Fish Community Assessment of Silver Lake using Broad-scale Monitoring Gear 2013

File Report

2014

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Silver Lake is located in Muskoka and Morrison Townships, within the Town of Gravenhurst. It is relatively small (58 ha) but of considerable depth (Z_{max}: 22 m, Z_{mean}: 11 m, Figure 1). Water clarity is moderately low with a mean secchi disk reading of 2.8 m (DMM 2013). There are no public access points on the lake but it can be accessed via a navigable channel from Gull Lake, where two boat launches are located.

The composition of the native fish community of Silver Lake is imperfectly documented. The 1927 field report indicates that smallmouth bass were native; however, the 1967 survey doesn't list any bass species as being present and the 1975 survey lists only largemouth bass as being present, though none of either species were actually caught in test nets. In adjoining Gull Lake there is similar ambiguity as smallmouth were reported in 1927, just 'bass' in 1963 and both species in 1975, despite, again , the lack of any being caught in nets. Overlying that is a stocking history of 'bass' that began in 1905 and smallmouth as early as 1942! Other species documented or reported include cisco, yellow perch, pumpkinseed, rock bass and rainbow smelt.

The 1927 report also indicates that "Salmon Trout" (lake trout) have been reported but none were caught in any of the surveys. There is no direct record of lake trout stocking having occurred in Silver Lake at that time, but the Gull Lake 1927 report states "good? authority say that 3 lake trout were caught last summer, perhaps some of those planted in Silver Lake, though one was 5 lbs, too big for time to grow…" These unconfirmed reports suggest that the lake may have supported a small native lake trout population.

There is one record of lake trout stocking in Silver Lake, in 1994. No assessment of this stocking has been done. We have one angler report of a lake trout being caught in recent years, but do not know if it was a native or a stocked fish.

Rainbow trout are currently stocked to enhance the fishery and take advantage of the deep water habitat that is available. Neighbouring Gull Lake is also stocked with rainbows. It is likely that there is movement of stocked fish between the lakes.

A survey was done in 2013 following the Broad-scale Monitoring (BsM) protocol to describe the current composition of the fish community.

Methods

The Broad-scale Monitoring protocol was followed, with some variations (Sandstrom et al., 2013). Gear consisted of large mesh (NA-1) and small mesh (ON-2) gill net gangs. The large mesh gill nets target fish larger than 20cm in length, typically the size range of interest to anglers. The net has a length of 24.8 m consisting of 8 panels which are 3.1 m long and 1.8m high. Two gangs are generally attached to one another to equal one strap. The mesh sizes, in inches, are 1.5", 2.0", 2.5", 3.0", 3.5", 4.0", 4.5" and 5.0" and are in random order in the nets. 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 that are 2.5 m long and 1.8 m high. Mesh sizes, also in inches, are 0.50", 0.75", 1.00", 1.25" and 1.50", arranged in random order.

The BsM protocol prescribes the number of nets of each gear type to be set based on lake area and depth. This survey employed a reduced number of sets due to the scope of the survey (emphasis on species occurrence not on obtaining estimates of abundance) and time limitations. Nets were set in depth strata of 1-3, 3-6, 6-12 and 12-20 m. Sets were set overnight for 16 to 22 hr periods.

All captured fish were counted and measured for fork length. Major sport fish species were more fully sampled, including length, weight and age structures for fish that were live released and, in addition, gender, gonad condition and stomach contents for mortalities.

A temperature and dissolved oxygen profile was collected and bathymetric data was recorded.

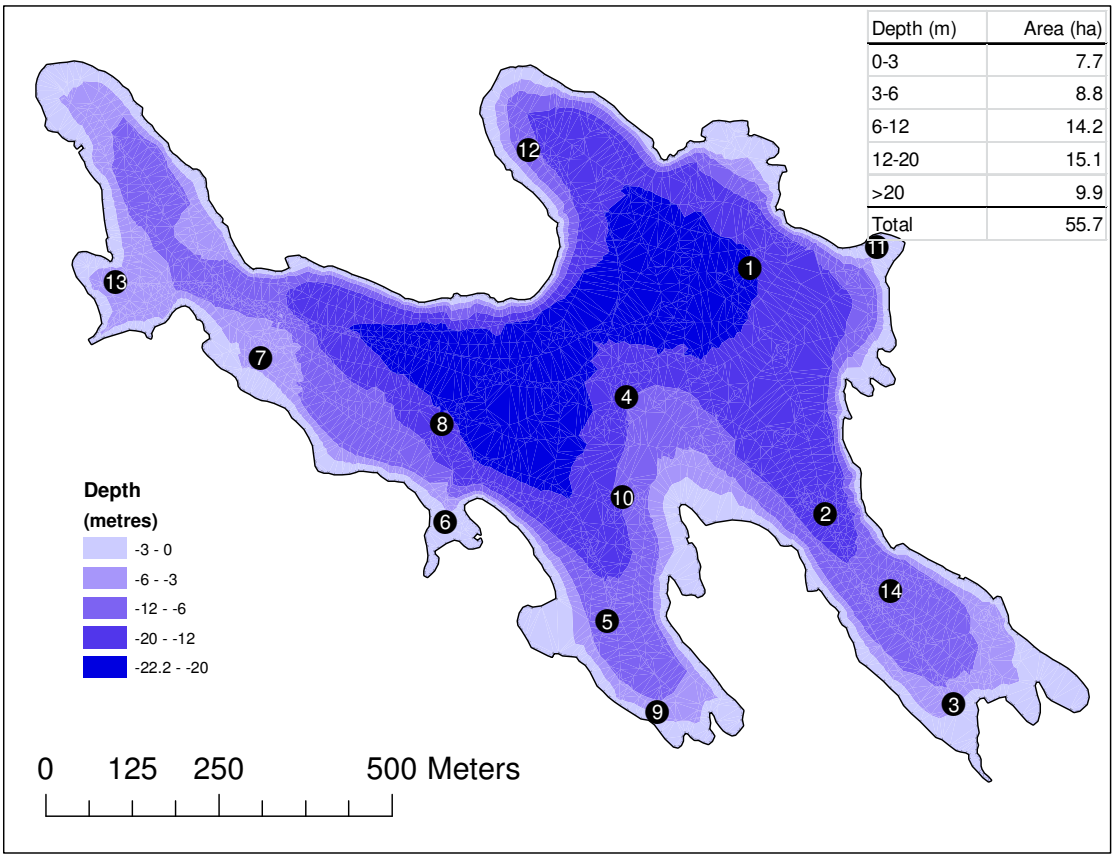


Figure 1 Map of Silver Lake showing bathymetry and net set locations, 2013.

Results

Sampling occurred from September 30 to October 2, 2013. The shape of the lake basin is similar to many other lakes in the bedrock ridge/valley topography of the southern part of the District. The near shore littoral area is very steep and narrow in most places then transitions to a relatively flat bottom offshore. The littoral substrate consists largely of steeply sloping bare bedrock with very little unconsolidated rock or cobble. In the shallow bays, the substrate is primarily fine-textured with a high organic content. This bathymetry greatly influences that habitat suitability for many species and presents challenges for effectively sampling the near shore area.

At the time of sampling the lake was still thermally stratified, though the surface temperature was considerably lower than typical summer levels (Table 1) presenting the potential for some species which would normally be confined above or below the thermocline to occur at other depths. The thermocline occurred from approximately 5 to 9 m deep. The dissolved oxygen profile displayed a negative heterograde pattern; with an oxygen minimum occurring in the thermocline, modestly higher levels through much of the hypolimnion and very low levels in the bottom several metres.

A total of 14 nets were set; eight large mesh and six small mesh (Table 2). The large mesh sets were all of two gang straps, but the small mesh were all single gangs. Of the large mesh, none

were set in the 1-3 m stratum, two in the 3-6 m, three in 6-12 m and three in 12-20 m. None were set greater than 20 m due to the absence of oxygen at that depth. Of the small mesh nets, two were set in the 1-3 m stratum, two in 3-6 m, one in 6-12 m and one in 12-20 m.

Table 1 Temperature and dissolved oxygen profile, Silver Lake, September 30, 2013.

Depth (m)	Temp (°C)	D.O. (ppm)
0.5	17.6	8.8
1	17.4	8.8
2	17.2	8.8
3	16.8	8.5
4	16.4	7.9
5	15.8	7.1
6	13.5	2.9
7	11.2	2.8
8	8.9	3.7
9	7.7	4.5
10	6.6	5.0
11	6.2	5.5
12	5.8	5.5
13	5.5	5.9
14	5.3	5.9
15	5.1	5.8
16	4.9	5.4
17	4.9	4.3
18	4.8	3.1
19	4.7	1.8
20	4.7	0.4
21		
22		

Table 2 Net set details, Silver Lake, 2013.

Effort	Easting	Northing	Set Date	Set Time	Gear	Gangs	Stratum	Start Depth (m)	Mid Depth (m)	End Depth (m)	Lift Date	Lift Time
1	633088	4973621	Sep-30	13:35	1	2	12 - 20	19.0	20.0	20.0	Oct-01	9:20
2	633197	4973266	Sep-30	13:40	1	2	12 - 20	13.0	14.0	14.0	Oct-01	9:30
3	633382	4972991	Sep-30	13:55	2	1	03 - 06	4.0	4.0	5.0	Oct-01	9:40
4	632910	4973435	Sep-30	14:00	2	1	12 - 20	12.0	13.0	13.0	Oct-01	9:55
5	632882	4973111	Sep-30	14:10	1	2	06 - 12	6.0	9.0	10.0	Oct-01	10:00
6	632648	4973254	Sep-30	14:20	2	1	01 - 03	2.0	2.0	3.0	Oct-01	10:10
7	632381	4973491	Sep-30	14:30	1	2	03 - 06	3.0	4.0	5.0	Oct-01	10:20
8	632643	4973396	Oct-01	11:25	1	2	12 - 20	12.0	17.0	21.0	Oct-02	9:40
9	632954	4972980	Oct-01	11:35	2	1	03 - 06	3.0	4.0	6.0	Oct-02	9:50
10	632904	4973290	Oct-01	11:40	2	1	06 - 12	8.0	10.0	11.0	Oct-02	10:10
11	633271	4973651	Oct-01	11:50	2	1	01 - 03	1.0	2.0	2.0	Oct-02	10:20
12	632768	4973791	Oct-01	12:00	1	2	06 - 12	8.0	10.0	13.0	Oct-02	10:40
13	632172	4973600	Oct-01	12:20	1	2	03 - 06	4.0	5.0	5.0	Oct-02	10:50
14	633291	4973155	Oct-01	12:30	1	2	06 - 12	8.0	10.0	11.0	Oct-02	11:05

A total of 84 fish of four species were caught (Table 3). The large mesh nets caught 19 smallmouth bass, 11 rock bass, two rainbow smelt and two yellow perch. The small mesh nets caught 43 rock bass, 22 smallmouth bass, 12 smelt and 7 perch. Four of the eight large mesh nets and one of the small mesh nets, all set in 6 m or greater, did not catch any fish.

Smelt were caught in all depths except the 1-3 m stratum. Rock bass were caught in the 1-3 m and 3-6 m depths. All the smallmouth bass were between 3 and 6 m deep. Perch were caught primarily in 1-3 m and 3-6 m, with one being caught in 12-20 m.

The smallmouth bass ranged in size from 147 to 310 mm fork length and 30 to 490 g in weight (Table 4). Ages ranged from 1 to 7 years old (Table 5).

Table 3 Catch summary, Silver Lake, 2013 (no fish were caught in sets not listed).

Gear	Effort	Rainbow Smelt	Rock Bass	Smallmouth Bass	Yellow Perch
Large Mesh	2				1
	7		5	19	
	8	2			
	13		6		1
Total		2	11	19	2
Small Mesh	3	2	3	1	1
	4	3			
	6		11		2
	9	2	13	2	
	10	3			
	11		5		2
Total		10	32	3	5
Grand Total		12	43	22	7

Table 4 Descriptive statistics by size (fork length) and species, Silver Lake, 2013.

Fork Length (mm)	Rainbow Smelt	Rock Bass	Smallmouth Bass	Yellow Perch
n	12	43	22	7
Min	128	78	147	132
Max	192	221	310	238
Mean	177.8	133.5	230.0	170.4
S.D.	18.0	31.5	46.8	38.4

Table 5 Size-at-age (fork length), by species, Silver Lake, 2013.

Rainbow Smelt

Age	n	Mean	S.D.
1			
2			
3	1	165	
4			
5	2	180	4.2
6	4	186.5	6.4

Smallmouth Bass

Age	n	Mean	S.D.
1	5	154.8	5.5
2	3	226.0	5.2
3	4	254.8	14.8
4	6	250.3	21.1
5	2	263.0	26.9
6			
7	1	310.0	

Discussion

The amount of netting effort employed differed from that prescribed by the BsM protocol (Table 6). Large mesh nets were concentrated in the deeper waters due to the difficulty of setting the longer nets in the very narrow shallow strata and to target cold water species. None were set in the 1-3 m and only one in the 3-6 m stratum due to the extreme narrowness of them in most places and none were set greater than 20 m due to the low oxygen level at that depth. Conversely, the small mesh nets were set mostly in the shallow strata where the shorter nets could more easily be placed and to target the diversity of small-bodied warm water species that may occur there. Again, none were set greater than 20 m deep. The total number of sets was reduced due to the scope of the project and work priorities.

Table 6 Stratum areas and target and actual number of net sets, by gear type, Silver Lake, 2013.

		Large Mesh		Small Mesh	
Depth (m)	Area (%)	Target	Actual	Target	Actual
0-3	13.8	2	0	2	2
3-6	15.8	3	2	2	2
6-12	25.5	3	3	2	1
12-20	27.1	2	3	2	1
>20	17.8	2	0	2	0
Total	100.0	12	8	10	6

Similar difficulties in finding suitable shallow net sites were encountered in Riley Lake in 2013 as well (Scholten 2014). Trap nets were used there to supplement catches. The use of trap nets was considered for Silver Lake but because of the greater mean depth than Riley Lake, suitable sites were extremely scarce.

No species previously undocumented in Silver Lake were caught. Conversely, some species previously sampled were not caught; namely white sucker, cisco and pumpkinseed. Further, several species reported or expected to be present; largemouth bass and brown bullhead which have been anecdotally reported, and rainbow trout, which are currently stocked, were also not caught.

The overall low catch and failure to detect species, even species which are quite likely or known to be currently present, was probably due to a combination of several factors including the amount of netting effort, lake bathymetry, low population abundance and low catchability.

White sucker, cisco and pumpkinseed were previously captured in 1963 and/or 1975 but were not caught in this survey. Suckers and cisco are generally catchable in gillnets; their absence in the catch indicates their populations are small, or possibly in the case of cisco, absent. Only small numbers of these species were caught in previous surveys, indicating that their abundance is indeed low. Introduced smelt can impact cisco by preying on their pelagic fry and/or through competition for food. As smelt appear to be abundant it is quite possible that cisco abundance has been reduced or even extirpated. The other two species probably persist in the lake but at low densities.

Largemouth bass and rainbow trout may not have been caught primarily due to their behaviour and habitat use. We have reliable angler reports that largemouth are present in Silver (and Gull) Lake. Largemouth bass are quite sedentary and there are only very limited areas of suitable habitat for this species in Silver Lake so their lake-wide abundance is probably low. It is somewhat surprising that none were caught as small mesh nets were set in some of the very limited areas of suitable habitat.

Rainbow trout are stocked regularly and anglers have reported catching them. Further, our echo sounder regularly marked large fish, presumably rainbow trout, in deep water. Rainbow trout are a pelagic species that often suspends off the bottom, reducing their vulnerability to nets set on the bottom. Further, the temperature/oxygen profile indicated that oxygen levels were very low in the 6-8 m range and the deepest waters of the lake and were probably avoided by trout. The oxygen limitation in combination with modest water clarity may have been limiting the rainbow trout to a narrow range of depths at the time of netting, further reducing their catchability. Like many small stocked lakes, the difficulty of assessing population abundance and limited information on the fishery makes it difficult to assess the success and value of the stocking program. In this case, an evaluation may also be influenced by fish movement from and to Gull Lake. Gull Lake receives substantial fishing pressure for rainbow trout and we have received reports from anglers about fishing activity and catches on Silver Lake. It can be concluded that rainbow trout are surviving and providing a fishery, although we don't know if reasonable returns of stocked fish are being realized.

No lake trout were caught. Given the physical habitat and water chemistry limitations, it seems unlikely that the lake would have supported a substantial native population, despite the ambiguous comment about their presence from the 1927 survey. It is possible that stocked fish from the 1994 plant are present, but the numbers would be very small.

Smallmouth and rock bass appear to be the dominant warm water species in the lake. Most smallmouth bass were caught in a single net in one of the few areas of suitable depth with a moderate slope where a net could be effective. Bass may have been more abundant along the steep shoreline areas that could not be effectively netted. The abundance of the smallmouth population appears to be relatively low and no large fish were caught. It is possible that there is movement of bass in and out of Gull Lake, where the more moderate depths may provide better foraging. Overall, the steep, featureless nature of much of the shoreline is a major limitation on the abundance of bass population and the shallow water fish community as a whole.

Non-native smelt are probably quite abundant, even though only 12 were caught. Their large average size indicates they experience a low rate of mortality. Like the rainbow trout, given the oxygen and clarity conditions, they may tend to be suspended and off shore making them not very vulnerable to the nets.

Black crappie is a species that appears to do very well in lakes with similar bathymetry and water clarity. If it becomes unfeasible to continue rainbow trout stocking, the introduction of black crappie should be considered. They could take advantage of the pelagic habitat and provide an open water and winter fishery. As they are already present in Lake Muskoka, downstream, any impact would be limited to Silver and Gull Lake (where they would also probably do quite well).

In summary, the littoral zone fish community of Silver Lake is currently dominated by smallmouth and rock bass. The abundance of bass and other species that use shallow waters is limited by the relatively narrow, steep, barren nature of much of the near shore area. Largemouth bass are also reported to be present but were not caught in nets. There is limited habitat for this species in the lake. The deeper, offshore water which comprises a large proportion of the lake is dominated by rainbow smelt and, though none were caught, probably stocked rainbow trout. Native cisco, which appear to have always been uncommon, may be extirpated. Silver (and Gull) Lake appears to be an excellent candidate for an introduction of black crappie if rainbow trout stocking becomes unfeasible in the future.

References

DMM, 2013. Silver Lake lake data sheet. http://www.muskokawaterweb.ca/images/lds/SilverGR.pdf. District Municipality of Muskoka,

Sandstrom, S, M. Rawson and N. Lester. 2013. Manual of Instructions for Broad-scale Fish Community Monitoring; using North American (NA1) and Ontario Small Mesh (ON2) Gillnets. Ontario Ministry of Natural Resources. Peterborough, Ontario. Version 2013.2 35 p. +appendices.

Scholten, S. 2014. Fish community assessment of Riley Lake, 2013. File Report. Ontario Ministry of Natural Resources, Bracebridge.

Appendix Individual fish attributes, sorted by species and fork length, Silver Lake, 2013.

Effort	Gear	Species	Fish	Fate	Fork Length (mm)	Total Length (mm)	Round Weight (g)	Sex	Gonad Condition	Age Structure	Assessed Age	Complete Annuli	Edge Code	Age Confidence	Age Method	Age Interpreter
3	2	121	6	D	128											
9	2	121	1	D	165	175	31	2	2	A2	3	3	+	5	A	SM
4	2	121	3	D	169											
8	1	121	2	D	177	190	34	2	2	A2	5	5	+	6	A	SM
10	2	121	2	D	180	197	40	1	2	A2	6	6	+	5	A	SM
9	2	121	2	D	182	196	42	1	2	A2	6	6	+	5	A	SM
10	2	121	3	D	183	195	37	2	2	A2	5	5	++	5	A	SM
4	2	121	2	D	185											
4	2	121	1	D	190											
3	2	121	5	D	191											
8	1	121	1	D	192	206	47	2	2	A2	6	6	+	7	A	SM
10	2	121	1	D	192	207	42	2	9	A2	6	6	++	5	A	SM
6	2	311	10	R	78											
9	2	311	13	D	84											
6	2	311	8	R	86											
9	2	311	12	D	86											
9	2	311	5	D	90											
9	2	311	15	D	94											
9	2	311	8	D	105											
6	2	311	6	R	107											
3	2	311	2	R	111											
6	2	311	4	R	111											
9	2	311	10	D	111											
6	2	311	9	R	114											
9	2	311	6	R	116											
9	2	311	9	D	116											
11	2	311	3	D	118											
9	2	311	14	D	121											
3	2	311	1	R	122											
6	2	311	13	R	124											
9	2	311	4	R	128											
7	1	311	21	R	133											
9	2	311	11	D	135											
6	2	311	7	R	136											
7	1	311	22	R	137											
11	2	311	7	D	137											
6	2	311	5	R	138											
7	1	311	24	R	139											
13	1	311	6	D	139											
9	2	311	3	D	140											
13	1	311	1	D	142											
7	1	311	23	R	144											
9	2	311	7	D	144											
6	2	311	12	R	146											
3	2	311	3	R	151											
13	1	311	3	D	154											
13	1	311	5	D	156											
6	2	311	11	R	160											
6	2	311	3	R	163											
13	1	311	4	D	164											

Effort	Gear	Species	Fish	Fate	Fork Length (mm)	Total Length (mm)	Round Weight (g)	Sex	Gonad Condition	Age Structure	Assessed Age	Complete Annuli	Edge Code	Age Confidence	Age Method	Age Interpreter
7	1	311	20	R	169											
11	2	311	6	D	170											
13	1	311	2	D	193											
11	2	311	5	D	206											
11	2	311	4	D	221											
7	1	316	1	D	147	153	30			27	1	1	++	8	7	SM
9	2	316	17	D	151	159	35	2	10	27	1	2	+	6	2	SM
7	1	316	15	R	158	165	100			27	1	1	++	6	7	SM
7	1	316	18	R	159	168	90			27	1	1	++	8	7	SM
9	2	316	16	D	159	168	45	2	10	27	1	1	++	8	2	SM
7	1	316	3	R	220	230	150			27	2	2	++	7	7	SM
7	1	316	11	R	223	236	180			27	4	4	++	6	7	SM
7	1	316	16	R	229	239	190			27	2	2	++	7	7	SM
7	1	316	17	R	229	239	200			27	2	2	++	8	7	SM
7	1	316	13	R	232	241	200			27	4	4	++	6	7	SM
7	1	316	2	R	233	246	200			27	3	3	+	7	7	SM
7	1	316	10	R	243	256	200			27	4	4	+	6	7	SM
7	1	316	7	R	244	257	210			27	5	5	+	6	7	SM
3	2	316	7	R	250											
7	1	316	12	R	259	275	250			27	3	3	++	6	7	SM
7	1	316	8	R	260	275	250			27	4	4	++	7	7	SM
7	1	316	14	R	261	276	290			27	3	3	++	7	7	SM
7	1	316	4	R	266	280	260			27	3	3	++	6	7	SM
7	1	316	5	R	267	281	280			27	4	4	++	7	7	SM
7	1	316	6	R	277	293	300			27	4	4	++	8	7	SM
7	1	316	9	R	282	298	320			27	5	5	+	6	7	SM
7	1	316	19	D	310	329	490	2	9	A27	7	7	+	7	7	SM
11	2	331	2	D	132											
11	2	331	1	D	138											
6	2	331	1	R	146											
3	2	331	4	R	164											
6	2	331	2	R	171											
13	1	331	7	D	204											
2	1	331	1	R	238											