Manitouwabing Lake

Near Shore Community Index Netting

Survey

2014-2015

File Report

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Manitouwabing Lake is a large, sprawling lake located in McKellar Township, northeast of the Town of Parry Sound. It has a surface area of approximately 1,200 ha but is relatively shallow with mean depth of 6 m. It is mesotrophic, with total phosphorus concentration averaging 11 ug/l and the water clarity is low; the Secchi disk reading averages 2.4 m (MECP Lake Partner Program). The water level on the lake is controlled by a dam on the outlet at Hurdville which has raised the water by approximately 2.5 m from its' natural level (difference between the sill elevation and normal operating level (AMEC 2009)). The lake supports a diverse cool/warm water fish community dominated by Northern Pike, Smallmouth and Largemouth Bass, Black Crappie and Walleye. McIntyre (2005) provided additional background information and the fisheries management history for the lake.

A Nearshore Community Index Netting (NSCIN) project was completed in 2014 and 2015 to obtain information on the current composition of the fish community and the abundance and population characteristics of primary sport fish species.

Methods

The NSCIN protocol was followed (Stirling 1999). Gear consisted of standard 6' (1.8 m) trap nets with 150' (46 m) leads. The protocol prescribes that the lead be set perpendicular to shore in water up to 2.5 m deep at the gap. Nets are set over night for approximately 24 hours and moved to new sites daily. Set locations are supposed to be randomly selected; however, we opted to use the same sites as McIntyre (2005). The window for netting is in late summer from August 1 until the surface temperature cools to 13^{o}C.

Captured fish were enumerated by species. Major sport fish species were sampled in detail including length and weight and calcified structures were collected for age determination. Other species were generally tallied by fork length class (10 mm interval) only.

For species that were measured for length only, the total weight of fish captured in each net set was estimated using the mean length for each species and length-weight regression equations.

All Northern Pike, Largemouth Bass and Walleye were aged. A sub-sample of Smallmouth Bass and Black Crappie were aged and the overall age composition estimated based on the size distribution. Most individuals were aged using pectoral rays or dorsal spines by an experienced ager at the Dryden ageing lab.

Tissue samples were collected from a selection of Black Crappie and Walleye and provided to the Ministry of the Environment and Climate Change for analysis of contaminants. Results will be published separately in the Guide to Eating Ontario Sport Fish.

Survey data are archived in the provincial FISHNET3 database as projects PSD_NS14_MAN and PSD_NS15_MAN.

Results

Netting occurred on September 8-13, 2014 and September 28 – October 2, 2015. The project was initially planned to be completed in 2014 but logistic issues resulted in the project being completed over two years. The protocol recommends that netting occur on two consecutive years to account for inter-year variability, so the unplanned change didn't compromise the project.

A total of 16 nets sets were completed in 2014. Two were set for non-standard durations; therefore, their catches were not used to calculate catch rates, but the individual fish statistics were included in

calculations of population characteristics (Table1). Fifteen sets were completed in 2015, including the two non-standard set sites from 2014 which were re-fished (Figure 1). Nets were set in the same general locations as used by McIntyre (2005) as well as could be determined from the available small-scale map (GPS coordinates were not available). It is likely that there were differences in the precise locations of nets and therefore habitat sampled. Two sets from 2004 (5 and 23) were moved to different locations (2015-7 and 2015-11) due to difficulty in locating suitable conditions for setting the nets. The depth of many sets exceeded the recommendation from the protocol due to steep nearshore gradients in many areas. In 2014, the surface water temperature was 19-20^{o}C while in 2015 it was cooler at 15-19^{o}C. The lake was assumed to be thermally stratified in both years, but no temperature or dissolved oxygen profiles were collected.

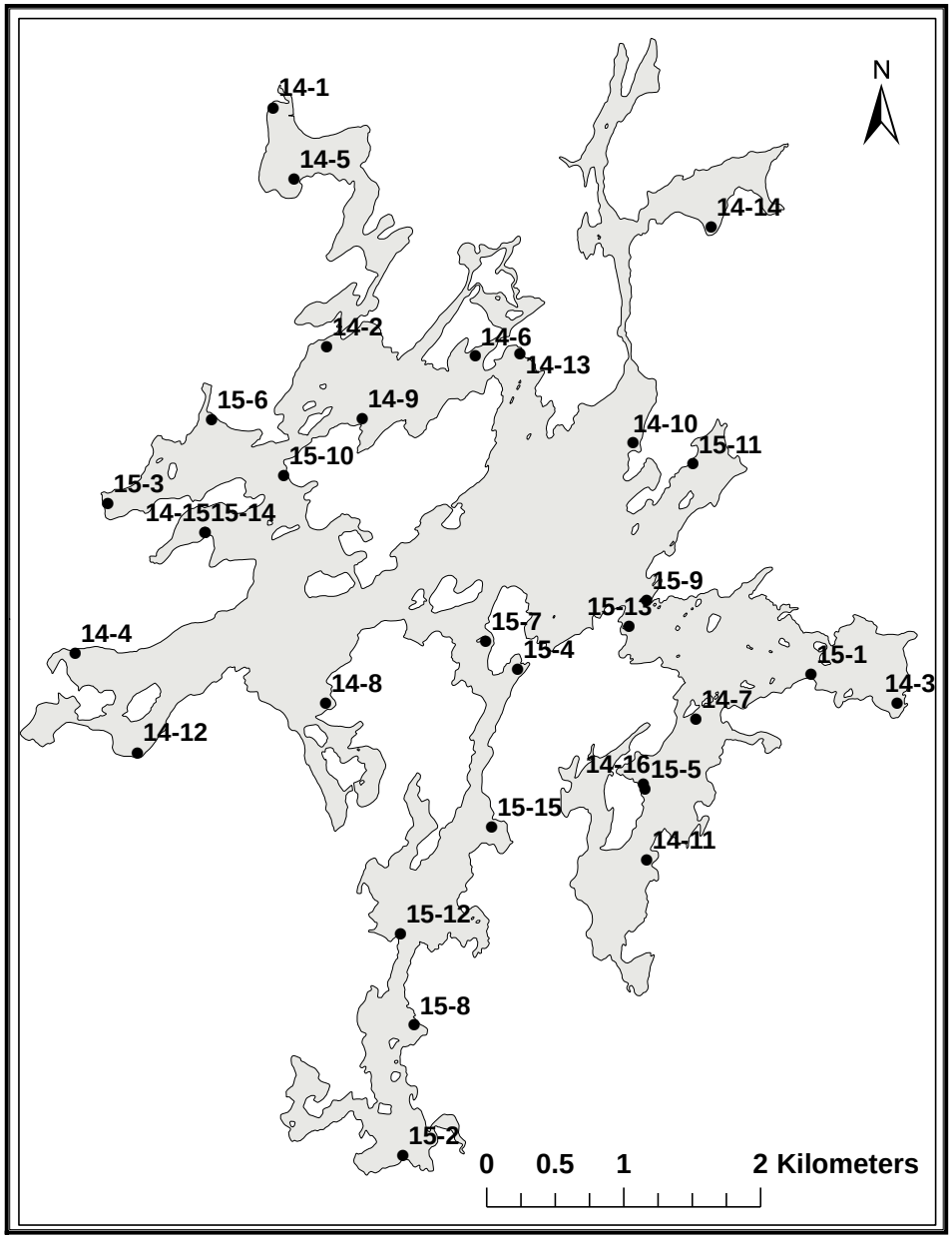


Figure 1 Map of Manitouwabing Lake showing net set locations, NSCIN, 2014-2015.

Table 1 Net set summary, Manitouwabing Lake, NSCIN, 2014-2015.

Sample	Easting	Northing	Depth at Gap (m)	Effort Status	Lift Date	Set Duration (hr)	Substrate	Cover
14-1	584277	5039745	4.1	1	9-Sep-14	21.2	4	2
14-2	584669	5038000	2.9	2	9-Sep-14	21.7	5	1
14-3	588834	5035397	3.0	1	9-Sep-14	22.0	4	2
14-4	582833	5035761	5.0	1	9-Sep-14	22.7	5	1
14-5	584429	5039223	5.5	1	10-Sep-14	22.5	2	2
14-6	585753	5037931	5.5	1	10-Sep-14	23.3	5	2
14-7	587365	5035283	3.2	1	10-Sep-14	23.4	4	
14-8	584662	5035400	3.6	1	10-Sep-14	24.0	5	2
14-9	584929	5037475	2.8	1	11-Sep-14	23.9	5	1
14-10	586904	5037296	3.8	1	11-Sep-14	24.7	5	3
14-11	587006	5034251	3.8	1	11-Sep-14	26.1	2	2
14-12	583286	5035037	4.0	1	11-Sep-14	23.9	2	2
14-13	586081	5037948	4.5	2	12-Sep-14	22.6	5	2
14-14	587475	5038875	5.0	1	12-Sep-14	22.5	2	1
14-15	583781	5036642	1.8	3	13-Sep-14	43.5	2	3
14-16	586981	5034809	3.2	3	13-Sep-14	43.0	2	3
15-1	588204	5035609	1.6	1	29-Sep-15	23.1	4	2
15-2	585225	5032096	2.3	1	29-Sep-15	27.5	4	1
15-3	583070	5036853	2.4	1	29-Sep-15	23.1	4	2
15-4	586064	5035648	3.8	1	29-Sep-15	23.4	4	1
15-5	586993	5034770	2.6	1	30-Sep-15	21.8	4	1
15-6	583828	5037469	3.2	1	30-Sep-15	22.4	2	2
15-7	585829	5035851	3.2	1	30-Sep-15	21.9	4	2
15-8	585306	5033048		1	30-Sep-15	22.4	4	2
15-9	587005	5036146	4.1	1	1-Oct-15	22.5	5	1
15-10	584355	5037062	2.3	1	1-Oct-15	23.2	3	2
15-11	587341	5037143	4.4	1	1-Oct-15	23.3	2	3
15-12	585207	5033714	2.3	1	1-Oct-15	23.7	3	2
15-13	586876	5035961	4.0	1	2-Oct-15	22.7	2	2
15-14	583780	5036645	1.8	1	2-Oct-15	22.3	4	2
15-15	585873	5034496	3.5	1	2-Oct-15	21.6	4	2

Substrate: 1: gravel/pebble/sand, 2:boulder/rubble/cobble, 3:sand, 4:soft mix, 5:bedrock, 6: other
Cover: 1:no cover, 2:low, 3: moderate,, 4: high

Overall, the catch composition was similar between years; therefore, most results are reported by combining results from both years. By number and weight, Brown Bullhead was the most abundant species, with an average of 16.4 fish/net (7.4 kg/net) caught in both years combined (Table 2). Smallmouth Bass were the most abundant large sport fish species, both by number (3.0/net) and weight (2.0 kg/net). Black Crappie were more numerous than Smallmouth Bass (4.9/net) but due to their smaller body size, the total weight caught was much less (1.2 kg/net). Northern Pike (0.8/net), Largemouth Bass (1.0/net) and Walleye (1.1/net) were all caught at similar rates, though due to the larger average size the weight of Walleye (1.6 kg/net) was somewhat larger than either Northern Pike (1.1 kg/net) or Largemouth Bass (0.8 kg/net). White Sucker, Rock Bass and Pumpkinseed comprised the remainder of the catch. Compared to the results from 2014, the catch rates of Northern Pike and Walleye were lower in 2015, but higher for Smallmouth and Largemouth Bass.

Table 2 Catch summary, by number (top panel) and weight (g, lower panel), Manitouwabing Lake, NSCIN, 2014-2015.

		Northern Pike	White Sucker	Brown Bullhead	Rock Bass	Pumpkin-seed	Small-mouth Bass	Large-mouth Bass	Black Crappie	Walleye
2014 excludes samples 15 and 16	n	15	19	208	28	1	23	5	44	23
	p	0.50	0.43	0.79	0.86	0.07	0.79	0.21	0.50	0.64
	Max.	5	6	73	5	1	4	3	21	6
	Mean	1.07	1.36	14.86	2.00	0.07	1.64	0.36	3.14	1.64
	St. Dev.	1.49	2.02	23.19	1.75	0.27	1.39	0.84	5.75	1.82
2015	n	8	6	267	42	5	65	23	99	8
	p	0.47	0.33	0.80	0.67	0.20	0.93	0.73	0.80	0.40
	Max.	2	2	133	9	2	10	7	67	2
	Mean	0.53	0.40	17.80	2.80	0.33	4.33	1.53	6.60	0.53
	St. Dev.	0.64	0.63	35.69	3.12	0.72	3.20	1.85	16.97	0.74
All	n	23	25	475	70	6	88	28	143	31
	p	0.48	0.38	0.79	0.76	0.14	0.86	0.48	0.66	0.52
	Max.	5	6	133	9	2	10	7	67	6
	Mean	0.79	0.86	16.38	2.41	0.21	3.03	0.97	4.93	1.07
	St. Dev.	1.15	1.53	29.81	2.54	0.56	2.81	1.55	12.75	1.46

		Northern Pike	White Sucker	Brown Bullhead	Rock Bass	Pumpkin-seed	Small-mouth Bass	Large-mouth Bass	Black Crappie	Walleye
2014 excludes samples 15 and 16	n	19415	27474	95056	4060	177	18680	4740	9878	36125
	p	0.50	0.43	0.79	0.86	0.07	0.79	0.21	0.50	0.64
	Max.	7100	8676	33361	725	177	3610	3460	4746	6700
	Mean	1387	1962	6790	290	13	1334	339	706	2580
	St. Dev.	2180	2926	10598	254	47	1296	929	1301	2624
2015	n	12475	8676	122019	6090	885	38150	19863	23999	9875
	p	0.47	0.33	0.80	0.67	0.20	0.93	0.73	0.80	0.40
	Max.	4600	2892	60781	1305	354	6025	6153	15142	3775
	Mean	832	578	8135	406	59	2543	1324	1600	658
	St. Dev.	1275	915	16309	453	128	1987	1658	3885	1161
All	n	31890	36150	217075	10150	1062	56830	24603	33877	46000
	p	0.48	0.38	0.79	0.76	0.14	0.86	0.48	0.66	0.52
	Max.	7100	8676	60781	1305	354	6025	6153	15142	6700
	Mean	1100	1247	7485	350	37	1960	848	1168	1586
	St. Dev.	1760	2211	13624	369	99	1770	1423	2922	2197

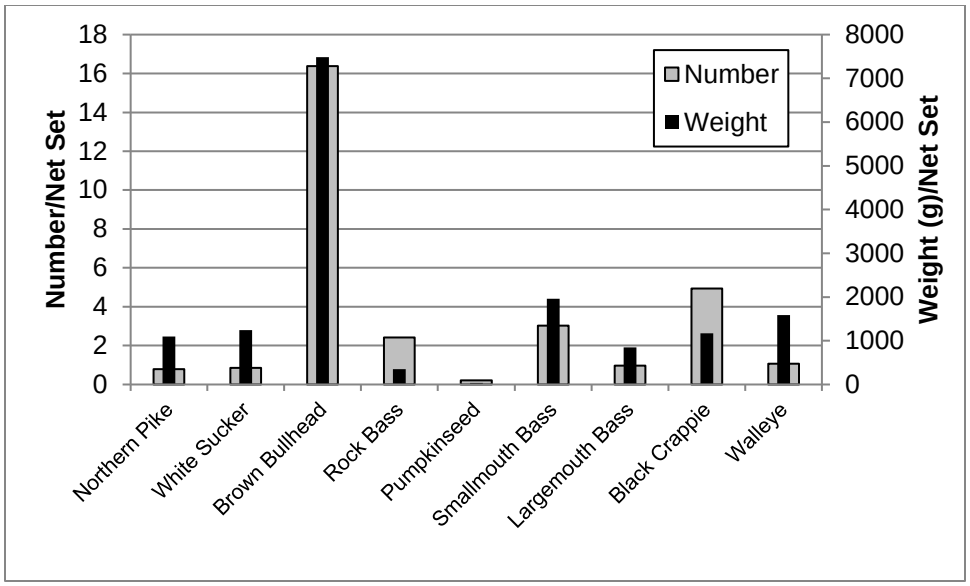


Figure 2 Catch summary, by number (wide bars, left vertical axis) and weight (narrow bars, right vertical axis), Manitouwabing Lake, NCSIN, 2014-2015.

A total of 39 Walleye were sampled in both years, combined. They ranged in size from 249 to 672 mm FL with an average of 487 (St. Dev.: 114) and were 2 to 19 years old (Mean: 7.7, St. Dev. 4.5) (Table 3, Figure 3 and 4).

Despite the relatively small sample size, the age distribution of Walleye was quite robust with a wide range and large number of cohorts represented (Figure 3). Smoothing of the age distribution could potentially occur by combining data from different years but a visual inspection indicated that it didn't occur in this case. Walleye grew quickly, averaging 361 mm at age 3 and 446 mm at age 5; at the upper end of the range for NSCIN surveys.

Table 3 Summary statistics of fork length (top) and age (bottom), by species, Manitouwabing Lake, NSCIN, 2014-2015.

	Northern Pike	Smallmouth Bass	Largemouth Bass	Black Crappie	Walleye
n	27	96	32	51	39
Min.	337	160	180	114	249
Max.	840	444	431	305	672
Mean	559	325	347	239	487
S.D.	119	79	49	38	114

	Northern Pike	Smallmouth Bass	Largemouth Bass	Black Crappie	Walleye
n	27	69	31	30	39
Min.	1	1	1	1	2
Max.	8	12	9	5	19
Mean	4.3	6.1	3.6	2.7	7.7
S.D.	2.0	3.0	2.0	0.9	4.5

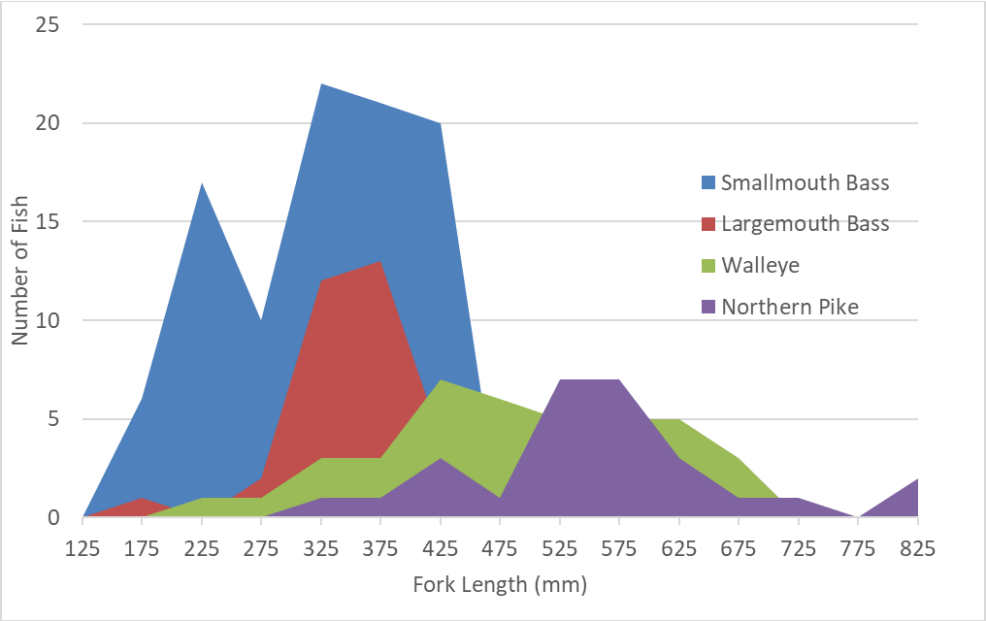


Figure 3 Fork length frequency distributions for species that were sampled in detail, NSCIN, Manitouwabing Lake, 2014-2015.

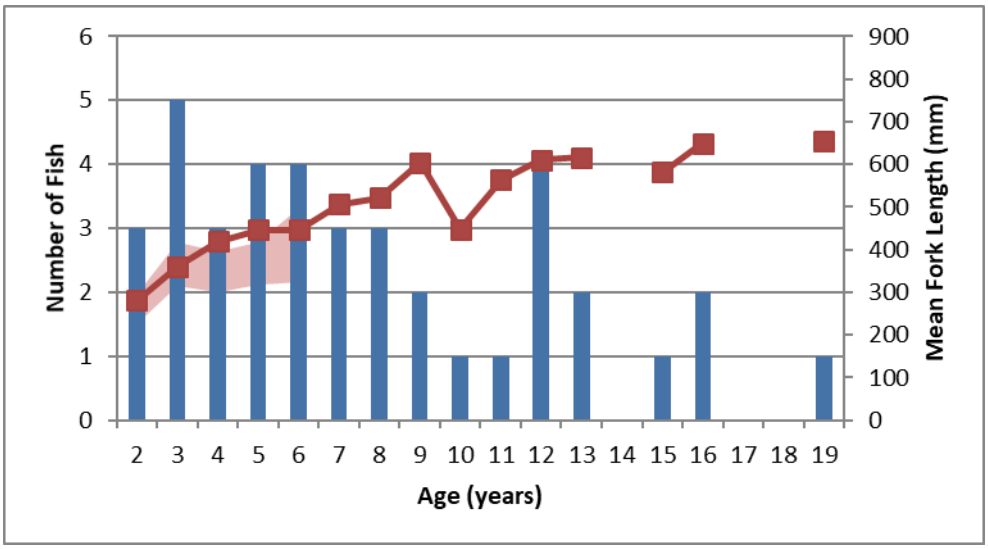


Figure 4 Age distribution and mean size-at age (fork length) for Walleye, Manitouwabing Lake, NSCIN, 2014-2015. Shaded area is range of mean fork-length-at-age for NCSIN surveys conducted on Ontario lakes 1991-1998 (Brereton 2000).

Northern Pike ranged from 337 to 840 mm long and averaged 559 mm (St. Dev.: 119 mm). Ages ranged from 1 to 8 years with the most common age classes being 3 to 6 years. The growth rate was essentially linear over the range of ages sampled, indicating that they have potential to reach large sizes in the lake even though the growth rate was below average (Figure 5).

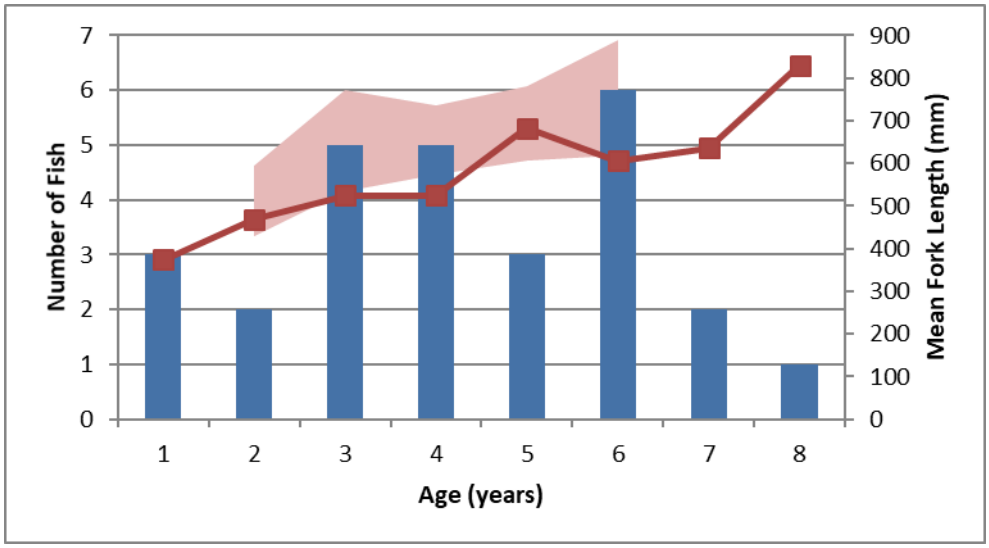


Figure 5 Age distribution and mean size-at age (fork length) for Northern Pike, Manitouwabing Lake, NSCIN, 2014-2015. Shaded area is range of mean fork-length-at-age for NCSIN surveys conducted on Ontario lakes 1991-1998 (Brereton 2000).

The Smallmouth Bass population was very robust with a wide range of sizes and ages caught. Lengths ranged from 160 to 444 mm FL, averaging 325 mm. Ages ranged from 1 to 12 years, with an average of 6.1 (Figure 6). The growth rate was above average compared to other Ontario populations sampled using NSCIN.

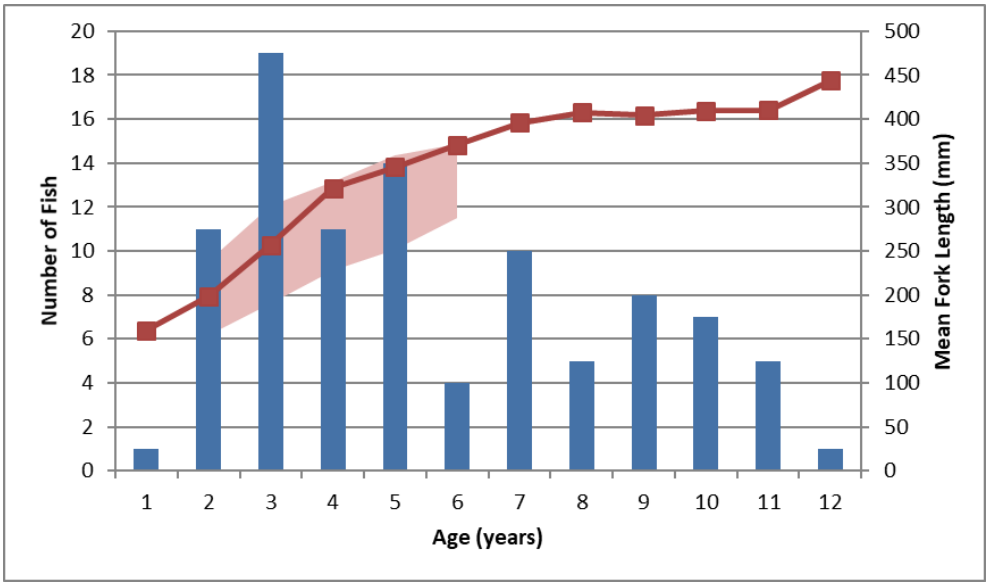


Figure 6 Age distribution and mean size-at age (fork length) for Smallmouth Bass, Manitouwabing Lake, NSCIN, 2014-2015. Shaded area is range of mean fork-length-at-age for NCSIN surveys conducted on Ontario lakes 1991-1998 (Brereton 2000).

The Largemouth Bass sizes were similar to Smallmouth Bass. Lengths ranged from 180 to 431 mm with an average of 347 mm. Ages ranged from 1 to 9 with an average of 3.1 (Figure 7). The age distribution didn't include as many older fish as was observed for Smallmouth Bass, but that may have been an artefact of the smaller sample size. The observed growth rate of Largemouth Bass was very rapid; above maximum values observed elsewhere in the province.

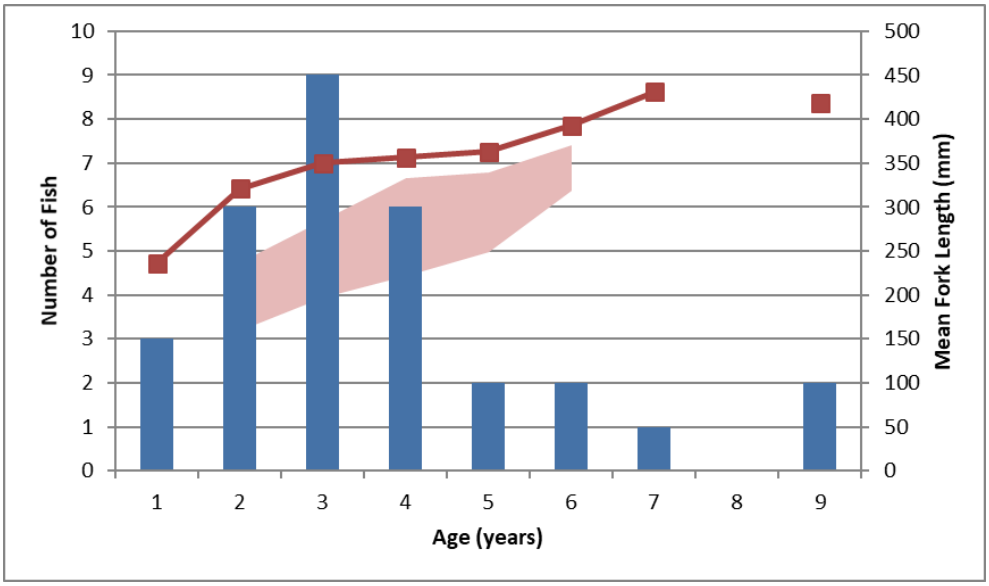


Figure 7 Age distribution and mean size-at age (fork length) for Largemouth Bass, Manitouwabing Lake, NSCIN, 2014-2015. Shaded area is range of mean fork-length-at-age for NCSIN surveys conducted on Ontario lakes 1991-1998 (Brereton 2000).

Black Crappie lengths ranged from 115 to 315 mm, averaging 232 mm. The length distribution had two distinct modes, corresponding to 2 and 3-year-old fish that dominated the catch (Figure 8). As with most other species, the growth rate of crappie was above average (Figure 9).

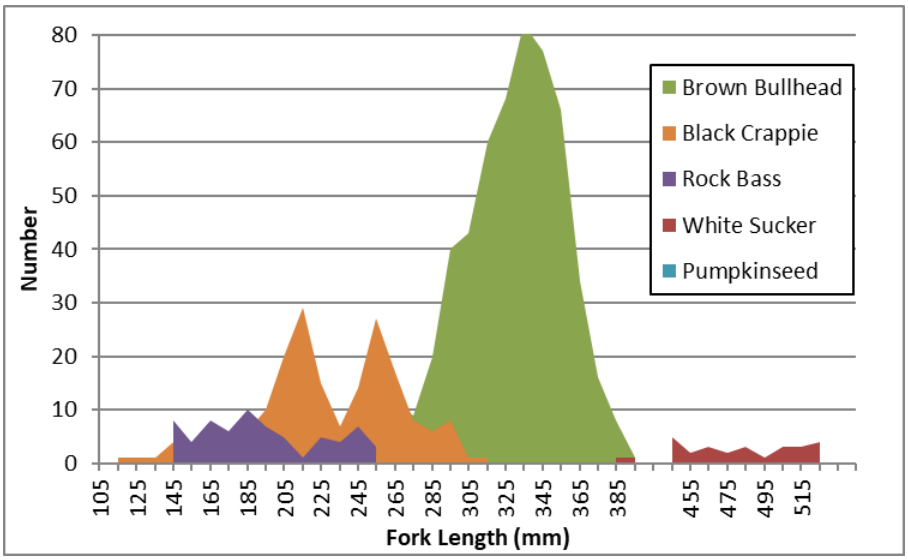


Figure 8 Fork length frequency distributions of species that were length-tallied, NSCIN, Manitouwabing Lake, 2014-2015.

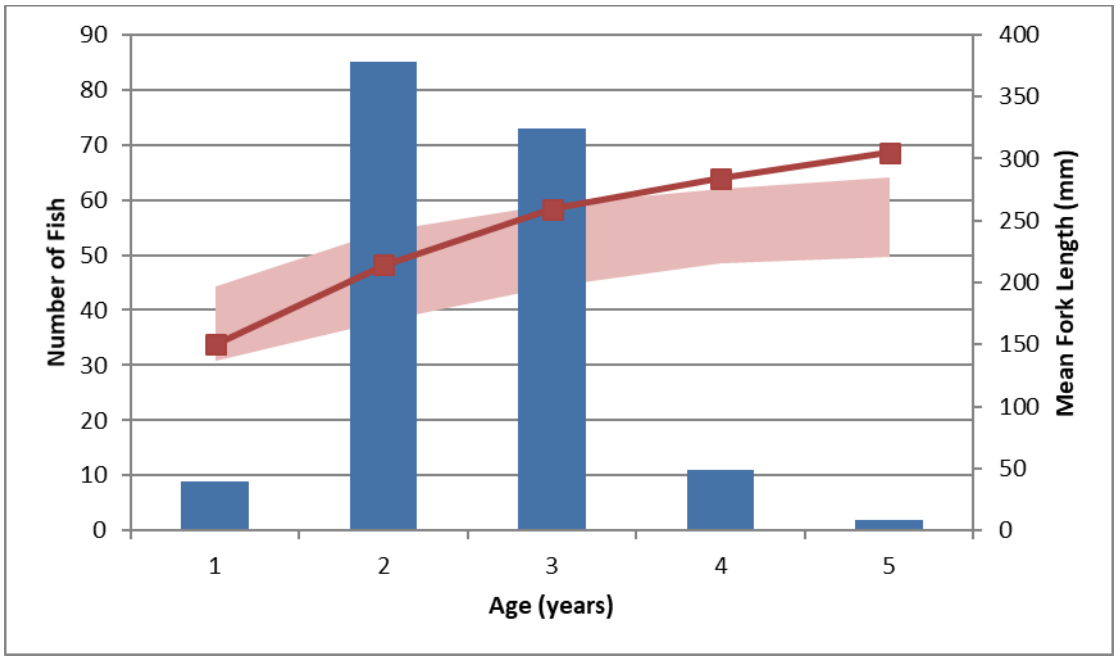


Figure 9 Age distribution (estimated) and mean size-at age (fork length) for Black Crappie, Manitouwabing Lake, NSCIN, 2014-2015. Shaded area is range of mean fork-length-at-age for NCSIN surveys conducted on Ontario lakes 1991-1998 (Brereton 2000).

The abundant Brown Bullhead population was dominated by large individuals, primarily between 280 and 370 mm long. The size distributions of other species caught are shown in Figure 8.

Discussion

Several methods were available for conducting this assessment, including End of Spring Trap Netting (ESTN, Skinner and Ball 2004), NSCIN and the netting protocol used by the Broad-scale Monitoring (BsM) program. NSCIN was chosen over ESTN because ESTN's were not being widely conducted and therefore comparative and diagnostic data was limited. The sampling window for ESTN is in the spring and is narrower than for NSCIN, which can make it logistically difficult to complete the work. Also, conditions at that time are changing relatively rapidly as lakes become thermally stratified. NSCIN is also intended to sample the shallow water fish community more completely whereas the timing of ESTN was chosen based on the best time to sample Walleye specifically. A major limitation of both trap net protocols is their inability to sample deep and offshore waters and their selectivity for larger fish.

Unlike the other two methods, BsM uses gill nets to sample the entire fish community and has the advantage of being able to sample all areas of a lake, not just the near shore area. However, it was not chosen due to a desire to use a similar method as the 2004 survey to allow for direct comparison of catches and because BsM surveys typically catch fewer fish making it more difficult to describe population characteristics. There was also sensitivity over the lethal nature of the sampling, even though the total number of fish killed would not be significant in relation to the size of the lake. In retrospect, it would have been preferable to use BsM because of its' ability to sample all lake habitats and the diagnostic support being developed due to it being the primary provincial sampling method, something not currently being done for NSCIN. BsM should be used for future surveys.

The unplanned completion of the project over two years for logistic reasons provided the opportunity to describe the amount of year to year variability in the catch. The catches of many species were quite different between years. It's not likely that large changes in the actual abundance of fish occurred between years; therefore, the differences in catch rates were probably due to sampling variation. The large amount of variation must be considered when comparing catches to other surveys.

No new species were documented during the survey. Manitouwabing Lake already supported all major sport fish species that occur in the area. New introductions would only likely occur by intentionally transporting fish from a considerable distance. Several species previously documented were not caught during the 2014-15 sampling, including Yellow Perch, Lake Whitefish, Cisco and Common Carp. Perch have been caught only in very low numbers in past surveys indicating that the abundance of large perch that are vulnerable to trap nets has been consistently low. Abundance of perch large enough to be caught in trap nets is typically low in most lakes in the District due to limited habitat and an abundance of predators. Lake Whitefish and Cisco are cold water species that would be confined to the deeper waters of the lake at the time of netting and therefore, were not vulnerable to the sampling gear. The BsM method is better suited to assessing the occurrence and abundance of these and other species that use deep water. The documentation of Carp in the 1982 survey is a curiosity and they have not been recorded since, nor do they occur in any other inland lake in the District that is not immediately connected to Georgian Bay.

Black Crappie had been reported to occur in the lake previously but did not occur when the last survey was done in 2004. They have become a major component of the fish community, being the second most commonly caught species by number. The catch of crappie relative to other species may be under-represented because of their pelagic behaviour. It is likely that crappie have had some impact on other species, due to their sheer number in combination with their known feeding preferences and habitat use. In some lakes they have been associated with declines in Walleye populations (Kerr and Grant 2000). Competition for food and depredation on the young of other species would be the primary mechanisms involved.

Overall, the catch composition and abundance of the major sport fish species caught were similar to previous surveys, other than the appearance of crappie (Figure 10). The overall catch rates of Northern Pike and Walleye were somewhat lower while those of Smallmouth Bass were higher than observed in 1988 and 2004. For these species, the changes were not substantial or consistent enough between years to be able to conclude that a long-term trend has occurred, especially when considering the large amount of year to year variation observed in the 2014-15 survey.

The catch rate of Largemouth Bass has increased with each successive survey indicating that there has been a real long-term increase in their abundance. Even though they represent a small proportion of the total catch, their true abundance in the lake is probably greater because of the selectivity of the gear for species that are more mobile. Largemouth Bass have been associated with negative impacts on Walleye populations (Neuswanger 2009). Even though we can't conclude that a long-term trend in the Walleye population has occurred, the introduction of Black Crappie and increasing abundance of Largemouth Bass indicate that the carrying capacity (the highest potential level of abundance that the lake could support) of Walleye is lower now than in the past.

Brown Bullhead catch has varied more than any other species (except crappie); none were caught in 6' trap nets in 1982 (small number were caught in other gear), extremely large numbers were caught in 1988 and 2004 and most recently, a decrease occurred in 2014-15 (Figure 11). Mean catches were highly skewed by a few catches of a large number of fish, but the median catches show the same pattern. Such dramatic changes in catch defy explanation. Some may be due to timing of surveys and net site

selection, but it seems likely that the actual population has changed greatly. Given the amount of suitable habitat in the lake, in the form of shallow areas of soft sediment, perhaps the question is not why they increased but why abundance was low in the first place. The implications of changing bullhead abundance on other members of the fish community is unclear. As with crappie, the sheer number of fish caught suggests there must be some impact but evidence in the published literature of direct interactions between bullhead and other species is not extensive. They are omnivorous, eating a wide variety of primarily benthic organisms but in turn are also eaten by various predators (Scott and Crossman 1973). The abundance of Largemouth Bass increased, coincident with removal of bullheads from Cole Lake (Thurston 1978 as cited by Baldwin 1980, OMNR 1982), suggesting a direct effect; but, at 32 ha, Cole Lake is very small and it is questionable that an effect would be as strong in a large complex lake like Manitouwabing. In Twin Lake, Wisconsin, declines in the catch rate and mean length of age-0 Walleye coincided with a large increase in the catch of Black Bullhead, suggesting that competition was occurring (Lucchesi 2002). In Manitouwabing Lake, the much lower catch in 2014-15 than in 1998 or 2004 suggests that a real decline in abundance has occurred and, if so, competitive interactions with other species may be easing.

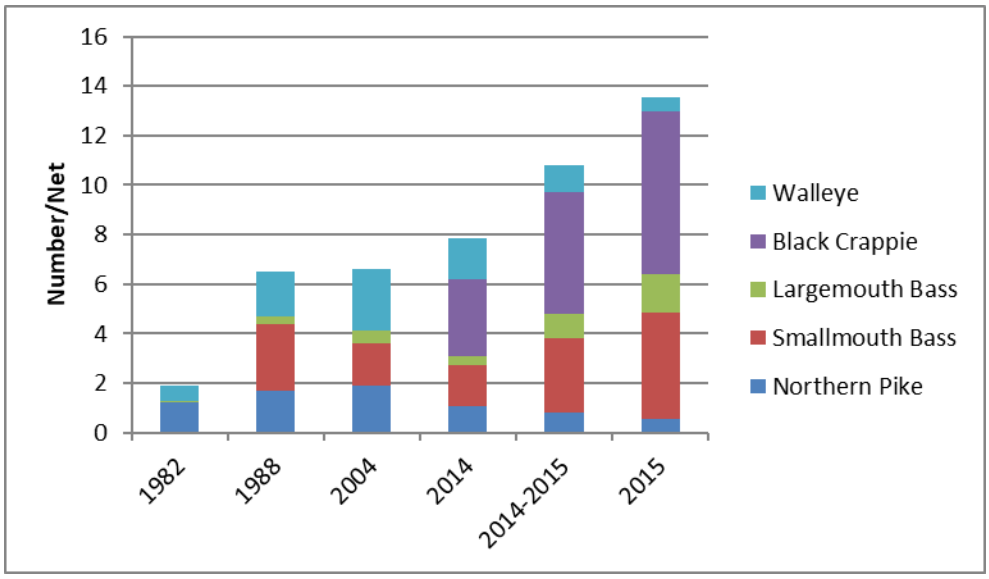


Figure 10 Catch rate (number/net) of major sport fish species from 6' trap nets, by year, Manitouwabing Lake. Brown Bullhead, White Sucker, Rock Bass, Pumpkinseed and Yellow Perch are not shown.

Data from other NSCIN projects conducted in Ontario were compiled by Brereton (2000). Her data tables were filtered to exclude projects from the Ottawa River and lakes with total dissolved solids measurement of more than 100mg/l as the fish communities and/or primary productivity of those waters are much different from Manitouwabing Lake. The catch rates of Northern Pike, White Sucker, Pumpkinseed and Yellow Perch from Manitouwabing Lake were below the 25th percentile observed in other projects (Figure12), whereas the catches of Rock Bass, Smallmouth Bass, Largemouth Bass and Walleye were between the 25th and 75th percentiles and catches of Brown Bullhead and Black Crappie were well above the 75th percentile.

Box plots of the mean fork lengths are shown in Figure 13. The average size of most species caught in Manitouwabing Lake was above the 75th percentile of other projects done in the province.

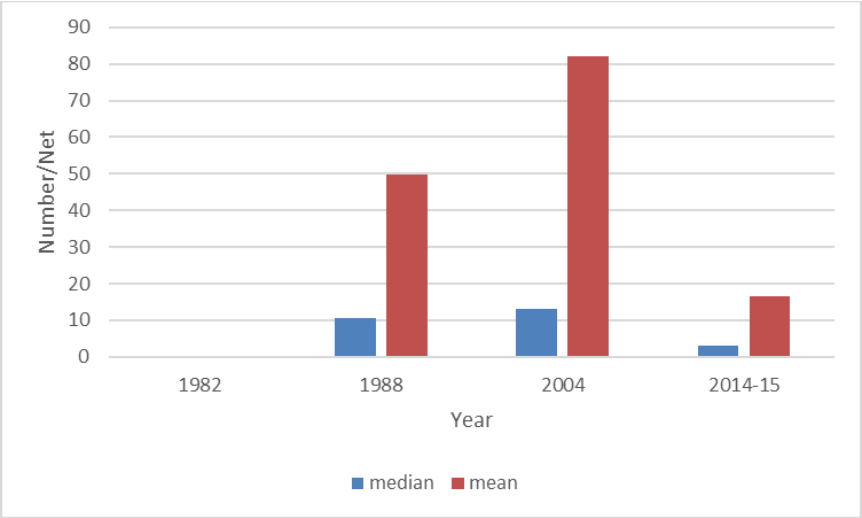


Figure 11 Mean and median catch of Brown Bullhead from 6' trap nets, by year, Manitouwabing Lake.

Comparing measures between lakes should always be done with caution because no two lakes are the same in terms of habitat, fish community and the stresses acting on them. Comparisons between lakes provide context to describe conditions in a lake but are less useful for interpreting population status. For example, the catches of Brown Bullhead and Black Crappie are, indeed, very high compared to other lakes which could be interpreted to mean that the lake should provide good fisheries for these species, but it doesn't mean necessarily that the populations are healthier or more sustainable because the carrying capacity may be higher than it is in other lakes.

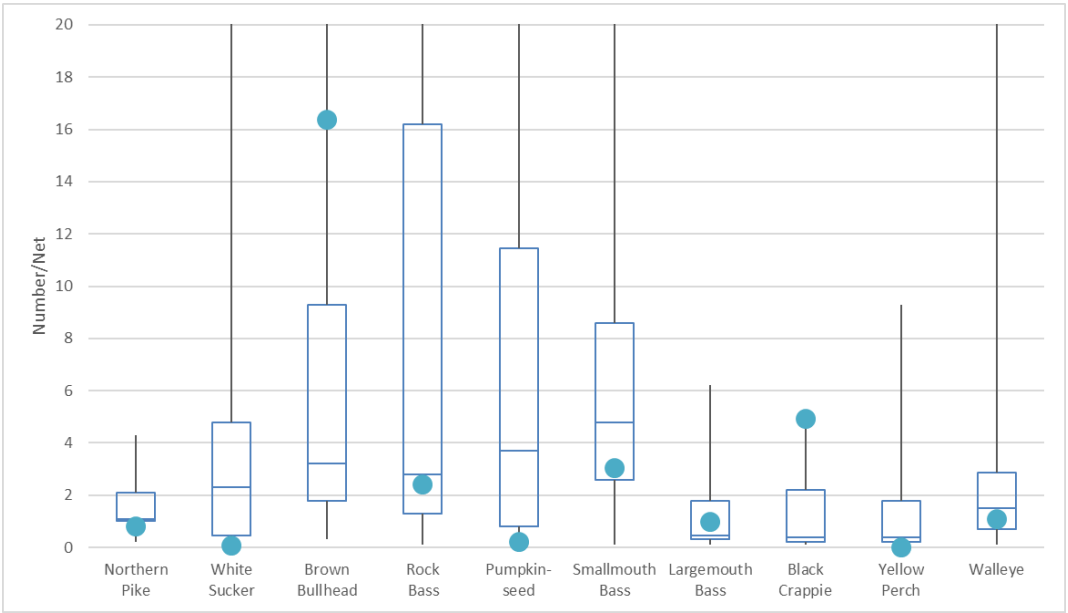


Figure 12 Box plots (min., 25%ile, median, 75%ile and max.) of catch rates (number/net), by species, from selected NSCIN projects conducted in Ontario, 1991-1998 (see text for details). Catch rate from Manitouwabing Lake shown as filled circles.

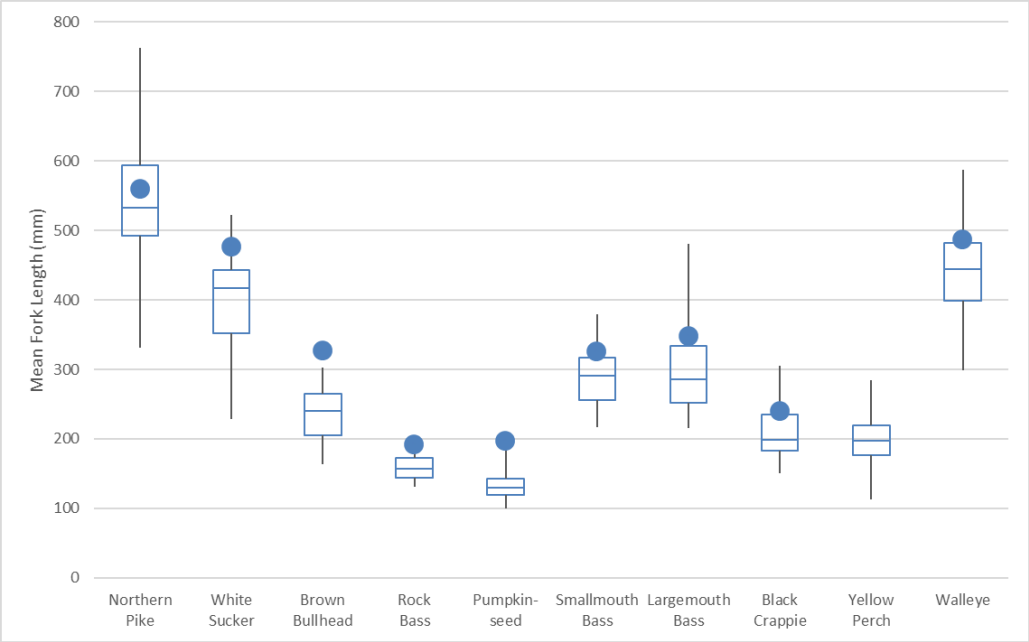


Figure 13 Box plots (min., 25%ile, median, 75%ile and max.) of mean fork length (mm), by species, from selected NSCIN projects conducted in Ontario, 1991-1998 (see text for details). Catch rate from Manitouwabing Lake shown as filled circles.

This project was conducted partly to address ongoing interest in the local community in the supplemental stocking of Walleye. Walleye fry have been stocked periodically in the past by the Manitou-Seguin Game and Fish Club and its' more recent incarnation, the McKellar Conservation Association; most recently in 2010. Provincial guidelines recommend that stocking of a species not occur when a viable self-sustaining population is present (OMNR 2002). Supplemental stocking often has a low and variable success rate and can have undesirable impacts such as competitive interactions with natural fish, genetic impacts, increased fishing effort and/or harvest and creating unrealistic expectations for anglers. Past stocking practices have often conditioned anglers to believe that stocking will resolve the real or perceived deficiencies in the fishery which is often not the case. A formal definition of what constitutes a viable Walleye population is currently lacking but it is clear that a viable self-sustaining population exists in Manitouwabing Lake. The abundance is above the lower quartile for populations in similar lakes in Ontario and the population structure contains a diverse range of sizes and ages, indicating that ongoing regular reproduction is occurring. Manitouwabing Lake should be managed as a natural Walleye lake and supplemental stocking should not be done.

Fisheries management planning in FMZ15 is currently ongoing. It is anticipated that the plan will provide direction for fishing regulations and supplemental stocking specific to the sustainable management of Walleye. Therefore, it is recommended that no lake-specific management actions take place at this time.

In summary, the fish community of Manitouwabing Lake has changed significantly since 2004. Black Crappie have been illegally introduced and become a major component. It appears that the abundance of Brown Bullheads has declined from the peak observed in 2004. The catch rate of Largemouth Bass has been increasing over successive surveys though they still comprise a small proportion of the catch. The catch rates of other species have not displayed any major changes; small changes may be masked by a high level of sampling variation. The observed changes likely have implications for the Walleye population but the overall direction and magnitude of the impacts are difficult to predict due to complex interactions

between species. The Walleye population is of moderate abundance but displays a healthy range of sizes and ages. Supplemental stocking is not likely to increase the population measurably and is not recommended.

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Appendix A Fork Length frequency distributions for species that were length tallied, Manitouwabing Lake NSCIN, 2014-2015.

FL (midpoint)	White Sucker	Brown Bullhead	Rock Bass	Pumpkin-seed	Black Crappie
105			1		
115					1
125			1		1
135					1
145			8		4
155			4		2
165		1	8		
175		1	6	1	2
185		1	10		6
195		1	7		10
205			5	3	20
215			1		29
225		3	5		15
235		1	4		7
245		1	7		14
255		7	3		27
265		12			17
275		9			8
285		20			6
295		40			8
305		43			1
315		60			1
325		68			
335		82			
345	1	77			
355		66			
365		34			
375		16			
385	1	8			
395	1	1			
405					
415					
425					
435					
445	5				
455	2				
465	3				
475	2				
485	3				
495	1				
505	3				
515	3				
525	4				
535					
545					
555					
565					
575					
585	1				
Total	30	552	70	4	180
Mean	477	327	191	198	232

Appendix B Age distribution and size-at-age (fork length) statistics, by species, Manitouwabing Lake, NSCIN, 2014-2015.

	Age	n (obs.)	n (est.)	Min	Max	Mean	St. Dev.
Northern Pike	1	3		337	404	374	34
	2	2		433	505	469	51
	3	5		428	554	524	54
	4	5		485	557	524	30
	5	3		543	840	682	149
	6	6		555	746	606	77
	7	2		634	637	636	2
	8	1		830	830	830	
	All	27		337	840	559	119
Smallmouth Bass	1	2	1	160	160	160	
	2	6	11	165	221	199	21
	3	13	19	201	307	257	33
	4	6	11	294	349	321	24
	5	8	14	286	444	345	50
	6	3	4	358	380	371	11
	7	8	10	363	443	396	25
	8	4	5	388	421	408	14
	9	7	8	384	423	404	16
	10	7	7	386	433	409	19
	11	5	5	376	428	410	22
	12	1	1	444	444	444	
	Not Aged	26					
	All	96		160	444	325	79
Largemouth Bass	1	3		180	265	236	49
	2	6		309	338	321	10
	3	9		322	365	350	14
	4	6		336	394	356	21
	5	2		352	374	363	16
	6	2		378	407	393	21
	7	1		431	431	431	
	9	2		406	431	419	18
	Not Aged	1					
	All	32		180	431	347	49
Black Crappie	1	1	9	150	150	150	
	2	12	85	199	224	214	7
	3	12	73	230	283	259	13
	4	4	11	272	294	284	9
	5	1	2	305	305	305	
	Not Aged	21					
	All*	51		114	305	239	38
Walleye	2	3		249	319	281	35
	3	5		312	420	361	44
	4	3		400	455	419	31
	5	4		411	471	446	25
	6	4		439	461	446	10
	7	3		452	554	506	51
	8	3		507	534	522	14
	9	2		591	618	605	19
	10	1		448	448	448	
	11	1		564	564	564	
	12	4		517	670	610	65
	13	2		586	646	616	42
	14						
	15	1		581	581	581	

Age	n (obs.)	n (est.)	Min	Max	Mean	St. Dev.
16	2		626	672	649	33
17						
18						
19	1		655	655	655	
All	39		249	672	487	114

Length statistics for Black Crappie include only fish that were detail sampled.
Fish that were length tallied only are reported separately in Appendix A)