Fish Community Assessment of Armstrong Lake

2016

File Report

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Armstrong Lake is a small (21 ha), mesotrophic (mean depth: 6 m, water clarity 3 m, total phosphorus: not available) lake located in the Township of McKellar, approximately 20 km NE of Parry Sound.

Shoreline development is moderate with approximately 19 shoreline properties including a trailer park and the municipal office which includes a public park with beach and dock. There is no boat launch but small boats or canoes can be launched at the municipal park.

The composition of the native fish community is not well documented. At the time of the 1973 lake inventory smallmouth bass and walleye were only sport fish species present. Smallmouth Bass were stocked periodically from 1940 to 1961, but it isn't known if the stocking was introductory or to supplement a native population. There are no stocking records but it also seems likely that Walleye were introduced as it is believed that they were also not native to Manitouwabing Lake, which is downstream of Armstrong Lake. Brook Trout were stocked briefly in the 1960s but stocking was discontinued, presumably due to poor returns as a consequence of limited habitat and a hostile fish community.

In 2015, adult Brook Trout (retired brood stock from the North Bay Fish Culture Station) were stocked on a one time basis to create a novel winter fishery for the community. Stocking wasn't intended to be continued but the event kindled interest in the management of the lake. The central location of the lake in the community and the availability of services such as parking and washrooms make it attractive for potential enhanced management.

A fish community assessment was conducted in 2016 to provide background information to be used to determine suitable management actions for the lake.

Methods

The fish community assessment component of the Broad-scale-Monitoring (BsM) protocol was used (Sandstrom et al 2015). Gear consisted of large mesh and small mesh gill nets. The large mesh gill nets target fish larger than 20cm in length, typically the size range of interest to anglers and are intended to estimate the abundance of major sport fish species. The net gang has a length of 24.8 m consisting of 8 panels of different mesh sizes. Two gangs are generally attached to one another to form one strap; however for this survey single gang straps were used because of the small size of the lake. The mesh sizes, in inches, are 1.5", 2.0", 2.5", 3.0", 3.5", 4.0", 4.5" and 5.0". The small mesh gill nets target smaller fish and are intended to detect the presence of other species in the lake. They have a length of 12.5 m, consisting of 5 panels. Mesh sizes, also in inches, are 0.50", 0.75", 1.00", 1.25" and 1.50".

The lake was divided into depth strata, with the number of sets of each gear to occur in each stratum based on the size of the lake and its' maximum depth. The depth strata were 1-3, 3-6, 6-12 and 12-20 m. Nets were set overnight for approximately 20 hr. Nets were set perpendicular to shore when possible, but due to the small size of the lake and some strata, some sets were set obliquely or parallel to shore.

The catch was enumerated, by species. Game fish species caught in large-mesh nets were detail sampled including length, weight, gender, maturity and collection of calcified structures for age determination. Other species caught in either gear and fish caught in small mesh nets were generally measured for fork length only.

Tissues samples were collected from sport fish species and provided to MOECC for analysis of contaminants. Results will be published independently in the Guide to Eating Ontario Sport Fish.

A temperature and dissolved oxygen profile was measured at the deepest point of the lake and updated bathymetric data were also collected using a Garmin GPSMAP depth sounder.

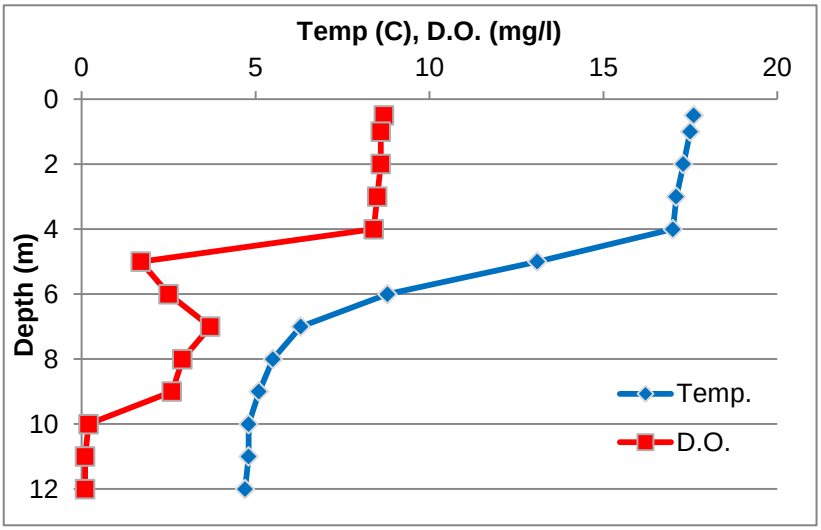
Project data will be archived in the provincial BsM database as a supplemental survey.

Results

Field operations occurred from September 26 to 29, 2016. The project was done relatively late in the season but the lake was still strongly thermally stratified with a thermocline occurring from 4 to 7 m deep (Figure 1). Dissolved oxygen declined to a very low level in the thermocline but recovered slightly in the upper part of the hyplimnion. Virtually no oxygen occurred deeper than 9 m. The Secchi disk measurement indicated that water clarity was 3.0 m.

Figure 1 Temperature and dissolved oxygen profile, Armstrong Lake, Sept. 28, 2016.

Depth	Temp	D.O.
0.5	17.6	8.7
1	17.5	8.6
2	17.3	8.6
3	17.1	8.5
4	17.0	8.4
5	13.1	1.7
6	8.8	2.5
7	6.3	3.7
8	5.5	2.9
9	5.1	2.6
10	4.8	0.2
11	4.8	0.1
12	4.7	0.1



A total of 18 nets sets were completed. Three large mesh and three small mesh sets were done in the 1-3 and 3-6 m strata, one small mesh was set in each of the 6-12 and > 12 m strata and three and one large mesh sets were done in the 6-12 and > 12 m strata, respectively (Table 1, Figure 2).

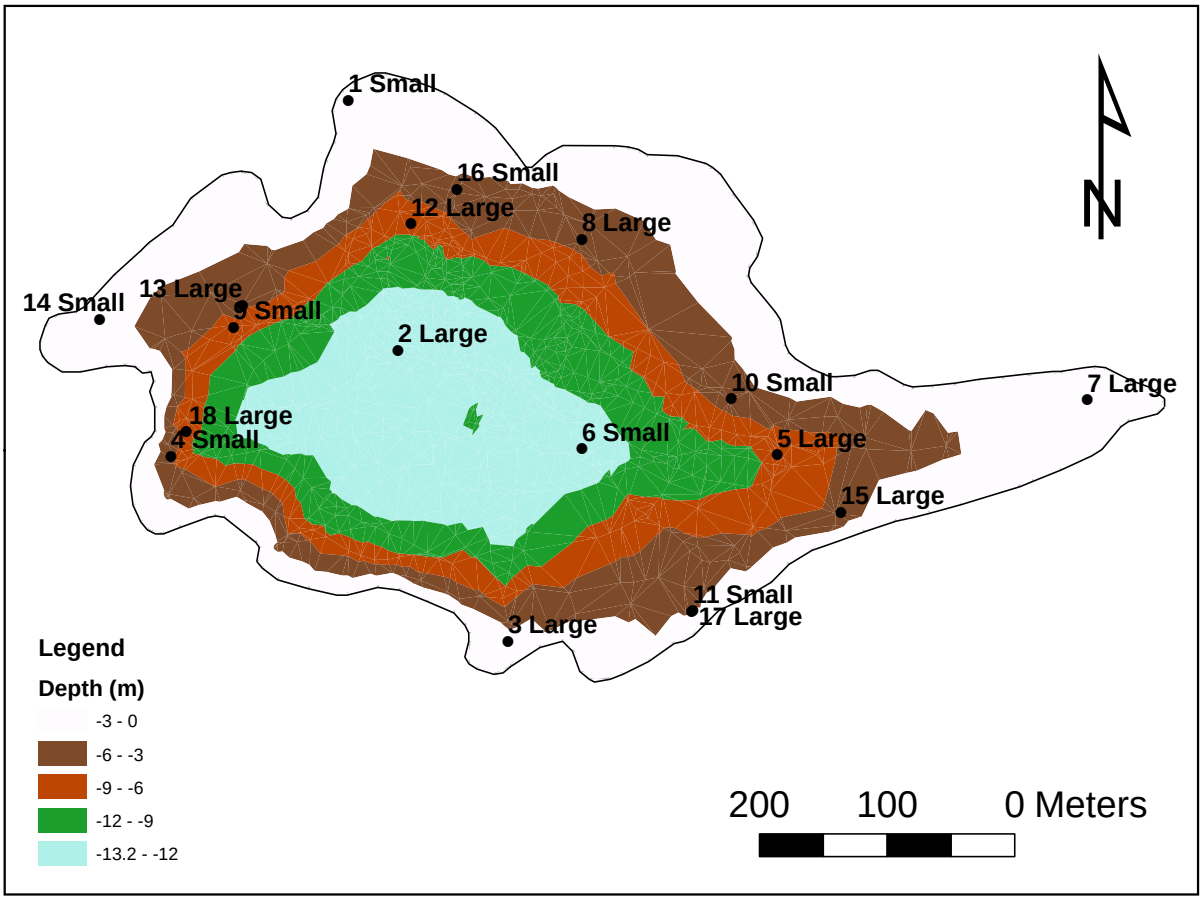


Figure 2 Map of Armstrong Lake showing bathymetry and net set locations, by gear type, 2016.

A total of 160 fish of 9 different species were caught. The small mesh nets caught 128 fish of 8 species. Yellow perch were most commonly caught (96), followed by Smallmouth Bass (10), Rock Bass (10) and Golden Shiner (8). One individual of Northern Pike, Creek Chub, Pumpkinseed and Largemouth bass were also caught. The large mesh nets caught fewer fish; 32 of 5 species. In order abundance they were Rock Bass (20), Northern Pike (4), Smallmouth Bass (3), Yellow Perch (3) and Walleye (2).

All fish were caught in the 1-3 and 3-6 m strata. Although fish were not recorded by the actual depth they occurred in the net it is likely that there were no fish in the lake greater than about 4 m deep because of the low oxygen levels.

The Broad-scale Monitoring program expresses fish abundance as the area-weighted, selectivity-corrected catch per net, by number and weight. Those calculations are not yet available for Armstrong Lake. In the interim, unadjusted catch per net was calculated for the two shallow strata where fish were caught and the whole lake (Table 2).

The size distributions of the various species caught, by the gear in which they were caught, are shown in Table 3. The small samples sizes preclude any detailed interpretation of the composition of the populations.

Table 1 Net set and catch summary, Armstrong Lake, 2016.

Effort	East	North	Gear	Stratum	Start Depth	End Depth	Northern Pike	Golden Shiner	Creek Chub	Rock Bass	Pimpkinseed	Smallmouth Bass	Largemouth Bass	Yellow Perch	Walleye
1	584457	5040678	Small	1-3	1.5	1.5	1	5						32	
11	584727	5040278	Small	1-3	1.3	3.0				4		2		5	
14	584262	5040506	Small	1-3	1.0	3.0		3	1	4			1	32	
4	584318	5040399	Small	3-6	3.0	4.4						1		4	
10	584757	5040444	Small	3-6	3.8	5.0						1		23	
16	584542	5040608	Small	3-6	3.0	6.0				2	1	6			
9	584367	5040500	Small	6-12	6.7	9.3									
6	584640	5040405	Small	12-20	12.4	12.5									
							1	8	1	10	1	10	1	96	
3	584582	5040254	Large	1-3	2.3	4.1				4		1			
7	585036	5040443	Large	1-3	2.2	2.5	2			2					
17	584726	5040277	Large	1-3	1.0	4.0						1			
8	584640	5040569	Large	3-6	3.6	6.0				2				1	
15	584843	5040355	Large	3-6	3.4	6.2	1							2	
18	584330	5040418	Large	3-6	3.5	6.1	1			12		1			2
5	584793	5040400	Large	6-12	8.2	7.5									
12	584506	5040581	Large	6-12	6.3	9.6									
13	584374	5040517	Large	6-12	6.0	6.7									
2	584496	5040482	Large	12-20	12.3	12.8									
							4			20		3		3	2

Table 2 Abundance (number/net) of fish caught in large mesh nets, Armstrong Lake, 2016

	Northern Pike	Rock Bass	Smallmouth Bass	Yellow Perch	Walleye
0-6 m (n=6)	0.7	3.3	0.5	0.5	0.3
All (n=10)	0.4	2.0	0.3	0.3	0.2

Table 3 Size distribution (fork length), by species and gear, Armstrong Lake, 2016.

Fork Length (mm)	Northern Pike		Golden Shiner	Creek Chub	Rock Bass		Pump-kinseed	Smallmouth Bass		Large-mouth Bass	Yellow Perch		Walleye
	Small	Large	Small	Small	Small	Large	Small	Small	Large	Small	Small	Large	Large
<50													
50-99			5	1	2		1	2			29		
100-149			3		7	5		4			56		
150-199					1	11		4		1	10	3	
200-249						3			2		1		
250-299						1							
300-349													
350-399									1				
400-449													
450-499													
500-549	1	4											2

Discussion

The Broad-scale Monitoring netting protocol is designed to sample the entire fish community. It is a provincial standard technique for which database and analytical support is provided. Synopses of the results of the first 5 year cycle (2008-2012) of monitoring are just becoming available. Benchmarks and other interpretive tools should be available in the near future. Given the small size of the lake and small sample sizes of captured fish it is unlikely that the more detailed analytics would provide additional insight beyond what is presented here.

The dissolved oxygen profile is primarily a product of the natural characteristics of the lake basin and water quality of the lake, which in turn strongly influence the fish community. The moderately low water clarity and small volume of deep water result in no oxygen production and high oxygen demand in and below the thermocline. These areas are unavailable to fish during much of the productive growing season and the fish species that occur in the lake are not well adapted to using the food resources that are there.

Of the nine species captured, five had not been previously documented in the lake. Golden Shiner and Creek Chub may be native, but Northern Pike, Rock Bass and Largemouth Bass were probably introduced illegally. One species was not caught in this survey that was present previously; White Sucker. It is possible that they still occur, but in low numbers. The introduction of additional predator species may have reduced or eliminated the species from the lake.

None of the adult Brook Trout stocked in February 2015 were caught. The old age of the fish at the time of stocking and the virtual absence of any summer habitat would result in low survival. It is possible that a small number persist in the lake but successful reproduction will not occur and the population will eventually disappear. The low levels of oxygen in the thermocline and hypolimnion and diversity of predators render the lake unsuitable for stocking of cold water species, other than perhaps stocking of catchable-sized fish for specific short term events.

The catch of two Walleye, approximately 0.3/net in the 1-3 and 3-6 m strata or 0.2/net if the whole lake is considered, indicates a low level of abundance. Provisional data from the BsM program provide a zone-wide average of about 0.5 Walleye/net for all strata combined. The ability of the lake to support a productive Walleye population capable of supporting a fishery is severely limited by the very small size and the depth and oxygen characteristics of the lake in combination with the high diversity of competing species. Successful reproduction is likely to be poor and sporadic in these conditions. Supplemental stocking of walleye generally has poor success when regular natural reproduction occurs and is discouraged due to potential impacts to natural populations. The Walleye population of Armstrong Lake can be considered to be marginally viable and therefore is a candidate for put-grow-take stocking. Stocking of the largest available life stages would be preferred to maximize survival in the presence of other predators. The relatively low water clarity would give Walleye somewhat of a competitive advantage.

The central area of the lake where depth exceeds 4 m and dissolved oxygen is low was devoid of fish during the survey. When the lake is not thermally stratified the species that are already present would be able to use more of the deep water habitat. The plankton net haul that was done captured a high abundance of zooplankton indicating that there are foraging opportunities in deeper water, However, a more productive fishery overall may be realized if a species, such as Black Crappie, was present that is better able to use the offshore habitat. Black Crappie may perform very well in Armstrong Lake as they are adapted to feeding efficiently on suspended zooplankton. Introducing another species to an already diverse community in a small lake may seem counter-productive but Black Crappie may be more efficient at using the available habitat and food and provide a more regular fishery than the current species provide. If introduced it is likely that Crappie would impact the other species to some degree but may

have a net benefit. If introduced, crappie would likely establish a self-sustaining population, eliminating the need for ongoing stocking, such as would be required for Walleye.

The four Northern Pike caught in the large mesh nets represent a catch rate of about 0.7/net for the two shallow strata or 0.4/net for the whole lake. Zone-wide, catches averaged about 0.5/net for the smaller lakes classes, indicating the abundance in Armstrong Lake is moderate.

The three Smallmouth Bass caught in the large mesh nets equate to about 0.5/net in the shallow strata and 0.3/net lake wide. Zone-wide catches varied greatly with lake size, with the highest catches in medium-sized lakes where the average was about 1/net. For a very small lake, the Smallmouth Bass abundance in Armstrong Lake is probably about average but low compared to larger lakes with better habitat.

As only one Largemouth Bass was caught, it is not possible to make any conclusions about their population status, other than that they occur in the lake. The absence of any young fish in the small mesh nets suggests that they are uncommon.

In summary, several species have been introduced to Armstrong Lake since the original survey in 1973. The natural physical characteristics of the lake and diverse community for a small lake results in modest to low populations of each species. The lake is a candidate for put-grow-take stocking of Walleye due to the marginal nature of the population. Introduction of Black Crappie can also be considered as they may make more efficient use of the available habitat. If Walleye stocking is attempted it should be done on a trial basis with monitoring to ensure an acceptable rate of return is being achieved and only if Black Crappie are not present. Finally, private trout stocking could be permitted but only catchable-sized fish stocked for short term returns are likely to have any value.

Acknowledgements

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References

Sandstrom, S, M. Rawson and N. Lester. 2015. Manual of Instructions for Inland Lakes Broad-scale Monitoring; Part 1 Netting Survey; version 2015.1..Ontario Ministry of Natural Resources and Forestry, Science and Research Branch, Biodiversity and Monitoring Section, Peterborough, Ontario. 35 pp. + appendices.

Appendix Detailed fish sampling data.

Effort	Species	Gear	Fish	FL	TL	RWT	Sex	Gon	AgeSt	Tissue
1	131	Small	1	532	566	1000	2	10	2C	1
7	131	Large	1	547	580	1280	2	10	2C	1
7	131	Large	4	542	581	1220	1	22	2C	1
15	131	Large	3	526	564	1100	2	22	2C	1
18	131	Large	1	521	556					
3	316	Large	1	221	231	150	1	10	2A	1
17	316	Large	1	209	223					
18	316	Large	14	385	406	950	2	22	27	1
18	334	Large	15	530	555	1510	2	22	2A	1
18	334	Large	16	501	523	1300	2	22	2A	1