Fish Community Assessment of Riley Lake
2013

File Report

2014

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Riley Lake is located in Ryde Township, within the Town of Gravenhurst. It is of moderate size (155 ha) and depth (Z_{max}: 14 m, Z_{mean}: 5.6 m, Figure 1) with a high level of shoreline complexity; consisting of several long narrow arms and bays interspersed with several islands. It is mesotrophic, with a total phosphorus concentration of 15.3 ug/l and secchi disk reading of 2.3 m (DMM 2013). The relatively high phosphorus level is probably due to internal loading, as the hypolimnion becomes anoxic in the summer and the low clarity results from dissolved carbon originating from wetlands in the watershed. The lake is accessible from a public boat launch with parking facilities located on Riley Lake Road.

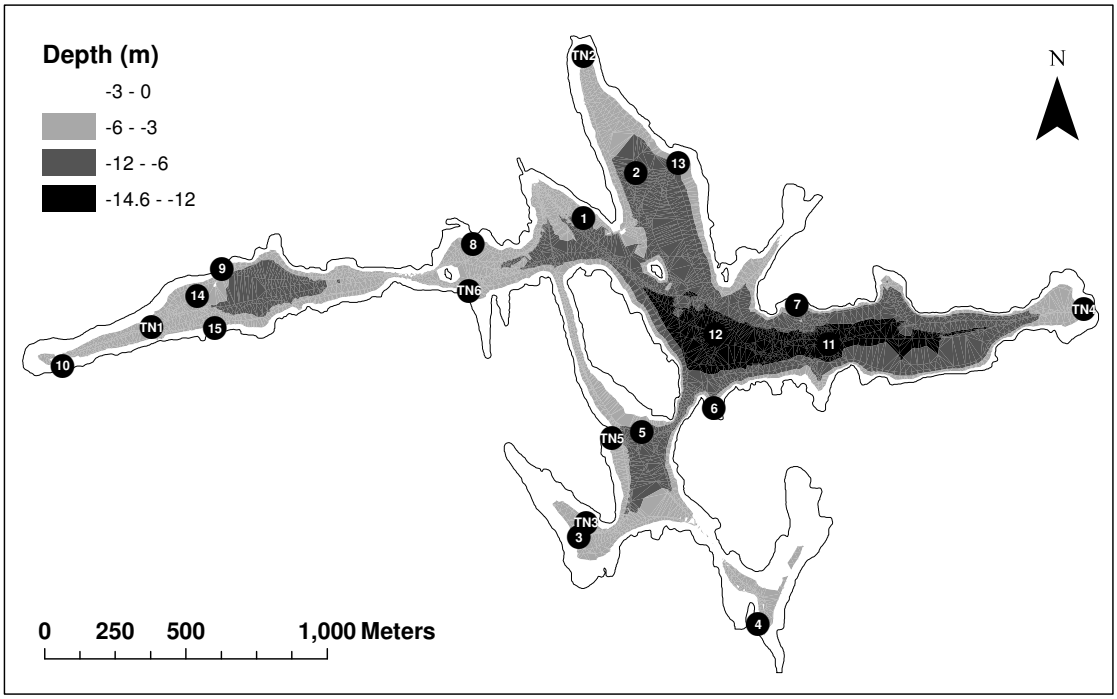


Figure 1 Map of Riley Lake showing bathymetry and net set locations, 2013.

The original fish community of Riley Lake is not well documented. There is an anecdotal report in the lake file from the 1930's that brook trout may have occurred; though it was speculated that they may have emigrated from a tributary stream. If they were present, they have likely been extirpated. Largemouth and smallmouth bass are the dominant sport fish species; both species may be introduced as stocking of 'bass' occurred as early as 1916 and smallmouth bass were stocked regularly between 1933 and 1961. Reliable anecdotal observations of the presence of northern pike and rock bass have been received as well, but the dates of their first occurrence are not known. Black crappies have also become established; presumably through an intentional but unauthorized introduction. A significant winter fishery for them has developed. Walleye were stocked several times in the 1930's, but no self-sustaining population is known to be established.

The only fisheries studies done on the lake are lake surveys in 1959 and 1975 and a collection of fish for contaminant analysis by the Ministry of the Environment in 2012. The 1959 survey documented smallmouth bass, white suckers, yellow perch, 'mudcat' (brown bullhead) and a large number of small cisco (lake herring, 180 caught in one test net). The single net set during the 1975 survey captured suckers, perch, cisco and pumpkinseed. Golden shiners and blacknose shiners were also listed, although the source of the observations is not certain (probably seine nets). Largemouth bass were also listed for the first time (caught in seine net hauls).

A survey was done in 2013 to describe the current composition of the fish community and to collect data intended to be used in a comparative review of fish community and population attributes in similar lakes with and without introduced black crappie.

Methods

Two gear types were used to sample the fish community; gill nets of the configuration used in the Broad-scale Monitoring (BsM) program, to sample the community in a standardized fashion, and trap nets to obtain additional fish samples. The BsM protocol prescribes the number of nets of each gear type to be set based on lake area and depth (Table 1). This survey employed a reduced number of and some atypical sets. The main reason was that a similar survey was done on Silver Lake (Scholten 2014) the previous week. It is a lake with similar physical characteristics and catches were quite low. Based on those results it was expected that catches would be low in Riley Lake as well and that a standard BsM survey would not yield robust sample sizes of individual fish. In lieu of the reduced number of gill nets, we decided to use trap nets to increase sample sizes. The reduced number of BsM net sets may diminish the value of the survey for estimating population abundance but the trade-off of increasing the number of fish sampled with the limited time and staff available was deemed to be worthwhile considering that even a full BsM survey would provide imprecise abundance estimates. In practice, the strata where net sets were reduced the greatest were largely anoxic and few fish were caught in the nets that were set.

Table 1 Stratum areas and target and actual number of net sets, by gear type, Riley Lake, 2013.

			Large Mesh		Small Mesh	
Depth (m)	Area (ha)	Area (%)	Target	Actual	Target	Actual
0-3	39	29	3	3	3	2
3-6	43	32	3	3	3	2
6-12	41	30	3	1	2	2
12-20	13	9	2	2[a]	2	0
Total	137	100	11	9	10	6

[a] nets were hung below 4 and 5 m strings

The BsM gear consisted of large mesh (NA-1) and small mesh (ON-2) gill net gangs (Sandstrom et al., 2013). 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. 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. Nets were set perpendicular to shore where the stratum width permitted.

Two standard ‘six foot’ (1.8 m) trap nets with 150’ (46 m) leads were used. They were set with the lead tied to and perpendicular to shore. The very narrow nature of the littoral zone in many areas of the lake necessitated the setting of some trap nets in deeper than normal water; up to 5.6 m deep.

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.

Results

Sampling occurred from October 7-10, 2013. Bathymetric mapping determined that 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 the 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 2). The thermocline occurred from approximately 5 to 9 m deep. The dissolved oxygen profile displayed a negative heterograde pattern; with oxygen declining quickly to very low levels in the first metre of the thermocline and remaining close to anoxic throughout the hypolimnion.

Table 2 Temperature and dissolved oxygen profile, Riley Lake, October 7, 2013.

Depth (m)	Temp (^{o}C)	D.O. (ppm)
1	16.0	8.0
2	16.0	7.8
3	16.0	7.9
4	15.9	7.7
5	15.7	7.0
6	14.3	3.3
7	13.0	1.0
8	11.3	0.5
9	10.1	0.4
10	9.2	0.4
11	8.2	0.4
12	8.1	0.3
13		
14		

A total of 15 BsM nets were set; nine large mesh and six small mesh (Table 3). The large mesh sets were all comprised of two gang straps, but the small mesh sets were a mix of single and double gangs. Of the large mesh, three were set in the 1-3 m stratum, three in the 3-6 m and one in 6-12 m. Two were set in the 12-20 m stratum but instead of setting them on the bottom, where oxygen was low and no fish would be expected to be present, nets were hung in the water column in an attempt to capture fish that were suspended in or near the thermocline. Of the small mesh nets, two were set in each of the 1-3 m, 3 -6 m and 6-12 m strata.

Table 3 Net set details, Riley 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	Comment
1	643529	4966956	Oct-07	13:50	1	2	3	3.0	6.0	6.0	Oct-08	10:11	
2	643715	4967117	Oct-07	14:00	1	2	6	7.0	7.0	7.5	Oct-08	10:38	
3	643513	4965828	Oct-07	14:15	1	2	3	3.0	4.3	4.6	Oct-08	10:50	
4	644146	4965518	Oct-07	14:20	1	2	1	3.0	2.9	2.7	Oct-08	11:10	set parallel
5	643735	4966199	Oct-07	14:25	2	2	6	7.0	7.0	7.0	Oct-08	11:24	
6	643991	4966282	Oct-07	14:35	2	1	3	4.0	5.0	5.0	Oct-08	11:35	
7	644285	4966649	Oct-07	14:40	2	1	1	2.0	2.0	4.0	Oct-08	11:40	
8	643137	4966863	Oct-08	15:35	1	2	3	4.0	5.0	6.0	Oct-09	10:30	
9	642251	4966777	Oct-08	15:30	1	2	1	3.0	3.5	3.0	Oct-09	10:45	
10	641686	4966434	Oct-08	15:40	1	2	1	1.0	2.0	3.0	Oct-09	10:55	set almost parallel
11	644398	4966510	Oct-08	16:00	1	2	12	13.0	13.0	13.0	Oct-09	10:10	suspended @ 4 m
12	643996	4966546	Oct-09	14:53	1	2	12	14.0	14.0	14.0	Oct-10	10:10	suspended @ 5 m
13	643865	4967149	Oct-09	15:00	2	2	6	6.0	6.0	7.0	Oct-10	10:25	
14	642163	4966680	Oct-09	15:10	2	2	3	5.0	5.5	5.4	Oct-10	10:40	
15	642225	4966566	Oct-09	15:15	2	1	1	1.0	3.0	4.0	Oct-10	10:45	
TN1	642001	4966569	Oct-07	12:50	TN			0.0	4.2	4.6	Oct-08	12:30	
TN2	643530	4967531	Oct-07	13:20	TN			0.0	2.6	3.5	Oct-08	14:00	
TN3	643539	4965876	Oct-08	13:50	TN			0.0	4.2	4.6	Oct-09	11:38	
TN4	645300	4966634	Oct-08	15:10	TN			0.0	3.0	4.0	Oct-09	13:20	
TN5	643630	4966178	Oct-09	13:00	TN			0.0	3.5	5.0	Oct-10	11:00	
TN6	643125	4966699	Oct-09	14:25	TN			0.0	5.0	5.6	Oct-10	12:10	

Six trap net sets were completed; two each day. Depth of set ranged from 3.5 to 5.6 m at the gap between the lead and the head of the net.

A total of 178 fish of 10 species were caught (Table 4). The large mesh nets caught small numbers of most of the species detected with no species dominating the catch. Black crappie was the only species not caught. Most of the large mesh catch came from sets in the 3-6 m stratum. No fish were caught in the suspended nets.

The small mesh nets also caught few fish with the largest proportion being yellow perch, rock bass and black crappie, though numbers were still small. Pumpkinseed and northern pike were the only other species caught in the small mesh nets. Unlike the large mesh, several fish were caught in the 6-12 m stratum, although much of the net was right on the 6 m contour so that the net largely fished between 4 and 6 m deep.

The trap net catch was more substantial and, proportionally, had a different composition than the gill net catches. Smallmouth bass, pumpkinseed were most commonly caught.

Smallmouth bass were the dominant large-bodied species in the catch overall. A total of 45 were caught, of which 41 were caught in the trap nets. They ranged in size from 174 to 475 mm FL (Table 5) and age from 1 to 14 years old (Figure 2, Appendix). A wide and well distributed range of sizes and ages were present in the population (Table 6). Smallmouth bass reached at length of about 30 cm at age 4 (five growing seasons complete at time of sampling in the fall) and 40 cm at age 8. The ultimate growth trajectory was such that few bass would reach lengths of 50 cm (~20 inches).

Table 4 Catch summary, Riley Lake, 2013.

Gear	Effort	Stratum	northern pike	white sucker	brown bullhead	rock bass	pumpkinseed	smallmouth bass	largemouth bass	black crappie	yellow perch	walleye
Large	4	1-3			1			2				
Mesh	9	1-3										
	10	1-3										
	1	3-6		1			2	1				1
	3	3-6	1				1		1		1	
	8	3-6		1		1		1				
	2	6-12										
	11	>12										
	12	>12										
Large Mesh Total			1	2	1	1	3	4	1		1	1
Small	7	1-3	1			3	1			1	1	
Mesh	15	1-3										
	6	3-6				1						
	14	3-6									5	
	5	6-12								1		
	13	6-12								2	1	
Small Mesh Total			1			4	1			4	7	
Trap	TN1				2	3	4	11	1	1		5
Net	TN2					1	2	6	1			5
	TN3				3	5	5	11	2	1		
	TN4				10	7		6	4	1		
	TN5		1			3	32	5				
	TN6			1	1	1	2	2		1		
Trap Net Total			1	1	16	20	45	41	8	4		10
Grand Total			3	3	17	25	49	45	9	8	8	11

Only nine largemouth bass were caught, of which one was in a large mesh gill net and eight in trap nets. They ranged in size from 183 to 429 mm FL and age from 1 to 9 years old. The size and age distribution was more limited than it was for smallmouth bass due to the small sample size. Size-at-age was virtually the same as it was for smallmouth bass.

A total of 11 walleye were caught; 10 in trap nets and one in a large mesh net. They were of two distinct size and age modes. Three fish were smaller, in the 300-350 mm size classes and 1 to 3 years old. The others were much larger, in the 500-575 mm size classes and 4 to 8 years old.

Three northern pike were caught, one in each gear type. They ranged from 415 to 534 mm long and 1 to 3 years old.

Despite efforts to catch them in suspended nets, only 8 black crappie were caught; 4 in trap nets and four in small mesh nets. The largest was 321 mm long and 9 years old. The remainder were 0 to 3 years old and 72 to 250 mm FL long.

A final noteworthy catch was 49 pumpkinseeds, of which all but four were caught in trap nets. The unusual attribute was the large size, with many fish being in the 175 to 224 mm FL size classes.

Table 5 Descriptive statistics, by size (fork length) and species, all gear types combined, Riley Lake, 2013.

	northern pike	white sucker	brown bullhead	rock bass	pumpkinseed	smallmouth bass	largemouth bass	black crappie	yellow perch	walleye
n	3	3	17	25	49	45	9	6	8	11
Min.	415	168	164	94	82	174	183	72	74	315
Max.	534	370	355	225	236	475	429	321	152	575
Mean	458.0	281.0	282.6	169.0	186.5	328.2	324.6	177.3	91.9	480.8
S.D.	66.0	103.1	51.8	37.2	32.9	90.6	79.3	100.2	26.6	101.3

Table 6 Fork length frequency distribution, by species, all gear types combined, Riley Lake, 2013.

Fork Length (mm)	northern pike	white sucker	brown bullhead	rock bass	pumpkinseed	smallmouth bass	largemouth bass	black crappie	yellow perch	walleye
<50										
50-74								2	1	
75-99				2	1				5	
100-124				1	1				1	
125-149				4	6			1		
150-174		1	1	7	9	2			1	
175-199			1	5	12	2	1			
200-224			1	5	17	5		1		
225-249				1	3	2	1			
250-274			3			3		1		
275-299			3			3				
300-324		1	5			4	2	1		2
325-349			2			3	1			1
350-374		1	1			5	2			
375-399						2				
400-424	1					7	1			
425-449	1					4	1			
450-474						2				
475-499						1				
500-524										3
525-549	1									2
550-575										3

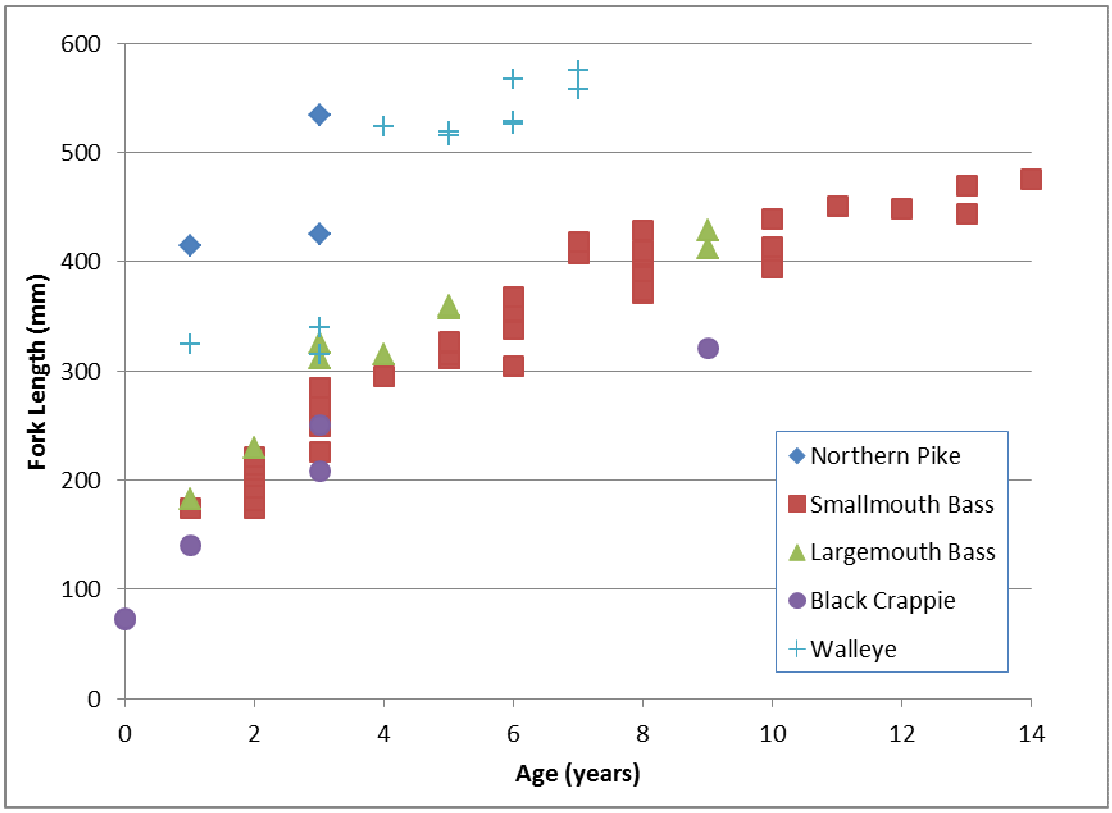


Figure 2 Scatter plots of size-at-age (fork length), by species, Riley Lake, 2013.

Discussion

The initial intention was to conduct the survey in the summer months; however after an initial visit in July it was decided to delay the survey until after the busy cottaging season. The narrow nature of many of the bays and high density of shoreline development and boat traffic would have been likely to result in conflicts with the netting. This change in timing may have affected catches as, by the fall, the lack of oxygen in the hypolimnion and extremely narrow thermocline may have reduced the catchability of some species, as discussed below.

The BsM nets, were not effective at capturing enough fish to be confident of their indication of fish abundance and sample sizes were too small to interpret population characteristics. Even if the number of net sets had complied with the standard BsM protocol, the number of fish caught would have been small as the sets were reduced in the deeper strata where few fish of most species were expected to be due to low oxygen levels. Many more nets sets would have been required to obtain reasonable sample sizes.

The trap nets were more effective at capturing larger numbers of fish; however, due to the bathymetry of the lake could only be set in limited, non-random locations. Therefore, the catch rate observed may not be an accurate reflection of the lake wide abundance of some species. For both gear types, the bathymetry provided challenges for sampling the fish community in a robust and representative fashion.

More importantly, the bathymetry influences that actual composition of the fish community. The steep shoreline results in a narrow littoral zone but wide off shore zone. This provides limited habitat for some species, especially those dependent on aquatic vegetation, such as northern pike and largemouth bass. Even though black crappie do use vegetation, especially when small,

they become pelagic and can use the offshore waters and the planktonic food available there, more than most other species. Riley Lake is relatively nutrient rich for a lake on the Canadian Shield, and probably has correspondingly abundant populations of zooplankton and aquatic insects, which we believe accounts largely for the success of black crappie in this and similar lakes.

The suspended gill net sets did not capture any fish. As we had no experience in attempting this type of set, we can't conclude whether there were few fish to be caught or whether or method of setting the net was not effective. The primary target species for the suspended sets were black crappie and cisco, which do often suspend. Marks assumed to be fish were observed on the echo sounder so it appears that the suspended nets did not fish effectively or fish abundance was just too low for them to encounter the nets. The gibbose shape of crappie results in a relatively low catchabiltiy in gill nets, though the trap net sets didn't catch many crappie either. If a larger sample size of crappie is desired, trap nets set in spring concentration or spawning areas may be more effective.

No cisco were caught, despite being captured in large numbers in both the 1959 and 1975 surveys. It is possible that they are still present, but were simply not caught; their probability of capture in a small number of nets may be very low due to their schooling nature and the extremely narrow range of suitable temperature and oxygen in the thermocline where they would likely be confined at the time of sampling. We hypothesize that crappie may impact cisco by preying on their pelagic young. The absence of cisco in the catch lends support to the idea; however, we have observed apparent declines or absence of cisco in other lakes in the area (eg. Wood, Silver), despite the absence of crappie (Ivany and Scholten 2008, Scholten 2014). Early summer sampling before the hypolimnion becomes anoxic and while cisco may be more broadly distributed may be more effective at verifying the presence of this species.

The walleye caught were the first documentation, other than historic stocking records, of this species in the lake. Their origin is unknown. It seems unlikely that a population could have been present for an extended period without knowledge of it coming to our attention. More likely they were introduced within the last few years without authorization. The bimodal population structure suggests an initial stocking event or events several years ago that now comprise the older, larger fish in the population, followed by some natural reproduction when they became mature. The lake provides some habitat for sub-adult and adult walleye, due to the high level of shoreline variability, though the width of the littoral area where walleye would normally live is narrow in most areas. The low water clarity would provide walleye a competitive advantage. Lacking is any suitable spawning habitat in the lake. Some spawning habitat may exist in the two larger tributary streams, though they have small watersheds and may not sustain reasonable flows through the spawning and incubation period. Black crappie have been implicated in having impacts on walleye through competition and particularly, depredation on their pelagic young (Kerr and Grant 2000), although the number of studies that examine this relationship is limited. Overall, we speculate that walleye may persist in the lake at fairly low densities. Creation or augmentation of spawning habitat may help the population. As the dissolved organic carbon content of the water is high, it is likely that walleye would accumulate high levels of mercury; an issue that the more planktivorous crappie does not normally experience. Given the apparent popularity of the crappie fishery, it doesn't appear that efforts to enhance walleye are warranted.

Smallmouth bass is currently the dominant littoral zone predator in the lake. It is difficult to assign an abundance rating with confidence due to the sampling limitations discussed earlier. Catch rates of smallmouth bass from lakes sampled by the Broad-scale Monitoring program were typically in the range of 0.5 to 1 fish per net (whole lake, area-weighted CUE, unpublished provisional BsM data for FMZ 15). The lake wide catch rate in this survey wasn't calculated as the full survey wasn't completed, but the catch rate would be well below 0.5; therefore bass abundance could be classified as below average. However, the size and age distribution are indicative of a healthy population that experiences a sustainable, if not low, level of exploitation. The maximum observed age (14 years) approaches the maximum sampled in the FMZ 15 BsM

program (16 years) and the size at age (~30 cm at age 4 and 40 cm at age 8) are about average for FMZ 15 (unpublished provisional FMZ 15 BsM data).

The catches of northern pike and largemouth bass were low in all gears. Habitat in the form of extensive shallow, vegetated areas are quite limited, so overall the low catch is to be expected, but in suitable habitat they may be locally common and, occasional very large individuals probably occur.

In summary, Riley Lake supports a diverse fish community that includes several introduced species. Smallmouth bass was the most common littoral zone in catches. The abundance appears to be below average due to the natural characteristics of the lake basin, but the population structure is healthy. Walleye were detected for the first time. It is speculated that they were illegally stocked several years ago and that some reproduction has occurred. Habitat for larger fish appears to be fair but spawning habitat is lacking and competition and depredation by other species, particularly crappie may limit survival of small fish. Cisco were not caught, despite being common in past assessments. We speculate that black crappie may impact this species as well, though it is noted that cisco populations have apparently declined in other local lakes that do not have crappie.

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Appendix Size at age (fork length), by species, all gear types combined, Riley Lake, 2013.

Species	Age	n	Mean	S.D.
Northern	1	1	415.0	
Pike	3	2	480.0	77.1
Smallmouth	1	1	174.0	
Bass	2	8	200.6	16.5
	3	7	261.7	20.7
	4	1	295.0	
	5	5	317.8	7.7
	6	5	343.8	24.7
	7	2	413.0	7.1
	8	7	397.9	20.7
	10	4	414.3	18.3
	11	1	451.0	
	12	1	449.0	
	13	2	457.0	18.4
	14	1	475.0	
Largemouth	1	1	183.0	
Bass	2	1	229.0	
	3	2	318.0	9.9
	4	1	315.0	
	5	2	358.5	2.1
	9	2	420.5	12.0
Black	0	2	72.5	0.7
Crappie	1	1	140.0	
	3	2	229.0	29.7
	9	1	321.0	
Walleye	1	1	324.0	
	3	2	327.5	17.7
	4	1	523.0	
	5	2	517.0	2.8
	6	3	540.3	23.1
	7	2	566.0	12.7

Appendix Individual fish attributes for species that were detail sampled, sorted by species, gear and fork length, Riley Lake, 2013.

Species	Gear	Effort	Fish	Fate	Fork Length (mm)	Total Length (mm)	Round Weight (g)	Sex	Gonad Condition	Age Structure	Age	Complete Annuli	Edge Code	Age Confidence	Age Method	Age Interpreter
131	1	3	4	R	415	439	490	9	9	24	1	1	++	6	2	SM
131	2	7	7	R	425	454	575	9	9	24	3	3	++	6	2	SM
131	TN	TN5	1	R	534	557	1000	9	9	24	3	3	+	7	2	SM
316	1	1	4	D	214	224	185	2	10	2A	2	2	++	8	A34	SM
316	1	8	3	R	226	238	225	9	9	27	3	3	++	6	7	SM
316	1	4	2	R	285	303	375	9	9	27	3	3	+	7	7	SM
316	1	4	3	R	311	334	500	9	9	27	5	5	++	7	7	SM
316	TN	TN1	8	R	174	184	100	9	9	27	2	2	++	8	2	SM
316	TN	TN1	16	R	174	182	90	9	9	27	1	1	++	8	2	SM
316	TN	TN1	11	R	181	190	125	9	9	27	2	2	++	8	7	SM
316	TN	TN1	15	R	193	204	140	9	9	27	2	2	++	8	2	SM
316	TN	TN1	9	R	204	215	175	9	9	27	2	2	++	8	2	SM
316	TN	TN1	17	R	209	220	175	9	9	27	2	2	++	8	7	SM
316	TN	TN5	3	R	209	220	150	9	9	27	2	2	++	8	7	SM
316	TN	TN1	14	R	221	234	225	9	9	27	2	2	++	8	7	SM
316	TN	TN1	10	R	249	263	325	9	9	27	3	3	++	8	2	SM
316	TN	TN1	6	R	257	275	280	9	9	27	3	3	++	8	7	SM
316	TN	TN1	12	R	263	279	300	9	9	27	3	3	++	8	7	SM
316	TN	TN3	10	R	267	281	300	9	9	27	3	3	++	7	7	SM
316	TN	TN6	1	R	285	298	325	9	9	27	3	3	++	7	7	SM
316	TN	TN1	7	R	295	311	400	9	9	27	4	4	++	8	7	SM
316	TN	TN3	7	R	304	320	450	9	9	27	6	6	++	6	7	SM
316	TN	TN3	3	R	311	329	500	9	9	27	5	5	+	7	7	SM
316	TN	TN3	9	R	315	334	500	9	9	27	5	5	+	8	7	SM
316	TN	TN3	1	R	325	341	600	9	9	27	5	5	+	8	7	SM
316	TN	TN3	6	R	327	342	550	9	9	27	5	5	+	6	7	SM
316	TN	TN3	5	R	338	357	600	9	9	27	6	6	+	5	7	SM
316	TN	TN3	12	R	354	375	800	9	9	27	6	6	++	7	7	SM
316	TN	TN3	4	R	355	384	700	9	9	27	6	6	+	8	7	SM
316	TN	TN4	1	R	368	390	775	9	9	27	6	6	++	7	7	SM
316	TN	TN3	8	R	371	393	825	9	9	27	8	8	++	6	7	SM
316	TN	TN4	4	R	374	394	900	9	9	27	8	8	++	6	7	SM
316	TN	TN5	6	R	391	411	900	9	9	27	8	8	+	6	7	SM
316	TN	TN4	6	R	395	414	1100	9	9	27	10	10	++	5	7	SM
316	TN	TN2	3	R	404	435	1100	9	9	27	8	8	+	7	7	SM
316	TN	TN2	11	R	406	433	1200	9	9	27	8	8	+	7	7	SM
316	TN	TN4	10	R	408	433	1000	9	9	27	7	7	+	6	7	SM
316	TN	TN2	1	R	410	436	1000	9	9	27	10	10	+	7	7	SM
316	TN	TN4	7	R	410	435	1100	9	9	27	8	8	+	5	7	SM
316	TN	TN4	5	R	413	434	1100	9	9	27	10	10	++	5	7	SM
316	TN	TN6	2	R	418	444	1150	9	9	27	7	7	+	6	7	SM
316	TN	TN5	5	R	429	448	1300	9	9	27	8	8	+	7	7	SM
316	TN	TN3	14	R	439	456	1400	9	9	27	10	10	++	5	7	SM
316	TN	TN5	4	R	444	472	1500	9	9	27	13	13	++	5	7	SM
316	TN	TN2	2	R	449	473	1550	9	9	27	12	12	++	7	7	SM
316	TN	TN5	2	R	451	474	1500	9	9	27	11	11	+	6	7	SM
316	TN	TN2	9	R	470	495	1600	9	9	27	13	13	+	6	7	SM
316	TN	TN2	10	R	475	505	2100	9	9	27	14	14	+	5	7	SM
317	1	3	3	D	183	189	105	1	10	2A	1	1	++	8	A	SM
317	TN	TN1	13	R	229	237	250	9	9	27	2	2	++	6	7	SM
317	TN	TN4	11	R	311	323	550	9	9	27	3	3	++	6	7	SM
317	TN	TN3	13	R	315	328	600	9	9	27	4	4	++	7	7	SM
317	TN	TN3	2	R	325	336	600	9	9	27	3	3	++	7	7	SM
317	TN	TN2	4	R	357	370	900	9	9	27	5	5	++	5	7	SM

Species	Gear	Effort	Fish	Fate	Fork Length (mm)	Total Length (mm)	Round Weight (g)	Sex	Gonad Condition	Age Structure	Age	Complete Annuli	Edge Code	Age Confidence	Age Method	Age Interpreter
317	TN	TN4	2	R	360	371	800	9	9	27	5	5	++	6	7	SM
317	TN	TN4	8	R	412	432	1400	9	9	27	9	9	+	5	7	SM
317	TN	TN4	9	R	429	443	1600	9	9	27	9	9	++	5	7	SM
319	2	5	1	R	72						0				FL	SS
319	2	7	6	D	73						0				FL	SS
319	TN	TN1	18	R	140	146	50	9	9	27	1	1	++	8	2	SM
319	TN	TN6	3	R	208	216	200	9	9	27	3	3	++	6	2	SM
319	TN	TN3	11	R	250	264	300	9	9	27	3	3	++	8	2	SM
319	TN	TN4	3	R	321	331	650	9	9	27	9	9	++	5	2	SM
334	1	1	5	R	515	545	1550	9	9	27	5	5	++	6	7	SM
334	TN	TN1	3	R	315	333	350	9	9	27	3	3	++	5	7	SM
334	TN	TN1	5	R	324	341	375	9	9	27	1	1	++	6	7	SM
334	TN	TN1	4	R	340	359	400	9	9	27	3	3	++	5	7	SM
334	TN	TN1	2	R	519	540	1500	9	9	27	5	5	++	7	7	SM
334	TN	TN2	8	R	523	555	1550	9	9	27	4	4	++	3	7	SM
334	TN	TN1	1	R	526	551	1750	9	9	27	6	6	++	5	7	SM
334	TN	TN2	7	R	528	554	1400	9	9	27	6	6	++	6	7	SM
334	TN	TN2	6	R	557	587	2000	9	9	27	7	7	++	6	7	SM
334	TN	TN2	5	R	567	595	2300	9	9	27	6	6	++	7	7	SM
334	TN	TN2	12	R	575	605	2400	9	9	27	7	7	++	5	7	SM

Appendix Individual fish attributes for species that were measured for length only, Riley Lake, 2013.

Species	Gear	Effort	Fish	Fate	Fork Length (mm)
163	1	1	1	D	168
163	1	8	1	R	370
163	TN	TN6	7	R	305
233	1	4	1	R	269
233	TN	TN6	8	R	164
233	TN	TN1	26	R	195
233	TN	TN1	27	R	224
233	TN	TN4	24	R	250
233	TN	TN3	27	R	259
233	TN	TN4	25	R	275
233	TN	TN4	27	R	286
233	TN	TN3	17	R	291
233	TN	TN4	20	R	305
233	TN	TN4	21	R	305
233	TN	TN4	26	R	316
233	TN	TN4	23	R	320
233	TN	TN4	19	R	322
233	TN	TN4	28	R	330
233	TN	TN4	22	R	339
233	TN	TN3	15	R	355
311	1	8	2	R	173
311	2	7	1	R	94
311	2	6	1	R	99
311	2	7	2	R	105
311	2	7	5	R	128
311	TN	TN6	6	R	140
311	TN	TN4	18	R	143
311	TN	TN3	20	R	149
311	TN	TN1	24	R	150
311	TN	TN4	17	R	150
311	TN	TN1	23	R	160
311	TN	TN3	26	R	168
311	TN	TN5	41	R	170
311	TN	TN2	13	R	174
311	TN	TN4	15	R	180
311	TN	TN3	25	R	182
311	TN	TN4	16	R	190
311	TN	TN4	14	R	192
311	TN	TN3	19	R	194
311	TN	TN5	40	R	207
311	TN	TN1	25	R	210
311	TN	TN4	13	R	210
311	TN	TN3	24	R	215
311	TN	TN5	39	R	216
311	TN	TN4	12	R	225

Species	Gear	Effort	Fish	Fate	Fork Length (mm)
313	1	1	3	R	160
313	1	1	2	R	174
313	1	3	1	R	181
313	2	7	3	D	82
313	TN	TN1	21	R	122
313	TN	TN1	22	R	128
313	TN	TN3	18	R	135
313	TN	TN5	31	R	144
313	TN	TN5	34	R	144
313	TN	TN1	20	R	146
313	TN	TN5	38	R	149
313	TN	TN5	33	R	154
313	TN	TN5	12	R	159
313	TN	TN5	19	R	162
313	TN	TN5	24	R	166
313	TN	TN5	16	R	171
313	TN	TN5	29	R	171
313	TN	TN5	36	R	173
313	TN	TN5	27	R	180
313	TN	TN1	19	R	186
313	TN	TN5	20	R	186
313	TN	TN5	14	R	187
313	TN	TN5	18	R	191
313	TN	TN5	25	R	191
313	TN	TN5	28	R	191
313	TN	TN5	13	R	195
313	TN	TN5	7	R	196
313	TN	TN5	32	R	196
313	TN	TN6	4	R	197
313	TN	TN5	30	R	200
313	TN	TN3	16	R	205
313	TN	TN5	22	R	206
313	TN	TN5	23	R	206
313	TN	TN6	5	R	208
313	TN	TN3	21	R	210
313	TN	TN5	8	R	210
313	TN	TN5	21	R	213
313	TN	TN5	26	R	213
313	TN	TN5	15	R	214
313	TN	TN5	37	R	214
313	TN	TN5	17	R	217
313	TN	TN5	35	R	218
313	TN	TN5	11	R	220
313	TN	TN5	9	R	221
313	TN	TN5	10	R	221
313	TN	TN3	23	R	224
313	TN	TN2	14	R	231
313	TN	TN2	15	R	234
313	TN	TN3	22	R	236
331	1	3	2	D	152
331	2	14	4	R	74
331	2	14	3	R	76
331	2	14	5	R	77
331	2	14	1	R	79
331	2	14	2	R	82
331	2	7	4	R	87
331	2	13	1	R	108