Fish Population Studies on Wood Lake, 2018

File Report

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The Broad-scale Fisheries Monitoring (BsM) program is one of the pillars of the MNRF's Ecological Framework for Fisheries Management (EFFM). The BsM program, started in 2008, collects information from randomly selected lakes from within each Fisheries Management Zone across the province on cyclical basis. This program is helping to improve the MNRF's understanding of the current and changing state of the fisheries across the province.

A series of fish population studies were conducted on Wood Lake in 2018 by MNRF's Biodiversity and Monitoring Section (BAMS), part of the Science and Research Branch. The overall purpose of the work was to obtain independent estimates of fish population sizes to contribute to the calibration of the sampling gear used in the standardized provincial program. More specifically, the goal of the study was to evaluate the relationship between the catch of Smallmouth Bass in North American (NA) gill nets (fish-per-net) and the estimated density (fish-per-hectare) in the lake. The secondary objective was to also opportunistically evaluate this relationship for Walleye, Largemouth Bass, and Rock Bass.

Wood Lake was chosen for this work due to its' size, fish community, suitability for live-capture netting (trap and fyke net) and proximity to the Bracebridge office.

Methods

The work was comprised of two primary components.

Spring Live Capture and Marking

Trap nets and fyke nets were used to capture, mark and live-release as many fish of the target species as possible. The gear primarily used were standard 6ft trap nets with 100ft lead lines and fyke nets that had a 3x5ft opening with a 50ft lead line. Net locations were not random and were intentionally chosen to maximize the catch. Some sites were fished repeatedly.

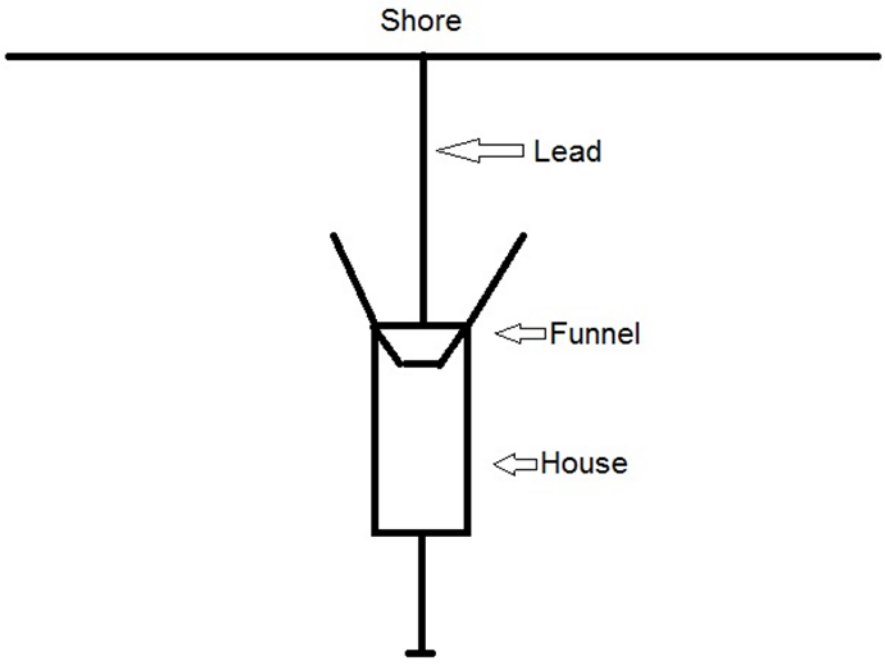


Figure 1 A simplified diagram of a trap net as shown from above (not to scale). Fish traveling along shore are diverted by the lead and funneled into the holding compartment known as the house. Fyke nets work on a similar principle but are typically smaller and can be used in shallower circumstances.

Individuals of all species caught were marked. Smallmouth Bass, Largemouth Bass, and Walleye longer than 200mm fork length (FL) were marked with a “T-bar tag” which was inserted behind the dorsal fin. In conjunction with the tags, a fin was partially clipped (3rd dorsal spine clip) to identify these fish if the tag was lost. Bass and Walleye smaller than 200mm were only marked with a spine clip. Tags were individually numbered and included a phone number to facilitate the reporting by anglers who caught one of these tagged fish. Fish were released alive back into the lake. Any fish that were recaptured (already had a fin clip or tag indicating that had been caught earlier) were noted. The target was that 10% of the population for each species was marked. The tagged fish were allowed to mix with the rest of the fish in the lake for a month and a half before the index netting phase of the study.



Figure 2 Example of a tagged fish. The tag contains a unique identification number and a phone number to report its capture to MNRF.

The ratio of marked to unmarked fish caught each day was used to calculate a population estimate for each species. For example, 100 fish are caught, marked and released back into the lake. In the next netting episode, it is found that 10 of captured fish have marks, it indicates that 10% of the total population have been marked and therefore the population is 1000 fish (100/10%). This is a simplified example; the actual estimates include measures of variation (population is estimated to be between a range of values).

Summer Index Netting

Large mesh gill nets, of the North American standard design, which are used in the BsM program, were set on three separate occasions (July 31st-August 3rd, August 21st-25th, and August 28th-31st) (Sandstrom et el. 2018). In this protocol, nets were randomly allocated around the lake at various depth strata (1-3m, 3-6m, 6-12m, 12-20m). The depth allocation is done before the survey start date to ensure that the entire lake is surveyed. Net locations within each depth strata are randomly generated by a computer program to remove bias in their locations. The intent is to obtain a random, unbiased, sample of the average fish abundance (i.e. the average number of fish caught per net set is representative of the lake-wide abundance). All fish caught were tallied and any previously marked fish were noted.

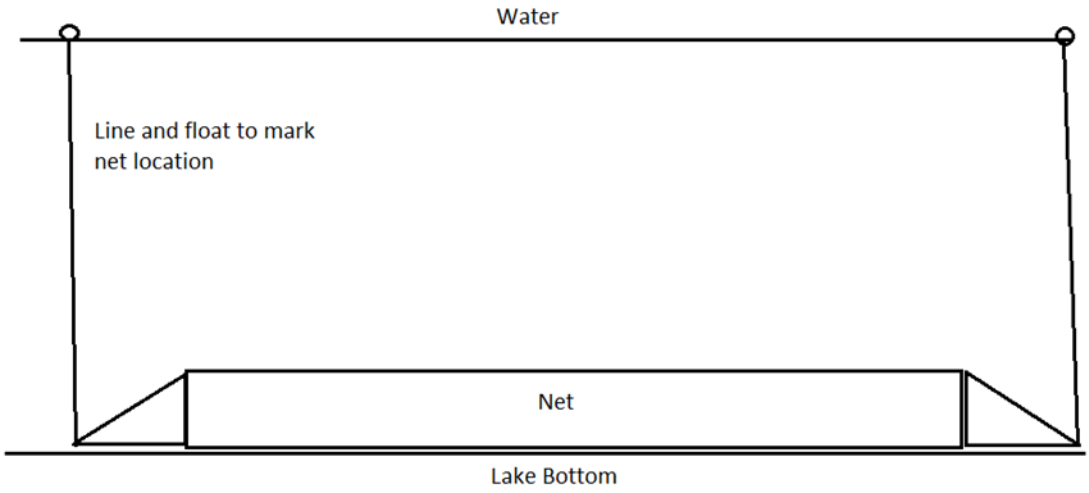


Figure 3 A diagram of a gill net as it fishes in the water. The net is approximately 25m long and 2m high. The net rests on bottom and is marked by a rope and float on each end. The standard Broadscale Monitoring program employs two nets tied together for a total of 50m of net at each location. Each net is comprised of 8 panels of different sized mesh from 1.5" to 5.0". Nets are distributed randomly covering all lake depths from 1m to the maximum depth of the lake

Population estimates from Wood Lake and other lakes where similar projects have been done across the province were then compared to the catch rate (number or weight of fish caught in each gill net set) from the large mesh nets. From this, a relationship has been developed which allows conversion of catch rates to population size and density within a lake. The relationship will be used to interpret results from the provincial BsM program. The development of these relationships is an ongoing process; as similar projects are done on additional lakes the relationships will be refined.

Wood Lake is currently being stocked with Walleye on a trial basis. The work done by BAMS provided an opportunity to try to determine if stocked fish have contributed to the Walleye population in the lake. Walleye are not marked when they are stocked due to being too small, but the sizes and ages of Walleye captured in the netting projects can be compared to the stocking record to determine which fish were of a size or age that might correspond with years of stocking. This method of validation is imprecise because even if a fish is of an age that corresponds to a year of stocking, there is no way to distinguish it from a fish that was produced naturally. The recent history of Walleye stocking is shown in Table 1.

Table 1 Recent Walleye stocking history, Wood Lake. All fish were stocked as age-0 summer fingerlings.

Year	Number	Age in 2018
2010	10,000	8
2013	10,000	5
2015	5,500	3
2018	26,000	0

Results

The spring live capture and marking project was conducted from May 9 to June 21 (Table 2). During this period, over 2,000 fish of six different species were caught. Smallmouth Bass (888) and Rock Bass (866) were most abundant and marked in near-equal numbers. Smaller numbers of Largemouth Bass (118),

Walleye (87) and White Sucker (87) were marked as well as a single Pumpkinseed. In addition, 234 fish were recaptured during this project. Based on the population estimates, the target of marking 10% of the population was exceeded for all species (except pumpkinseed), which resulted in relatively precise population estimates.

It was calculated that there were about 5,000 Smallmouth Bass (>200mm fork length) in Wood Lake, with 95% confidence limits of 4,130 to 6,550). The confidence limits indicate that there is a 95% chance that the actual population size is between these numbers. Based on the size of the lake, the population estimate translates into a density of 13.2 fish/ha or 7.3 kg/ha. There are a lot of Smallmouth Bass in Wood Lake!

The corresponding estimates for the other species captured can be found in Table 2 and Figure 4. Rock Bass are also very abundant. Walleye abundance is moderately low, perhaps not surprising given the dominance of the bass species.

Table 2 Summary of fish marked, recaptured and population estimates, by species, spring trap and fyke nets, Wood Lake, 2018.

	Abundance	Lower 95CL	Upper 95CL	Density (fish/ha)	Mean Wt (kg)	Density (kg/ha)	Number Marked	% Marked
Smallmouth Bass	5,070	4,130	6,550	13.17	0.55	7.3	888	18%
Rock Bass	4,000	3,320	5,030	10.39	0.23	2.4	866	22%
Walleye	370	210	700	0.96	0.87	0.8	87	24%
White Sucker	330	190	600	0.86	1.26	1.1	87	26%
Largemouth Bass	300	210	450	0.78	1.03	0.8	118	39%
Pumpkinseed	*incidental*							
	10,070	8,060	13,330	26.2		12.4	2,046	

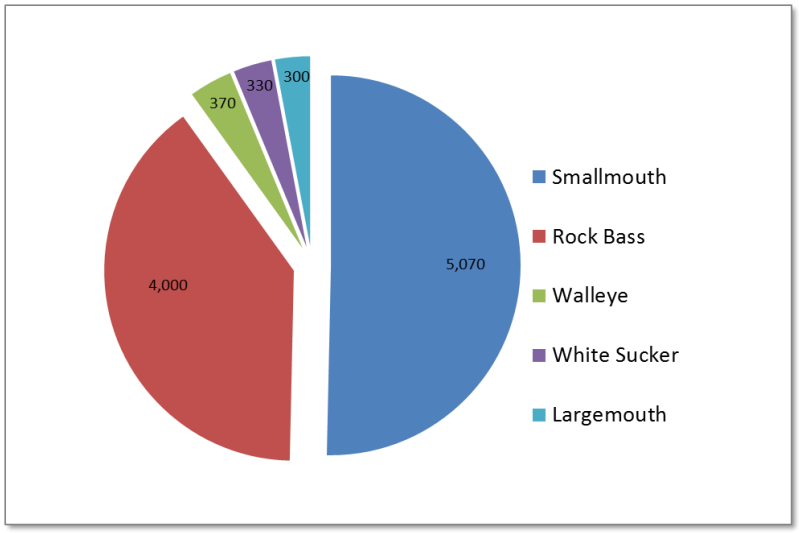


Figure 4 Population estimates, by species, Wood Lake, 2018.

The length distributions of the main sport fish species caught in the spring netting are shown in Figure 5. For the three species of bass, the distributions are very regular because of the large number of fish

caught and overlap in size of fish of different ages. For all species, small individuals are not susceptible to being caught in the live capture gear. Most Smallmouth Bass were between 300 and 400 mm (12-16”). Largemouth were slightly larger, with most being about 350 to 450 mm (14-18”). The Rock Bass were quite large, with most being between 175 and 300 mm (7-12”)

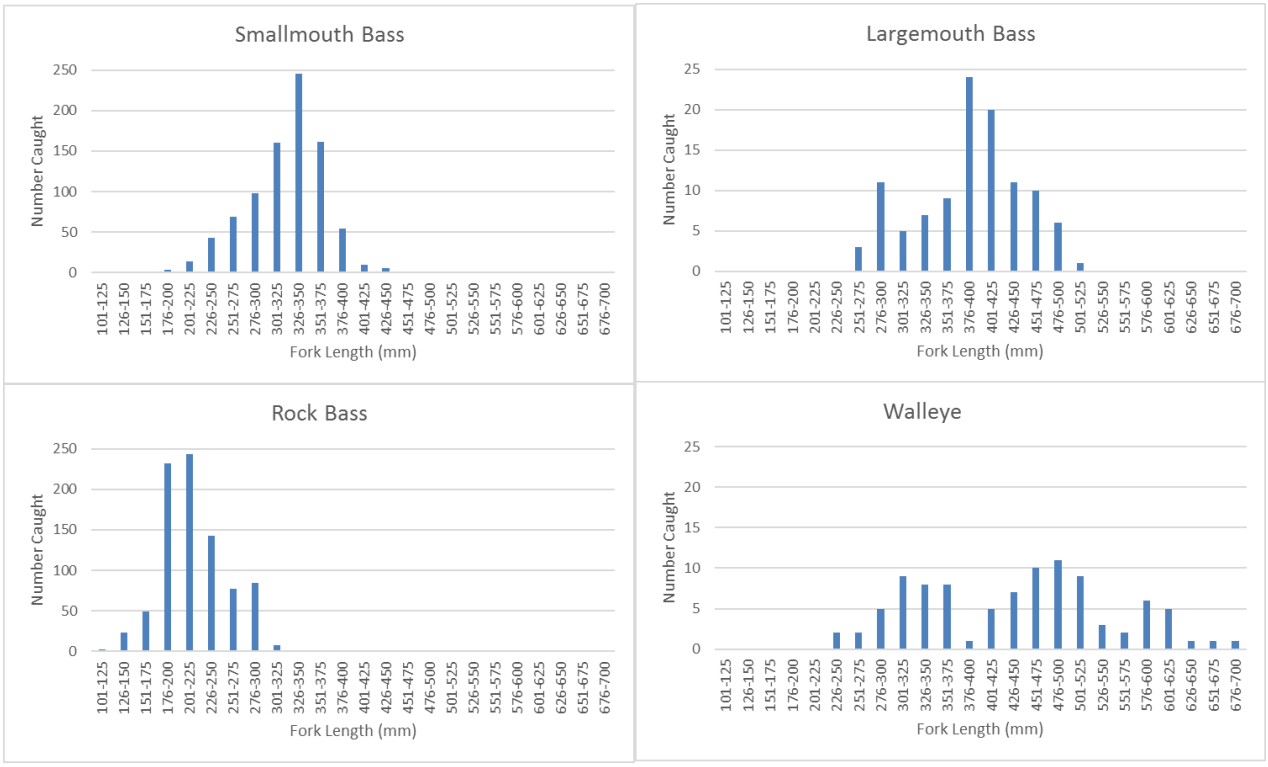


Figure 5 Size distribution (fork length), by species, of fish caught in spring trap and fyke nets, Wood Lake, 2018.

The summer North American standard (NA1) large mesh gill netting occurred in three episodes (Table 4). Except for three nets during the first project, all nets were comprised of 2-gang straps. Two species not caught in the live capture gear were caught; Cisco and Brown Bullhead. Both species are native to but uncommon in the lake. Cisco is a cold water species that lives primarily in deeper, offshore waters and is not vulnerable to the live capture gear which were set near to shore in shallow water.

As with the live-capture gear, Rock Bass and Smallmouth Bass were the dominant species in the catch of all three gill net projects with White Sucker and Walleye being less commonly caught. The differences in the relative catch composition of the two gears was due to differences in gear selectivity. Each species has a unique body shape, behaviour and habitat use that affects its vulnerability to being caught and the vulnerability differs by gear type. For example, Largemouth Bass comprised a much larger proportion of the spring trap net catch than it did of the summer gill net catch, partly because they move more actively in the spring and very sedentary during stable summer conditions but also because of their body shape they are less likely to be caught be a gill net than a trap net. This example illustrates the importance of obtaining true population estimates to help interpret the catch from any gear.

Table 3 Catch summary for large mesh (NA1) gill nets, Wood Lake, 2018.

Project	Start Date	End Date	Number of Net Sets	Cisco	White Sucker	Brown Bullhead	Rock Bass	Pumpkin-seed	Smallmouth Bass	Largemouth Bass	Yellow Perch	Walleye
1	30-Jul-18	03-Aug-18	24	4	21		149	1	61		1	45
2	20-Aug-18	24-Aug-18	24	1	43		159	3	84	1	2	42
3	27-Aug-18	31-Aug-18	24	1	25	1	126	1	72			29

	Survey 1			Survey 2			Survey 3			Average
	NA CUE >200	SE	n	NA CUE >200	SE	n	NA CUE >200	SE	n	NA CUE >200
Smallmouth B.	0.87	0.15	24	1.92	0.42	24	1.83	0.35	24	1.54
Rock Bass	1.18	0.27	24	3.4	1.02	24	1.32	0.25	24	1.97
Walleye	0.98	0.25	24	1.63	0.39	24	1.25	0.28	24	1.29
White Sucker	0.34	0.15	24	1.69	0.51	24	0.87	0.37	24	0.97
Largemouth B.	0		24	0.04	0.04	24	0		24	

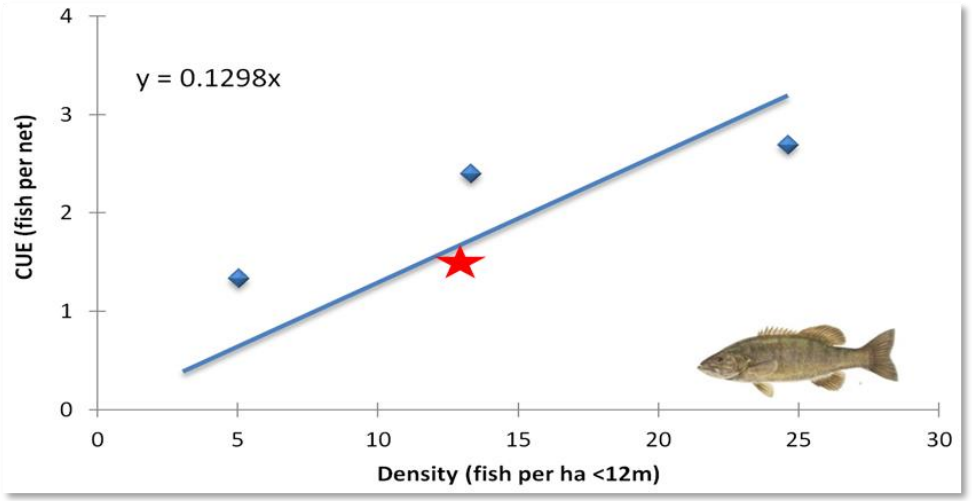


Figure 6 Relationship between smallmouth Bass density (number of fish/ha as estimated from independent mark-recapture studies) and catch rate in North American standard gill nets (fish/net). Wood Lake is shown as a red star.

The catch rates of Smallmouth Bass, Walleye and Rock Bass in Wood Lake are plotted against the catch rates obtained from other lakes in FMZ 15 in Cycle 1 of the BsM program, in Figures 7, 8 and 9, respectively. For each lake size category, the box and whisker plot presents the mean, first and third quartile and range of catch rates. For Smallmouth Bass, the catch rate from Wood Lake was above the third quartile and amongst the highest catch rate for lakes sampled in FMZ 15. For Walleye the catch rate was near the lower quartile for lakes of similar size and above average for all lakes in FMZ 15. On the provincial scale, catch rates of Walleye in FMZ 15 were among the lowest. Finally, the catch rate of Rock Bass was amongst the highest for lakes sampled in the zone, indicating a very high abundance.

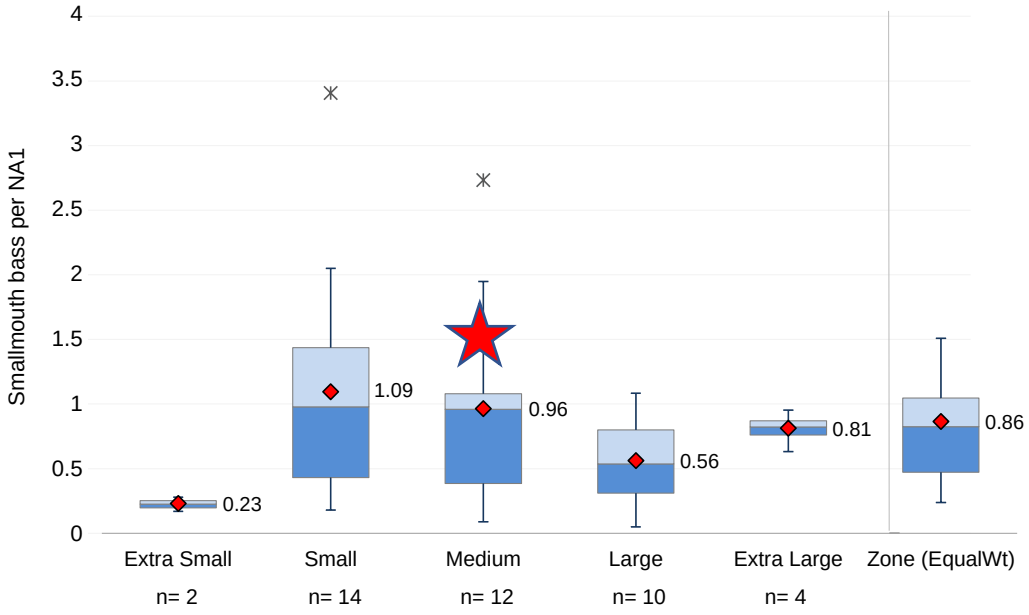


Figure 7 Catch rate (number/net) of Smallmouth Bass in large-mesh nets, by lake size class, BsM, Cycle 1. Catch rate from Wood Lake in 2018 shown as a red star.

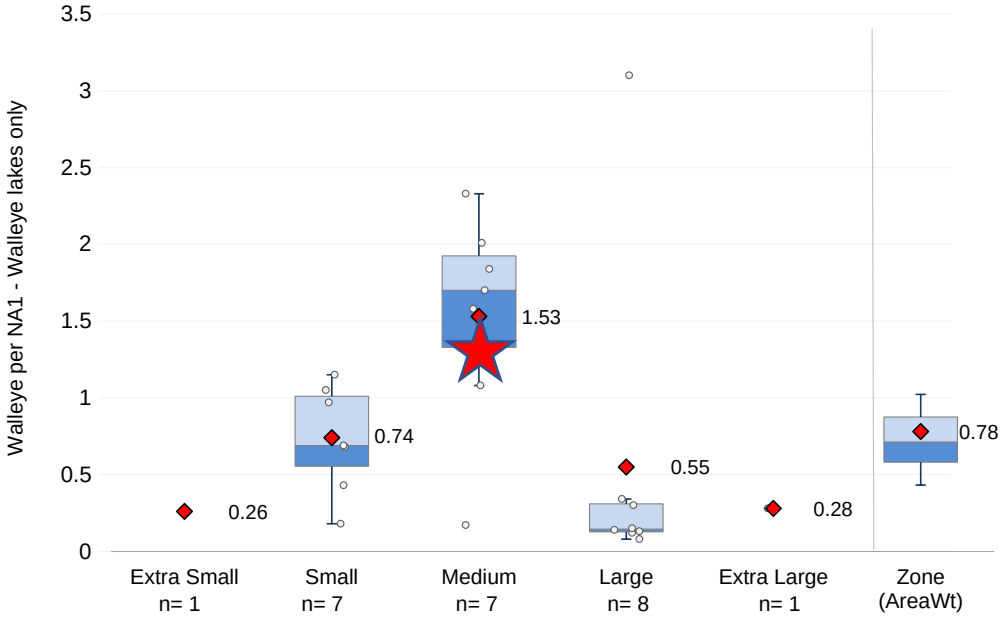


Figure 8 Catch rate (number/net) of Walleye in large-mesh nets, by lake size class, BsM, Cycle 1. Catch rate from Wood Lake in 2018 shown as a red star.

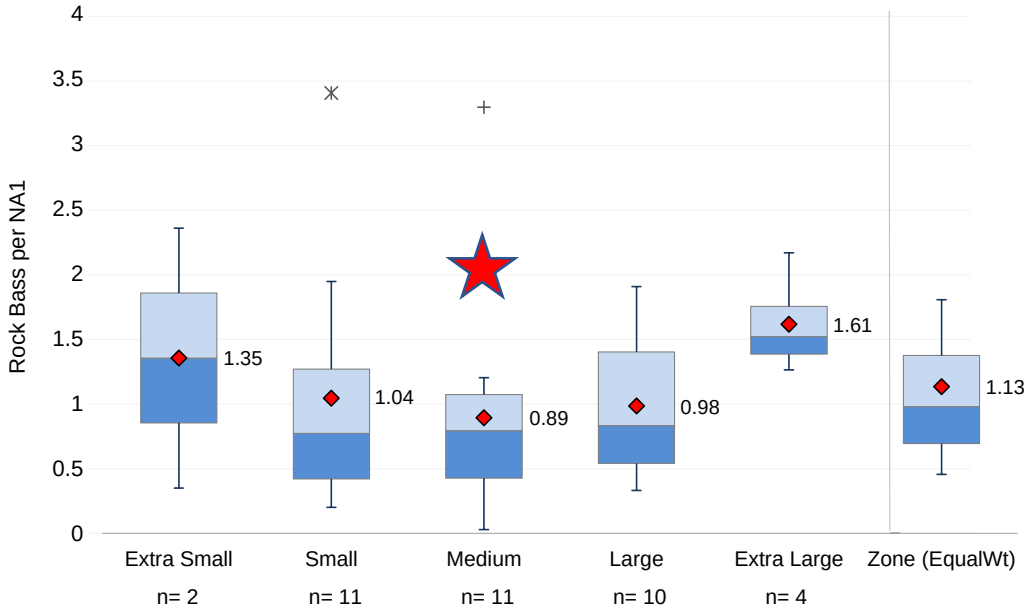


Figure 9

Catch rate (number/net) of Rock Bass in large-mesh nets, by lake size class, BsM, Cycle
Catch rate from Wood Lake in 2018 shown as a red star.

Assessment of Walleye Stocking

The ages of 89 Walleye were determined, primarily using otoliths, a calcified structure from the inner ear that typically yields the most accurate age estimates. The fish ranged from 2 to 26 years old with most being less than 10 years old. Fish that were 2 and 4 years old were most common, representing the 2014 and 2016 year classes (Figure 10). Walleye stocked in 2015 and 2013 were 3 and 5 years old in 2018. Relatively few 3 and 5-year-old Walleye were caught, indicating that stocking had very little if any impact on the abundance of Walleye in those years. The number of Walleye caught that were 7 years old and older was too few to make any inferences about the contribution of fish stocked in 2010. Walleye stocked in 2018 were too small to be vulnerable to the gear being used.

The apparent poor contribution of stocked walleye to the population is disappointing, but perhaps not surprising. A variety of factors influence the survival of and contribution of stocked fish to a population. The number of Walleye stocked has been below the recommended stocking density, partly due to the availability of fish from the provincial fish culture system. It would be preferable to stock fish at a larger size than the summer fingerlings that are commonly available. The water of Wood Lake is clearer than is ideal for Walleye and it supports a high abundance of competing bass species. It may take several stocking cycles of larger numbers of larger fish for stocked fish to become more abundant. Walleye recruitment is typically highly variable and density-dependent effects have been observed in some populations. The strong year classes in 2014 and 2016 may have reduced survival in the following years, which were coincidentally years that stocking occurred.

Based on this evidence it appears that there is little value to continue Walleye stocking in Wood Lake unless another stocking strategy (number and/or size of fish) is used. Even then, the prospects for significantly improving the population may be low.

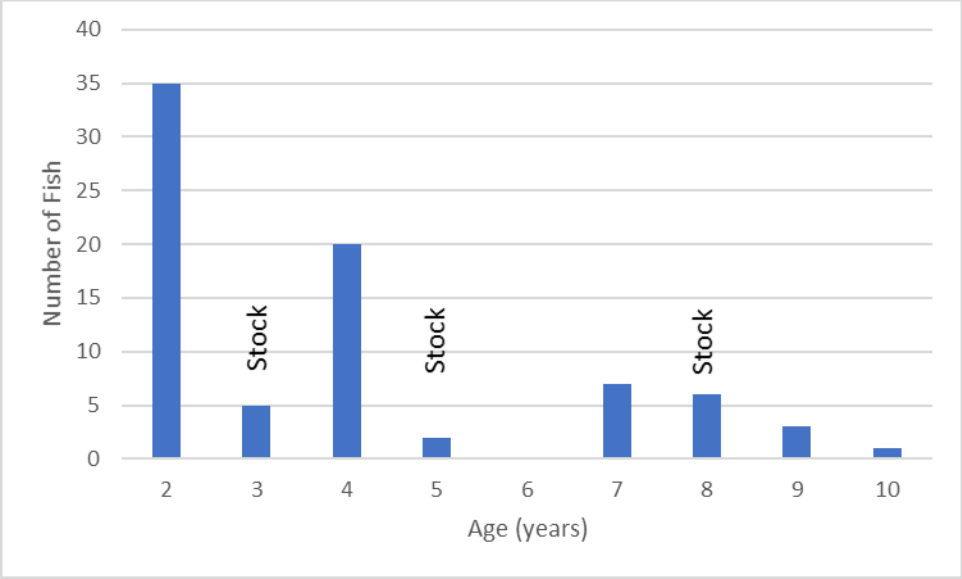


Figure 10 Age distribution of Walleye caught in Wood Lake, 2018 with years in which stocking occurred indicated.

References

Sandstrom, S, M. Rawson and N. Lester. 2018. Manual of Instructions for Broad-scale Fish Community Monitoring; using North American (NA1) and Ontario Small Mesh (ON2) Gillnets. Ontario Ministry of Natural Resources and Forestry. Peterborough, Ontario. Version 2018.1 35 p. + appendices.