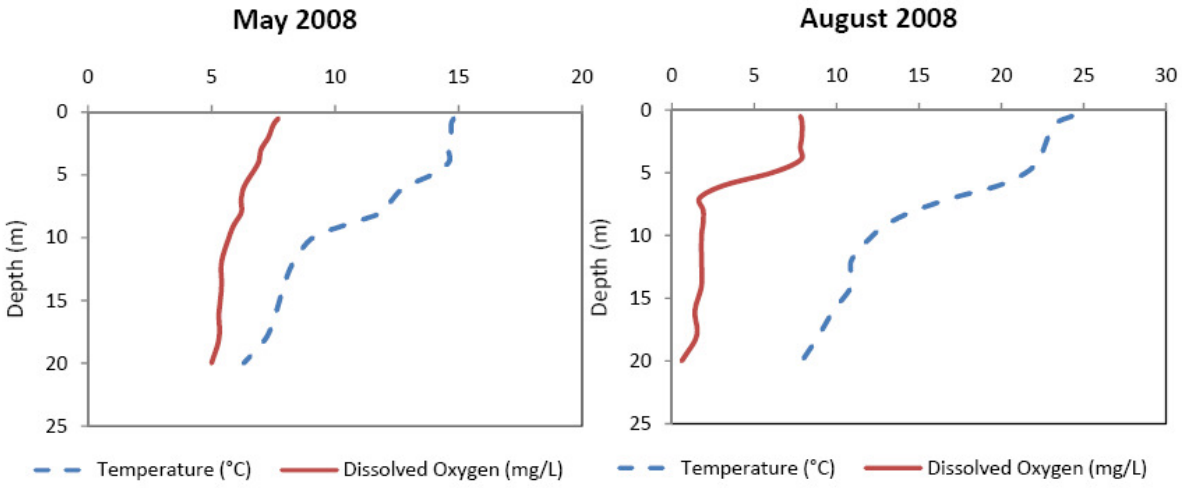
Appendix A Kahshe Lake lake data sheet (source: District Municipality of Muskoka, 2008).

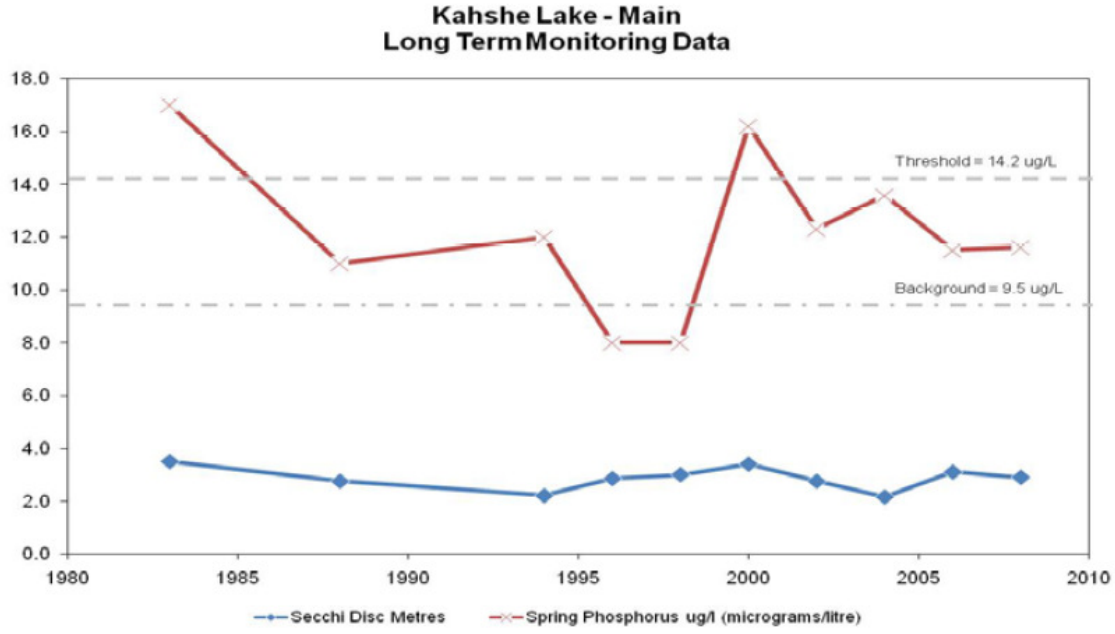
THE DISTRICT MUNICIPALITY OF MUSKOKA

Lake Data Sheet
2008

Kahshe Lake – Main

Municipality:	Gravenhurst	Watershed:	Sparrow Lake
Surface Area:	8.3 km^2	Watershed Area (excluding lake):	32.7 km^2
Maximum Depth:	20 m	Cold Water Fishery?	No
Wetland Area:	5 %	Secchi Depth (10-year average):	2.9 m
Phosphorus (10-year average 1999-2008):	13.0 µg/L	Sensitivity:	Moderate





This information is supplied without expressed or implied warranty of any kind, including warranty of fitness for a particular purpose. In no event will the District Municipality of Muskoka be liable for any damages, whether incidental, consequential or direct in conjunction with, or arising from the furnishing or use of this information.