Summary of Wabikon–Riley Spring Fyke Net Survey 2012-13

Waterbody Identification Code:
Wabikon 0556900
Riley 0557100

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April, 2014

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Lake and location:

Wabikon Lake, Forest County	T.36N. R.14E. Sections 29-32
Riley Lake, Forest County	T.35N. R14E. Sections 5-8

Located in south central Forest County, between the cities of Laona and Crandon, along highway 8. Wabikon and Riley Lakes are part of the Rat River watershed and drain to the Peshtigo River.

Physical Attributes:

Morphometry:	Wabikon:	594 acres, max depth 13 ft., and 70% $\leq$ 3 ft.
	Riley:	213 acres, maximum depth of 11-12 ft.
Lake type:	Drainage (two inlets, outlet to the Rat River)	
Water clarity:	Generally clear, can change quickly with soft substrate.	
Aquatic vegetation:	Wabikon: Emergent- Abundant Submergent: Moderate	
	Riley: Emergent- Abundant Submergent: Abundant	
Shoreline character:	Approximately 35% upland, 65% wetland	
Shoreline development:	Only one resort on the north end of the lake	
Winterkill:	Seemingly not a problem.	
Boat landing:	One public boat landing	
Littoral Substrate:	Wabikon:	95% very soft, low density silt/muck
		5% sand/rock
	Riley:	75% muck
		20% sand
		5% rock

Purpose of Survey: Muskellunge population assessment.

Dates of fieldwork:

Muskellunge Fyke Netting 2012:	4/1-4/25/2012
Muskellunge Fyke Netting 2013:	5/10-5/17/2013

ACKNOWLEDGEMENTS

Aaron Nelson, Brad Shucha, John Aschenbrenner, Jeff Aromi, Bill Gerndt, Joey Clark, Bill Tuck, Greg Cisar, Jason Mollen, Chad Forrest and Cody Forrest assisted in the field. Aaron Nelson and Brad Shucha assigned panfish age from scales, spines and rays.

I. EXECUTIVE SUMMARY

Wabikon and Riley Lakes were surveyed during 2012 and 2013 with fyke nets starting approximately 2 weeks after ice-out to assess the status of the muskellunge population. While the purpose of the survey was to assess the muskellunge population data was also gathered to assess the spring spawning panfish populations in both lakes.

Muskellunge are abundant in both of these lakes. Size structure of the muskellunge populations is surprisingly good, considering the high abundance.

Yellow perch are very abundant in Wabikon Lake and abundant in Riley Lake. In both lakes yellow perch grow at rates faster than the average for Northern Wisconsin. Yellow perch size structure is better than most lakes in this region, but could be improved upon with decreased angler harvest.

Black crappie are very abundant in Riley Lake and moderately abundant in Wabikon Lake. Unlike yellow perch, black crappies grow at a slower rate than the Northern Wisconsin average. Size structure of black crappie in both lakes is quite poor, with the biggest factor limiting size structure being poor growth rates.

II. RESULTS AND DISCUSSION

Wabikon Lake

Muskellunge

Abundance

Muskellunge abundance was assessed over a two year period on Wabikon Lake. Thirty-nine muskellunge were captured during the first year of the survey and another forty-three fish were captured during 2013 for a total of eighty-two muskellunge sampled. While the number of fish captured was very similar, the amount of effort dedicated to capturing muskellunge was much less during 2013, showing highly variable relative abundance of muskellunge in Wabikon Lake (Table 1). The drastic change in relative abundance from one year to the next is not because of a changing fishery, but the unique layout of Wabikon Lake which can make it very challenging to sample muskellunge consistently with standard gear.

Table 1. Relative abundance, indexed using catch per net-night, of muskellunge in Wabikon Lake, Forest County, 2012-2013.

	2012	2013
Wabikon	0.33	1.72

The best way to assess abundance in a “non-typical” system like Wabikon Lake is to conduct a population estimate. In order to do this fish must be tagged or marked the first year of sampling so that those fish can be identified the following year, using the ratio of

"new fish" to "previously captured fish" to estimate of the total population present. This was the process used during this survey.

During 2012, a total of 37 different muskellunge, larger than 20 inches in total length, were captured and marked with an identifiable fin clip during the spring of 2012 (Figure 1). Nets were set again in 2013; during this survey a total of 44 different muskellunge over 20 inches in length were captured, 15 of which were recaptured fish from 2012 (Figure 2). After analyzing the data I estimate there to be approximately 95 muskellunge larger than 20.0 inches (0.16 fish/acre). Approximately 66 of the 95 muskellunge estimated to be present in Wabikon Lake are over 30.0 inches in length and considered to be adults (0.11 fish/acre).

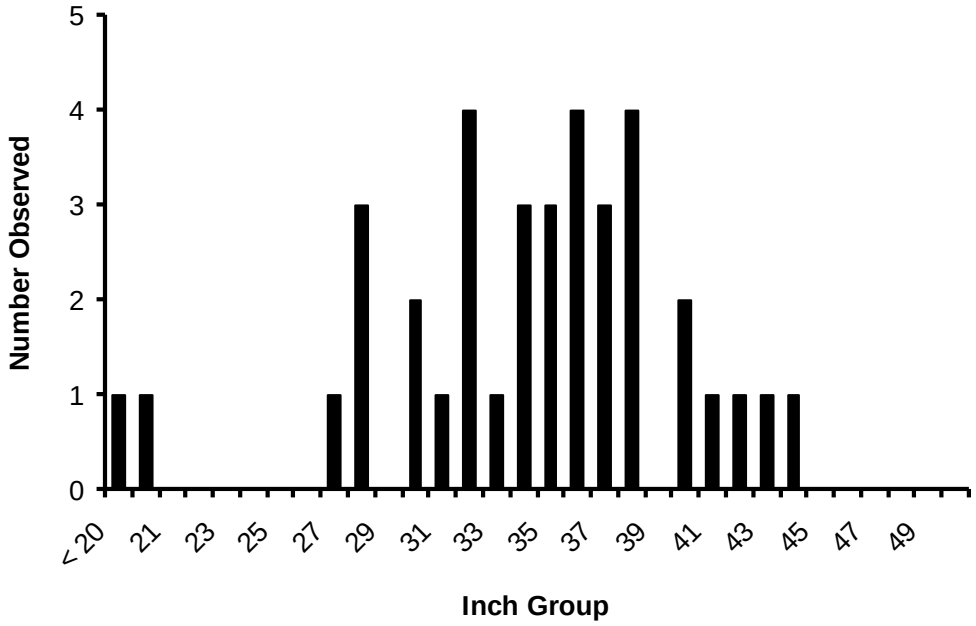


Figure 1. Length frequency of muskellunge captured during a spring fyke net survey of Wabikon Lake, Forest County, 2012 (N=37).

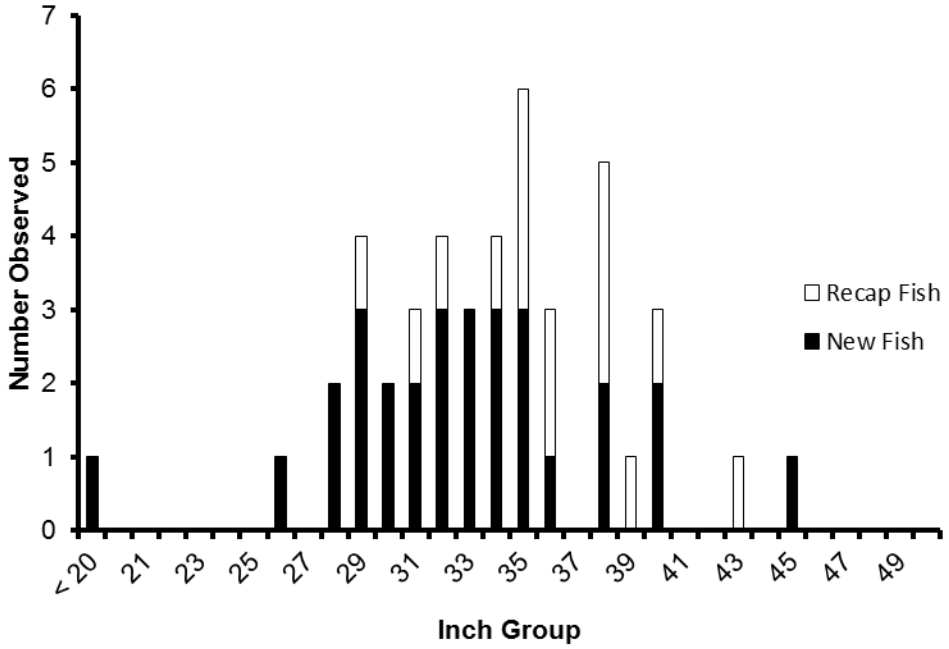


Figure 2. Length frequency of muskellunge captured during a spring fyke net survey of Wabikon Lake, Forest County, 2013 (New Fish: N=29, Recaptured Fish: N=15).

The 2012 adult musky population, estimated to be approximately one adult fish per nine surface acres of water, would typically be considered a low density musky population. However, Wabikon Lake is not typical. While Wabikon Lake has a considerable amount of surface area (594 acres), the lake lacks depth, with the majority of the lake being less than two feet deep and an average depth likely below three feet. The unique layout of this lake allows for very little water volume (which I estimate to be $\leq$ 1,500 acre-feet). This is a very similar volume of water found in most of the 75-125 acre lakes in our area. So while the density of fish per acre is considered low at 0.11 adults/acre, the density of fish per acre-foot is very high. In general I would compare the musky population in Wabikon Lake to be very similar to other, more typical, lakes that have adult densities near 1 adult/acre, which is a very high density of muskellunge.

Size Structure

Every muskellunge captured during the two year survey was measured to assess size structure (Figure 3). During the 2012 spring survey a total of 37 different muskies were captured ranging from 18.4 to 44.6 inches in length with an average length of 34.6 inches (Table 2). In 2013, a total of 44 different muskies were captured during a musky recapture survey ranging from 12.2 to 45.0 inches in length, with an average length of 34.1 inches.

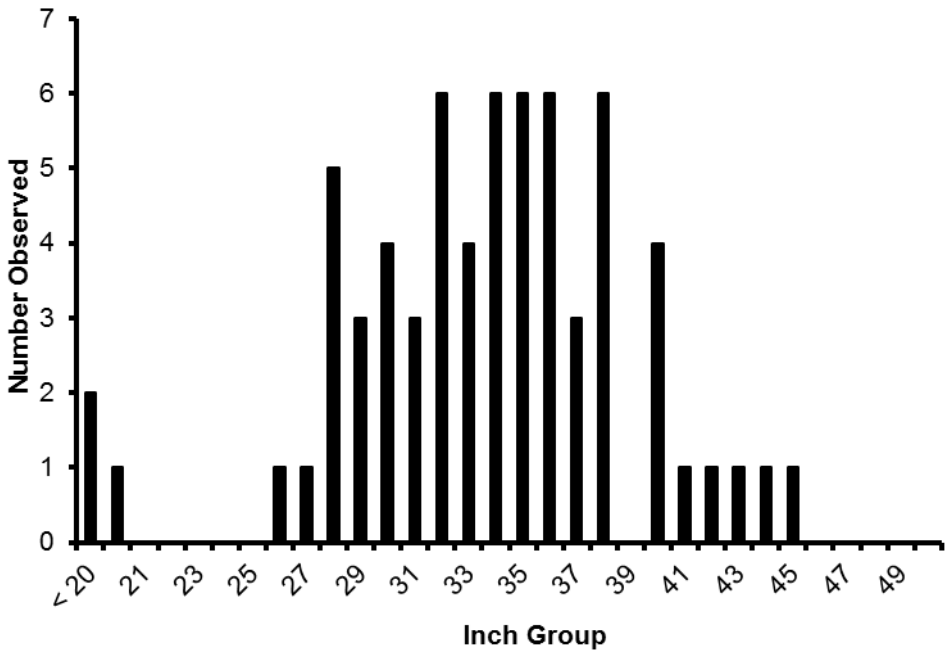


Figure 3. Length frequency of muskellunge captured during a spring fyke net survey of Wabikon Lake, Forest County, 2012-13 (N=66).

Table 2. Mean and median length of muskellunge sampled during spring fyke net surveys of Wabikon Lake, Forest County, 2012 & 2013 (2012: N=37, 2013: N=44).

	Male		Female		Unknown		All Fish	
Survey Year	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**
Mean Length	33.1	33.0	38.5	37.8	31.8	31.4	34.6	34.1
Median Length	32.6	33.9	38.2	38.6	33.3	31.9	35.4	34.6

Very similar average and maximum size for muskellunge was expected, since this population is a fully developed stocked fishery that has been managed for muskellunge since 1937. Since the lake has no known reproduction of muskellunge (aside from a small amount of hybridization between muskellunge and northern pike) the input into this population is quite regular. The Wabikon Lake muskellunge population does not have the extreme differences in reproduction from year to year that naturally reproducing populations of muskellunge have (with some large and some missing year classes of fish). Consistent stocking allows for a quite consistent musky population.

Our current stocking strategy has been in place since 1996 for Wabikon Lake. Muskellunge are stocked every other year, in order to limit intraspecific competition between neighboring year classes of fish. This every-other-year stocking practice is likely what is responsible for the slight decline in average length from 2012 to 2013. Muskies are stocked during the fall of even numbered years, so when we surveyed during 2012 the youngest year classes of fish were 2, 4, 6, 8, 10 … years of age; during 2013 the youngest year classes would have been 1, 3, 5, 7, 9 … this allows for a slightly reduced age structure during odd years, and is likely the reason for the 0.5 inch decrease in average size.

Relative stock density (RSD) was used to index size structure. Currently the size structure of the muskellunge population appears to be very stable from year to year with approximately 85% and nearly 27% of fish captured being ≥ 30 and 38 inches respectively (Table 3). Since the RSD30 and 38 values are so similar; I recommend using these two values as an index of the Wabikon Lake muskellunge population. Meaning that if we see a large variation in RSD30 or 38 during future surveys action could be taken to alter the population. For instance, if during a future survey we see an average RSD30 value of 50, then there is a larger portion of the population less than 30 inches, which probably means the survival of stocked fish has increased, at this point we could reduce the number of fish stocked every other year to bring the population back to more of a regular level. Conversely if we saw a very high RSD 38 value, one could assume that survival of stocked fish has decreased and some sort of management activity should be conducted to improve muskellunge survival.

Table 3. Size structure, indexed using relative stock density, for muskellunge sampled from Wabikon Lake, Forest County during spring 2012 & 2013 (2012: N=36, 2013: N=43, Entire: N=66).

	2012	2013	Entire Survey
RSD30	86.11	83.72	82.81
RSD38	27.78	25.58	23.44
RSD42	8.33	4.65	6.25
RSD45	0.00	2.33	1.56
RSD48	0.00	0.00	0.00

Body Condition

Weight measurements were taken from nearly every muskellunge captured in 2012. Body condition was then indexed using relative weight (W_r) for all known sex muskellunge. Body condition of male muskellunge showed a strong trend of increased body condition as length increased (P=0.058). Female body condition showed a very weak trend of increasing with body length. However, this was because of a single fish that had impressive body condition, if you omit this single fish body condition was very steady across all sizes of females. W_r of male muskellunge ranged from 64.5 to 88.8 with an average of 73.5, while females ranged from 73.0 to 97.7 with an average of 76.0 (Figure 4).

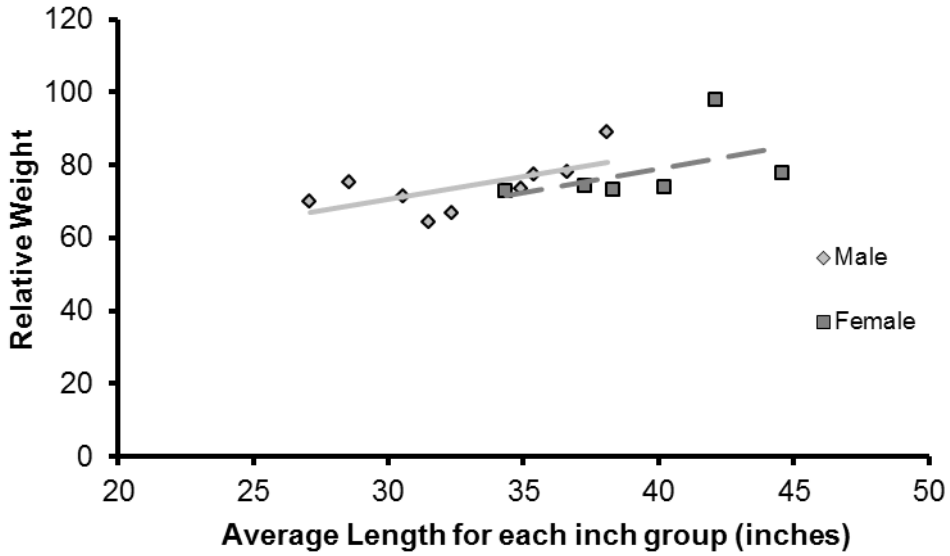


Figure 4. Average relative weight at length, measured from a sample of muskellunge captured during a spring fyke net survey of Wabikon Lake, Forest County, 2012 (Male: N=18, Female: N=12).

The same process was used to index body condition during the muskellunge recapture survey in 2013. W_r for males muskellunge was very steady, ranged from 72.2 to 84.6 with an average of 80.4, showing no correlation between body condition and body length. Females body condition was also quite steady ranged from 70.3 to 80.8 with an average of 76.1 (Figure 5). From 2012 to 2013, body condition was very similar for female fish, showing no relationship to body length and an average value of approximately 76 both years. Male fish had a little more variation, with a fairly strong positive correlation to body length in 2012.During 2013 W_r analysis showed no correlation between W_r and body length, however the average W_r value increased approximately 7 points. Body condition was expected to stay similar from one year to the next since it normally takes a change in the fish community to trigger a response in body condition. I cannot think of a logical explanation for increased male body condition from one year to the next, and no change in female body condition. For this reason I believe it was just random variation from one year to the next.

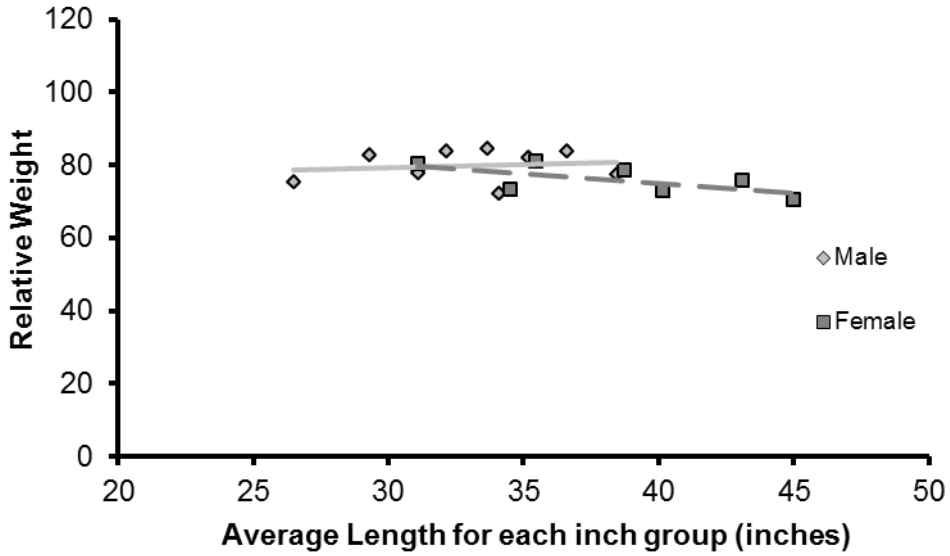


Figure 5. Average relative weight at length, measured from a sample of muskellunge captured during a spring fyke net survey of Wabikon Lake, Forest County, 2013 (Male: N=18, Female: N=11).

Yellow Perch

Abundance

Relative abundance of yellow perch was indexed using average catch per net-night during each year of our survey. During the first year of our survey we witnessed a very abundant population of yellow perch with an average catch of nearly 49 fish per net-lift (Table 4). However, the following year the catch rate of yellow perch dropped off dramatically to just over 2 fish per net-lift.

Table 4. Relative abundance, indexed using catch per net-night, of yellow perch in Wabikon Lake, Forest County, 2012-2013.

	2012	2013
Wabikon	48.98	2.28

While yellow perch populations can be quite cyclic it is surprising to see a population have such a drastic change over a single year. I believe the reason for the change is the timing of these surveys and the drastic differences in the weather from 2012 to 2013.

Typically yellow perch populations are monitored using fyke nets immediately after the ice goes out. Since the main purpose of the 2012-2013 survey was to assess the muskellunge population we set our nets approximately one week after the ice went out (which is normal practice for muskellunge sampling). During 2012 the ice left the lake very early, during late March, which allowed us to have our gear set by 4/1/2012. Since the ice went out so early in the year the water was able to stay cold for quite a while, which allowed our survey to line up better with yellow perch spawning. 2013 was very much the opposite, the ice did not leave the lake until later than normal, during early May, and we were not able to start our survey until 5/10/2013. Since the ice held on so long during 2013 the weather changed very fast and the water warmed at an unusually

fast rate, which likely commenced yellow perch spawning after a much shorter period of time, causing us to under sample the population compared to 2012.

Since each year of sampling fell during extremely different weather conditions, combining the two surveys is appropriate and likely creates a value closer to the true population. After combining the data from 2012 and 2013 the relative abundance of yellow perch in Wabikon Lake was just over 25 fish per net-lift (Figure 6, Table 5). To put this into perspective we can compare the relative abundance of yellow perch in Wabikon Lake to other lakes that received the same survey over the past few years. Wabikon Lake has a higher relative abundance of all other lakes surveyed since 2011, nearly five times higher than the lake with the second highest perch abundance, which happens to be connected to Wabikon Lake. This abundance data shows that Wabikon has a very large yellow perch population for this part of Wisconsin, and yellow perch should be considered very abundant.

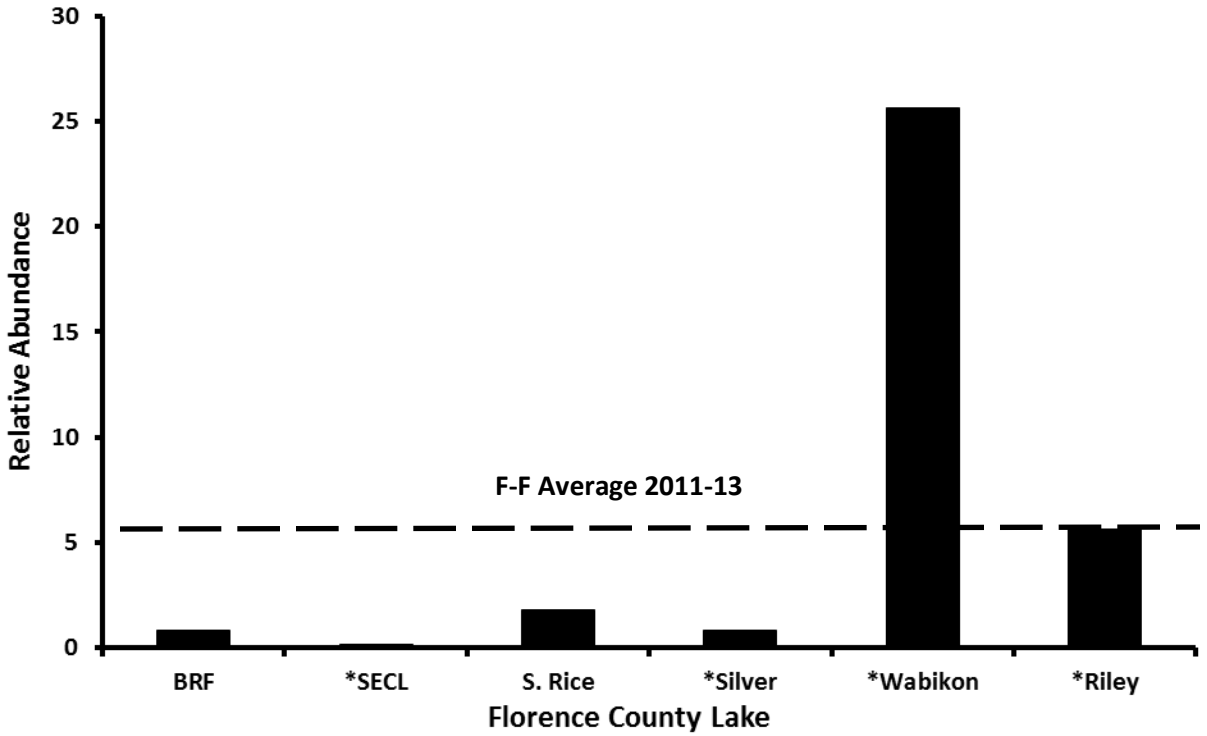


Figure 6. Yellow perch relative abundance, indexed using catch per net-night during SN2 surveys, for all lakes surveyed in Florence and Forest Counties 2011-2013 (Mean = 5.82).

Table 5. Yellow perch relative abundance, indexed using catch per net-night during SN2 surveys, for all lakes surveyed in Florence and Forest Counties 2011-2013.

	BRF	*SECL	S. Rice	*Silver	*Wabikon	*Riley	Mean
YP (SN2)	0.85	0.18	1.78	0.85	25.63	5.63	5.82
**SN2 total	23.35	17.89	12.39	4.975	54.115	97.04	34.96

Size Structure

A random sample of 50 yellow perch was measured to analyze size structure during the 2013 survey (Figure 7). Approximately 34% and 4% of the yellow perch sampled were ≥ 8.0 and 10.0 inches respectively (Table 6). The Wabikon Lake yellow perch population shows above average yellow perch size structure, when compared to other populations sampled in this region since 2011 (Table 7).

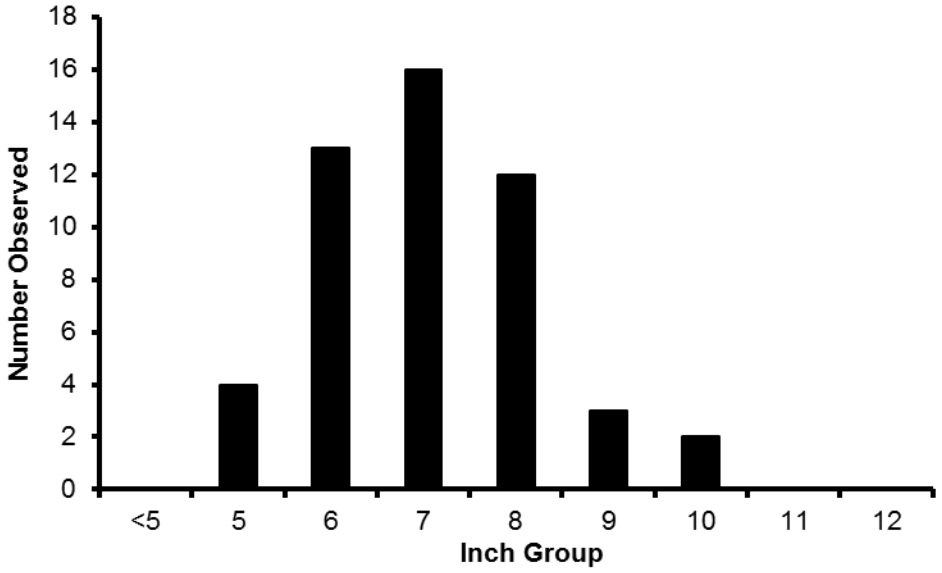


Figure 7. Length frequency of a random sample of yellow perch captured during a spring fyke net survey of Wabikon Lake, Forest County, 2013 (N=50).

Table 6. Size structure, indexed using relative stock density, of a random sample of yellow perch captured during a spring fyke net survey of Wabikon Lake, Forest County, 2013 (N=50).

RSD6	92.00
RSD8	34.00
RSD10	4.00
RSD12	0.00

Table 7. Size structure, indexed using relative stock density, or all significant yellow perch populations sampled between 2011-13 in Florence and Forest Counties.

	Patten	SECL	Wabikon	Riley	Fay	Halsey	Long	Van Zile	Mean
RSD7	31.17	36.21	66.00	75.41	11.92	42.91	4.58	5.79	34.25
RSD8	6.49	13.79	34.00	34.43	1.32	7.96	0.42	0.83	12.40
RSD9	2.60	5.17	10.00	11.48	0.00	0.00	0.42	0.00	3.71
RSD10	0.00	1.72	4.00	1.64	0.00	0.00	0.42	0.00	0.97
RSD12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Growth

Age was estimated from a random sample of yellow perch by analyzing cross sections of anal rays and scale samples. Growth was then indexed using average length at age showing that yellow perch in Wabikon Lake grow at or above the regional average (Figure 8).

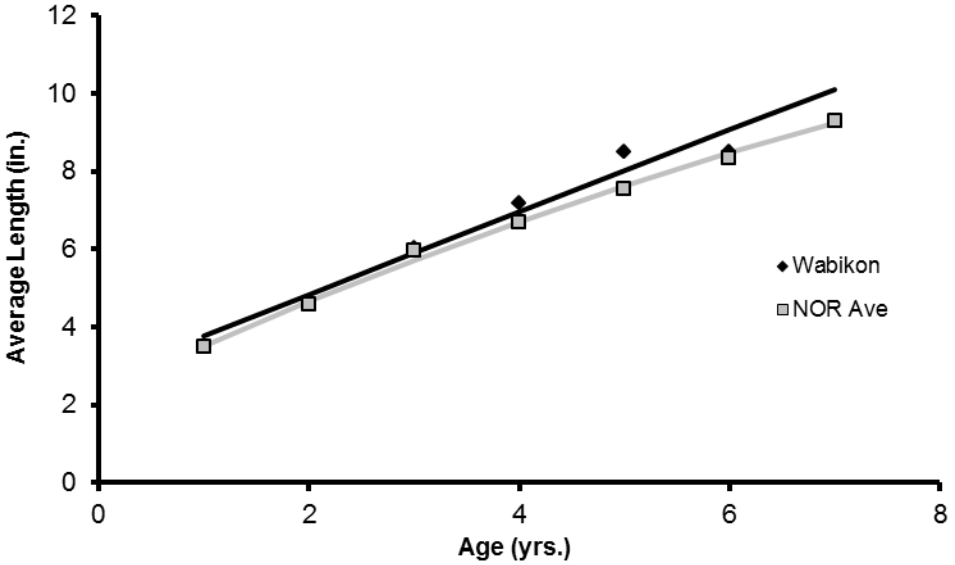


Figure 8. Average length at age of a random sample of yellow perch captured during spring surveys of Wabikon Lake during 2013, fit with von Bertalanffy growth curves and compared to the average length at age for yellow perch in the Northern Region of WI (N=18).

Black Crappie

Abundance

Like yellow perch, relative abundance of black crappie was indexed using catch per net-night during 2012 and 2013. Relative abundance increased from 2012 to 2013 by 70% (Table 8). This increase in abundance can be explained similarly to the drastic change seen in yellow perch abundance from 2012 to 2013. However, black crappie typically spawn weeks after ice out. The very late ice cover in 2013 created a situation where the water warmed very quickly and likely started black crappie spawning activities nearer to ice-out, increasing our catch rate. When comparing the relative abundance of black crappie in Wabikon Lake to the five other lakes sampled during this time period in Forest and Florence Counties in recent years, Wabikon Lake is second in black crappie abundance (Figure 9, Table 9).

Table 8. Relative abundance, indexed using catch per net-night, of black crappie in Wabikon Lake, Forest County, 2012-2013.

	2012	2013
Wabikon	5.08	8.64

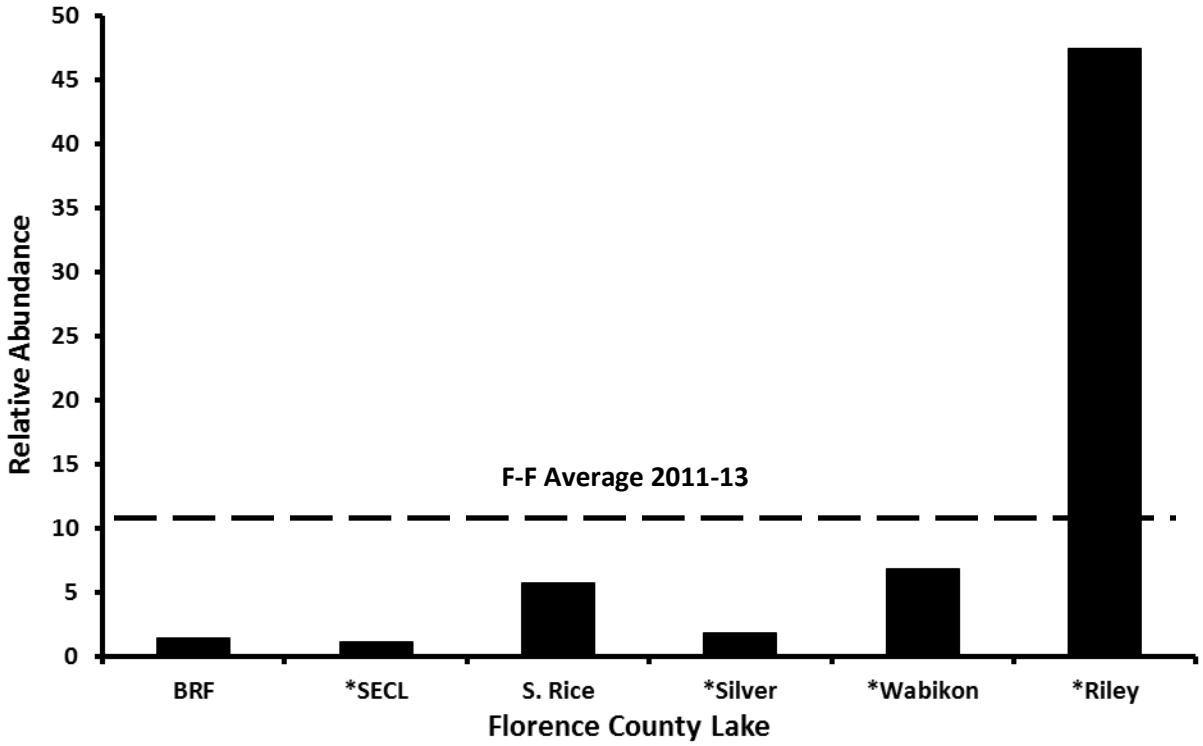


Figure 9. Black crappie relative abundance, indexed using catch per net-night during SN2 surveys, for all lakes surveyed in Florence and Forest Counties 2011-2013 (Mean = 10.73).

Table 9. Black crappie relative abundance, indexed using catch per net-night during SN2 surveys, for all lakes surveyed in Florence and Forest Counties 2011-2013.

	BRF	*SECL	S. Rice	*Silver	*Wabikon	*Riley	Mean
BC (SN2)	1.48	1.10	5.69	1.86	6.86	47.38	10.73
**SN2 total	23.35	17.89	12.39	4.975	54.115	97.04	34.96
*Average of two years							
**Panfish species included: BG, PKS, BGxPKS, BC, YP, RKB							

Size Structure

A random sample of 220 black crappie was measured to assess size structure of black crappie in Wabikon Lake (Figure 10). Approximately 36% and just under 4% of this sample was $\geq$ 8.0 and 10.0 inches respectively (Table 10). The current size structure of the black crappie population in Wabikon Lake is well below the average size structure for populations in this region and should be considered poor (Table 11).

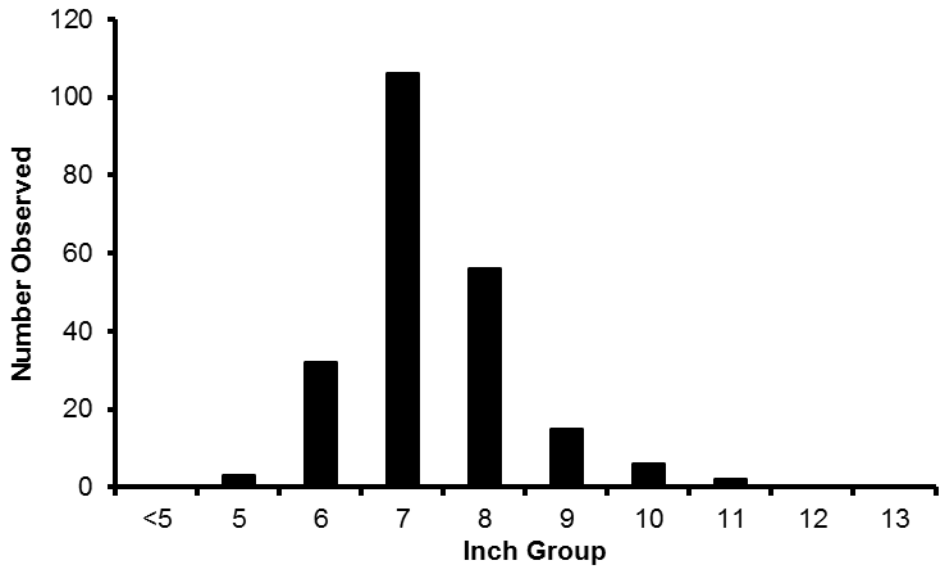


Figure 10. Length frequency of a random sample of black crappie captured during a spring fyke net survey of Wabikon Lake, Forest County, 2013 (N=220).

Table 10. Size structure, indexed using relative stock density, of a random sample of black crappie captured during a spring fyke net survey of Wabikon Lake, Forest County, 2013 (N=220).

RSD8	35.91
RSD10	3.64
RSD12	0.00
RSD14	0.00

Table 11. Size structure, indexed using relative stock density, of all significant black crappie populations sampled between 2011-13 in Florence and Forest Counties.

	2011			2012				2013								
	Patten	SECL	Silver	*Ellwood	Emily	Keyes	Sea Lion	Wabikon	Riley	Twin Falls	Fay	**Halsey	Long	Van Zile	Mean	Outliers Omitted
RSD8	95.45	79.49	88.24	100.00	62.26	85.42	66.67	35.91	35.99	41.68	1.29	100.00	25.16	95.24	65.20	59.40
RSD10	63.64	38.46	31.37	100.00	28.30	58.33	4.76	3.64	2.80	11.45	0.00	50.00	7.04	42.86	31.62	24.39
RSD12	36.36	0.00	3.92	100.00	0.00	2.08	0.00	0.00	0.22	0.31	0.00	50.00	2.56	33.33	16.34	6.57
RSD14	0.00	0.00	1.96	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	3.38	0.20

Outliers: *Currently no natural reproduction **6 fish sample

Growth

A sample of structures from 27 black crappie was analyzed to estimate age. Growth was then inferred using average length at age. Black crappie in Wabikon Lake display growth rates well below the average for this region of Wisconsin (Figure 11). This data suggests that it takes a Wabikon Lake black crappie nearly 7 years to reach 9 inches in length, a size that most populations achieve in only 5 years.

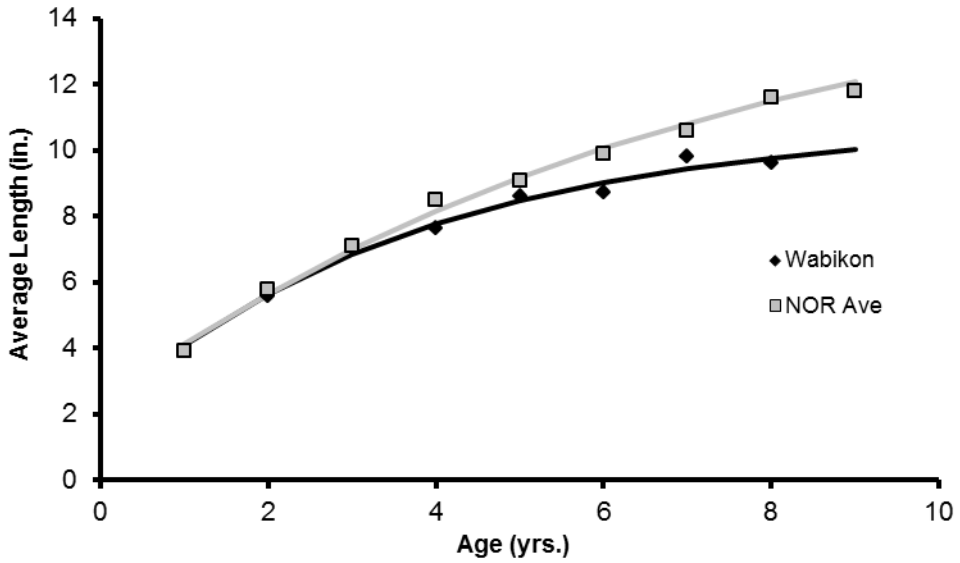


Figure 11. Average length at age of a random sample of black crappie captured during spring surveys of Wabikon Lake during 2013, fit with von Bertalanffy growth curves and compared to the average length at age for black crappie in the Northern Region of WI (N=27).

Riley Lake

Muskellunge

Abundance

Just like on Wabikon Lake, muskellunge abundance was assessed over a two year period on Riley Lake. Twenty muskellunge were captured during the first year of the survey and another thirty-two fish were captured during 2013 for a total of fifty-two muskellunge sampled. The relative abundance of muskellunge was significantly higher in 2013 when compared to 2012. This is not because the population became drastically more abundant, but an example of the variability of muskellunge spawning conditions and the reason why two-year population estimates are needed to manage muskellunge populations effectively (Table 12).

Table 12. Relative abundance, indexed using catch per net-night, of muskellunge in Riley Lake, Forest County, 2012-2013.

	2012	2013
Riley	0.29	0.68

A total of 19 different muskellunge, larger than 20 inches in total length, were captured and marked with an identifiable fin clip during the spring of 2012 (Figure 12). During 2013; a total of 28 different muskellunge over 20 inches in length were captured, 5 of which were recaptured fish from 2012 (Figure 13). After analyzing the data I estimate there to be 97 muskellunge larger than 20.0 inches (0.45 fish/acre) in the current population. Approximately 90 of the 97 muskellunge estimated to be present in Riley Lake are over 30.0 inches and considered to be adults (0.42 adults/acre).

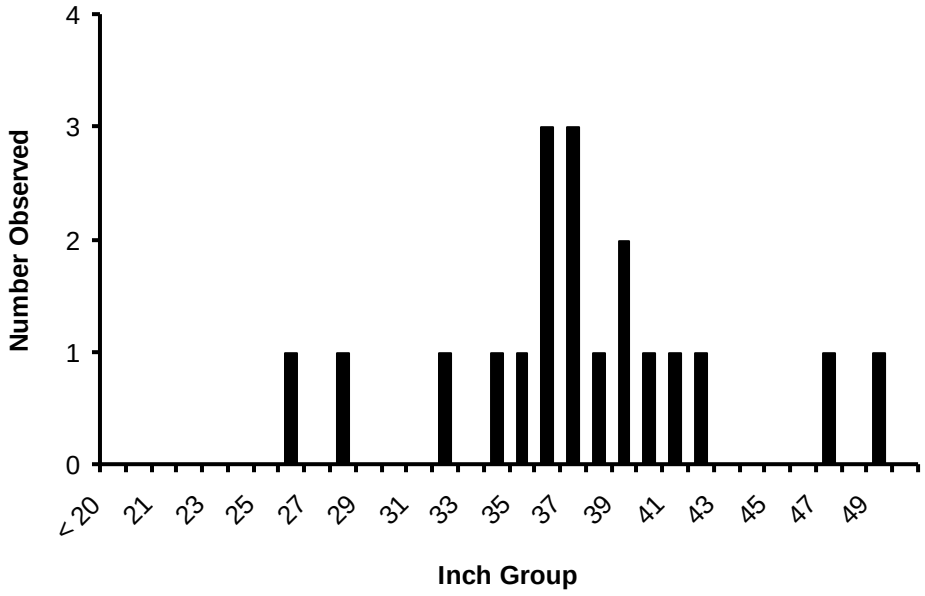


Figure 12. Length frequency of muskellunge captured during a spring fyke net survey of Riley Lake, Forest County, 2012 (N=19).

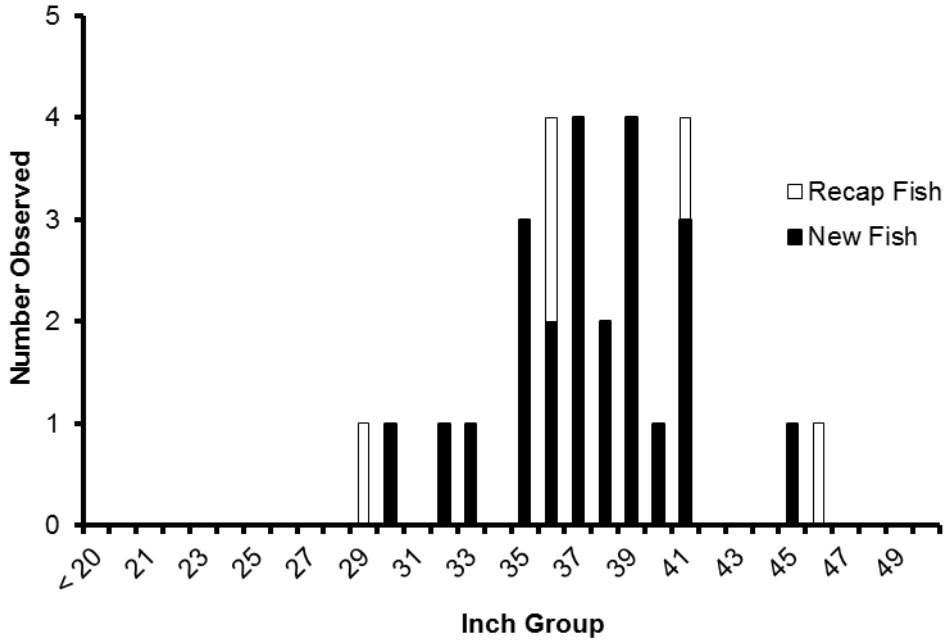


Figure 13. Length frequency of muskellunge captured during a spring fyke net survey of Riley Lake, Forest County, 2013 (New Fish: N=23, Recaptured Fish: N=5).

The 2012 adult musky population, estimated to be approximately one adult fish per 2.4 surface acres, is an above average density of muskellunge. Riley Lake is also very shallow, with a maximum depth of about 12 feet and an average depth in the 5-8 foot range, giving it a water volume somewhere between 1,100-1,700 acre-feet. I would

compare the Riley Lake musky population to other, more typical, lakes that have adult densities near 1 adult/acre, a very high density of muskellunge.

Size Structure

Every muskellunge captured during the 2012 and 2013 surveys were measured to assess the size structure of the Riley Lake population (Figure 14). More large fish (those ≥ 42 inches) were captured during 2012, giving Riley Lake a higher size structure during 2012 than 2013 (Table 13). A better assessment of size structure for Riley Lake is to combine the fish captured from both years, this eliminates any type of seasonality and the larger sample size allows for a better representation of true size structure. The size structure of Riley Lake is surprisingly good. Typically lakes that have musky abundance over 0.4 adults/acre will have a hard time getting fish over 40 inches, let alone 45 inches. I believe the size structure measured during 2012-13 should become a standard for the Riley Lake population. Goals for this population going forward should be values of ≥ 40, 10 and 5 for RSD38, 42 and 45 respectively. As long as two of these 3 goals are hit Riley Lake should be considered properly managed for muskellunge.

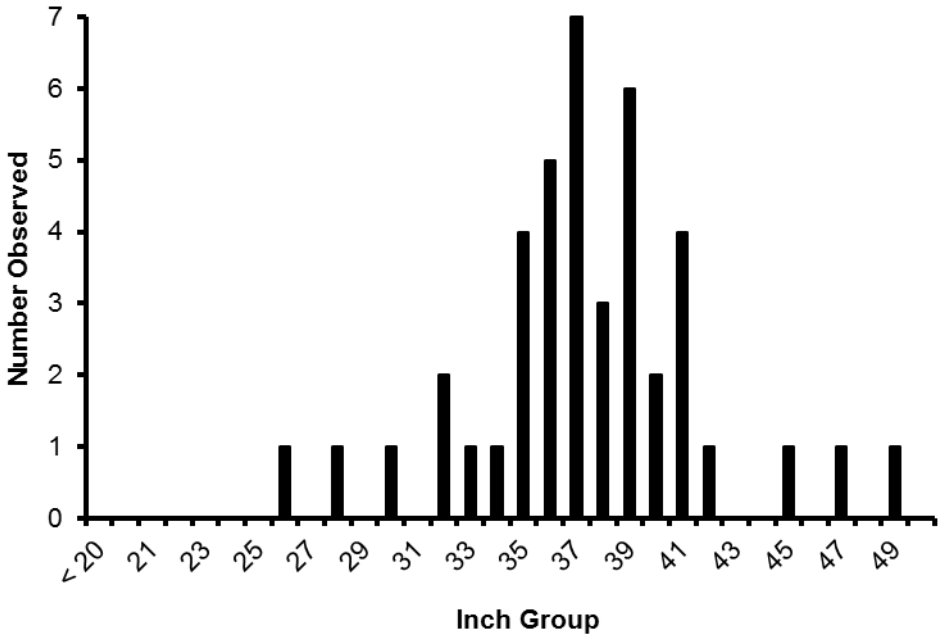


Figure 14. Length frequency of muskellunge captured during a spring fyke net survey of Riley Lake, Forest County, 2012-13 (N=42).

Table 13. Size structure, indexed using relative stock density, for muskellunge sampled from Riley Lake, Forest County during spring 2012 & 2013 (2012: N=19, 2013: N=28, Entire: N=42).

	2012	2013	Entire Survey
RSD30:	89.47	96.43	95.24
RSD38:	42.11	46.43	45.24
RSD42:	15.79	7.14	9.52
RSD45:	10.53	7.14	7.14
RSD48:	5.88	0.00	2.50

Another way to evaluate size structure is by looking at the mean and median length of fish sampled from the population. In general mean and median lengths of muskellunge in Riley Lake are approximately 3 inches longer than those in Wabikon Lake (Table 14). This is another example of the surprising size structure of this abundant population.

Table 14. Mean and median length of muskellunge sampled during spring fyke net surveys of Riley Lake, Forest County, 2012 & 2013 (2012: N=19, 2013: N=28).

	Male		Female		Unknown		All Fish	
Survey Year	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**	**2012**	**2013**
Mean Length	34.06	36.30	41.04	42.33	38.44	33.80	37.77	37.93
Median Length	35.90	36.70	40.40	41.60	36.60	33.80	37.20	37.75

Body Condition

Weight measurements were taken from nearly every muskellunge captured during the two year survey. Body condition was then indexed using relative weight (W_r) for all known sex muskellunge. During 2012 male W_r ranged from 65.2 to 92.6 with an average of 79.3 (Figure 15). Female body condition was steadier than that of males with W_r values ranging from 70.7 to 87.3 with an average of 79.8. Riley Lake body condition trends were opposite of those displayed by the Wabikon Lake population, with the W_r of both male and female fish decreasing with length (male: P=0.11, female: P=0.23).

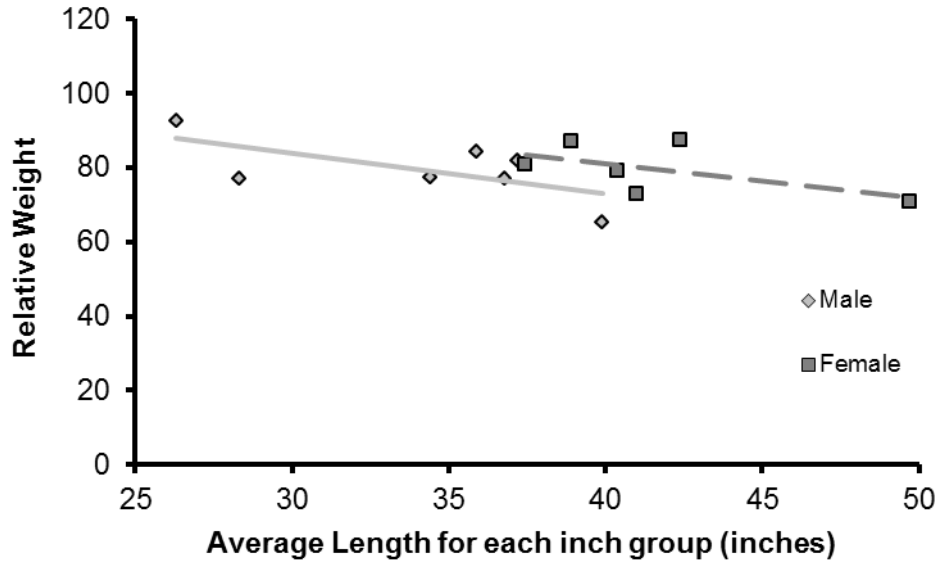


Figure 15. Average relative weight at length, measured from a sample of muskellunge captured during a spring fyke net survey of Riley Lake, Forest County, 2012 (Male: N=7, Female: N=7).

The same process was used to index body condition during the 2013 survey. W_r for male muskellunge was very steady, ranged from 71.4 to 89.8 with an average of 81.6, showing no correlation between body condition and body length (Figure 16). Female body condition appears to decrease with body length, however a single fish which had very high relative weight (103.9) is what creates this trend. If that fish is omitted, female body condition was very steady ranging from 76.8 to 81.1, after factoring in the single outlier the average W_r of female fish was 82.9. From 2012 to 2013, body condition was quite similar with an increase of approximately 2 pts. There was no correlation between W_r and body length seen over the two year study.

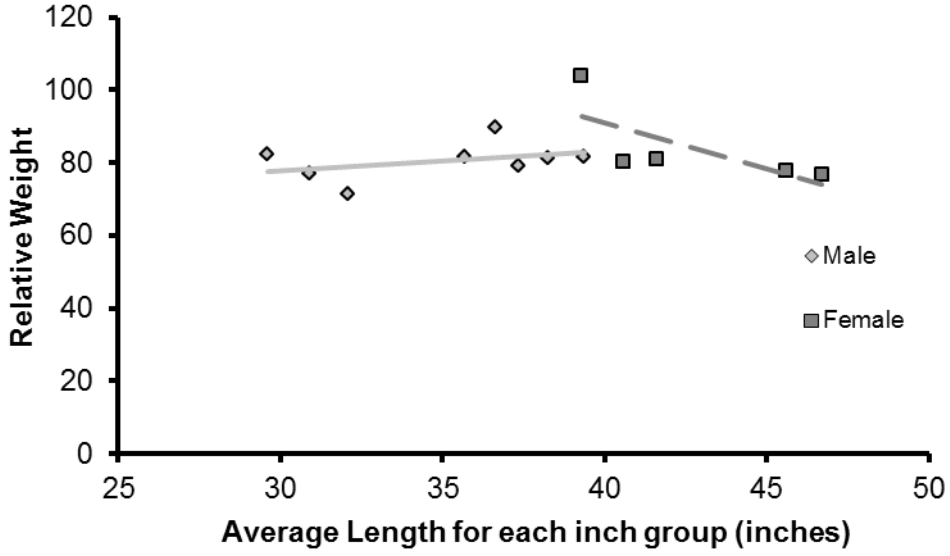


Figure 16. Average relative weight at length, measured from a sample of muskellunge captured during a spring fyke net survey of Riley Lake, Forest County, 2013 (Male: N=18, Female: N=8).

Yellow Perch

Abundance

The Riley Lake yellow perch population is less abundant than the Wabikon Lake population. From 2012 to 2013 the relative abundance decreased substantially, similar to what was seen in Wabikon Lake (Table 15). The major reason for decreased relative abundance was drastic weather change from year to year.

Table 15. Relative abundance, indexed using catch per net-night, of yellow perch in Riley Lake, Forest County, 2012-2013.

	2012	2013
Riley	9.61	1.65

The mean relative abundance of yellow perch in Riley Lake was just under 6 fish per net-lift (Figure 17, Table 16). While this sounds like a low abundance of yellow perch, it really isn't. This survey does not take place at the peak of yellow perch spawning and a value of 6 fish per net-night represents a significant population. In fact, the only lake surveyed during this time period that has had a higher abundance of yellow perch in recent years is Wabikon Lake.

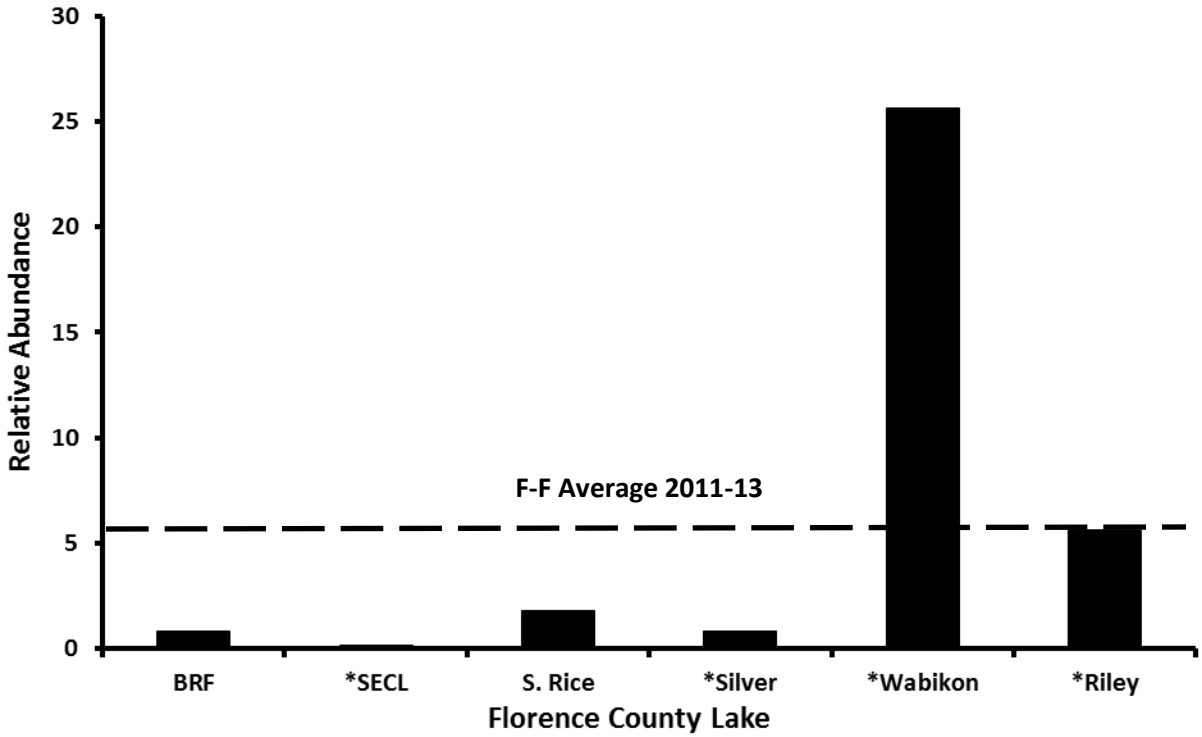


Figure 17. Yellow perch relative abundance, indexed using catch per net-night during SN2 surveys, for all lakes surveyed in Florence and Forest Counties 2011-2013 (Mean = 5.82).

Table 16. Yellow perch relative abundance, indexed using catch per net-night during SN2 surveys, for all lakes surveyed in Florence and Forest Counties 2011-2013.

	BRF	*SECL	S. Rice	*Silver	*Wabikon	*Riley	Mean
YP (SN2)	0.85	0.18	1.78	0.85	25.63	5.63	5.82
**SN2 total	23.35	17.89	12.39	4.975	54.115	97.04	34.96
*Average of two years							
**Panfish species included: BG, PKS, BGxPKS, BC, YP, RKB							

Size Structure

A total of 61 randomly selected yellow perch were measured to analyze size structure during the 2013 survey (Figure 18). Approximately 34% and just under 2% of the yellow perch sampled were ≥ 8.0 and 10.0 inches respectively (Table 17). This size structure is very similar to the size structure of perch in Wabikon Lake, and is above average when compared to other populations in this region (Table 18).

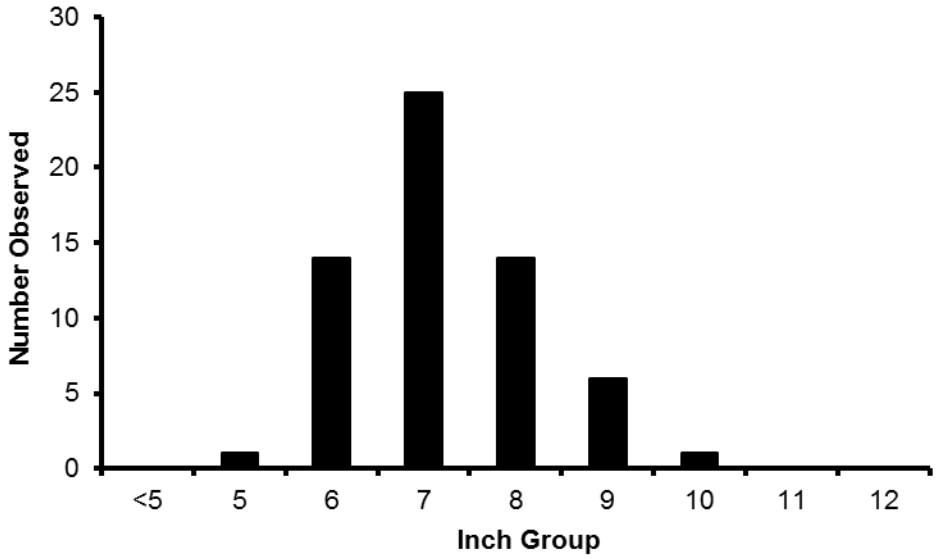


Figure 18. Length frequency of a random sample of yellow perch captured during a spring fyke net survey of Riley Lake, Forest County, 2013 (N=61).

Table 17. Size structure, indexed using relative stock density, of a random sample of yellow perch captured during a spring fyke net survey of Riley Lake, Forest County, 2013 (N=61).

RSD6	98.36
RSD8	34.43
RSD10	1.64
RSD12	0.00

Table 18. Size structure, indexed using relative stock density, of all significant yellow perch populations sampled between 2011-13 in Florence and Forest Counties.

	Patten	SECL	Wabikon	Riley	Fay	Halsey	Long	Van Zile	Mean
RSD7	31.17	36.21	66.00	75.41	11.92	42.91	4.58	5.79	34.25
RSD8	6.49	13.79	34.00	34.43	1.32	7.96	0.42	0.83	12.40
RSD9	2.60	5.17	10.00	11.48	0.00	0.00	0.42	0.00	3.71
RSD10	0.00	1.72	4.00	1.64	0.00	0.00	0.42	0.00	0.97
RSD12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Growth

Age was estimated from a random sample of yellow perch by analyzing cross sections of anal rays and scale samples. Average length at age suggests that the Riley Lake yellow perch population has above average growth rates when compared to the regional average (Figure 19). Based on this data I estimate that it takes yellow perch in Riley Lake 5 years to reach 8 inches and 7 years to reach 10 inches in length.

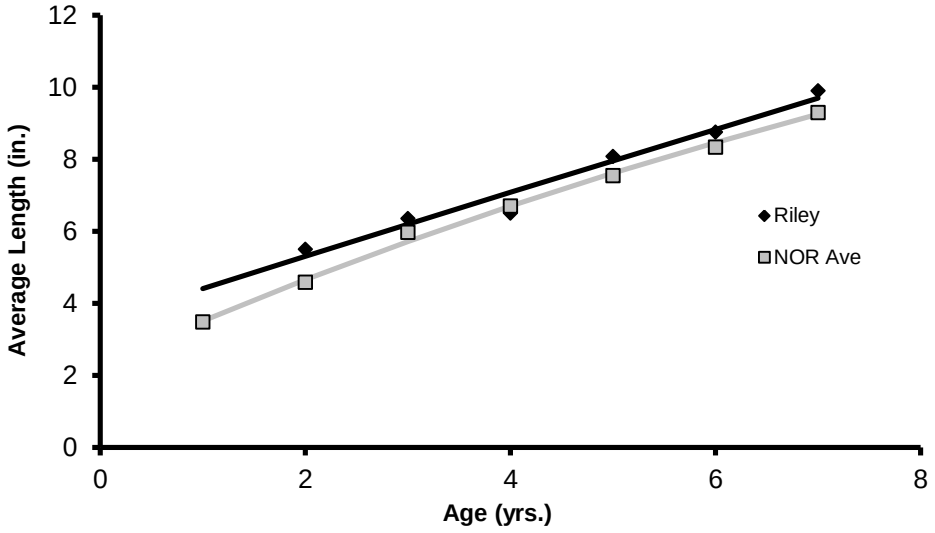


Figure 19. Average length at age of a random sample of yellow perch captured during spring surveys of Riley Lake during 2013, fit with von Bertalanffy growth curves and compared to the average length at age for yellow perch in the Northern Region of WI (N=23).

Black Crappie

Abundance

Relative abundance of black crappie in Riley Lake showed the same trend as in Wabikon Lake increasing by nearly 72% from 2012 to 2013 (Table 19). It is believed that this increase in abundance can be explained by the drastic change in weather from 2012 to 2013 which allowed more of the crappie population to be vulnerable to our gear in 2013. With an average relative abundance of over 47 fish per net-night Riley Lake has the highest abundance of the area lakes receiving the same survey in recent years, and is

likely among the most abundant black crappie populations in Forest and Florence Counties (Figure 20, Table 20).

Table 19. Relative abundance, indexed using catch per net-night, of black crappie in Riley Lake, Forest County, 2012-2013.

	2012	2013
Riley	34.86	59.90

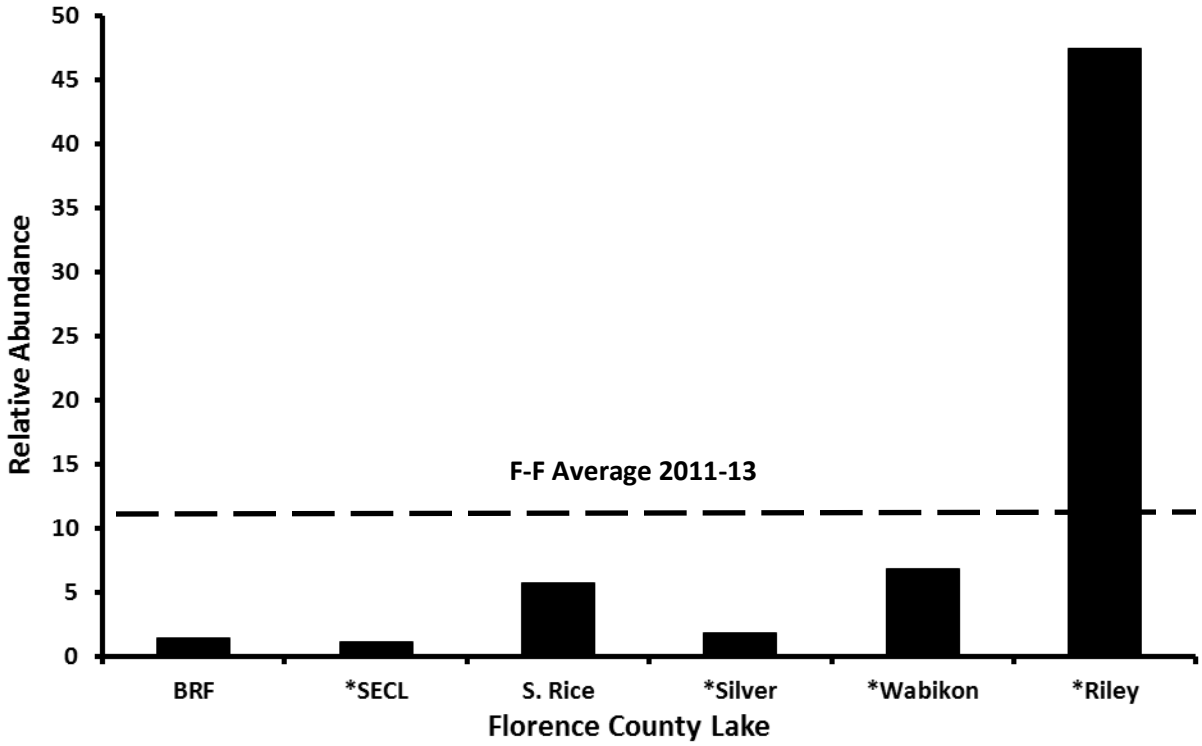


Figure 20. Black crappie relative abundance, indexed using catch per net-night during SN2 surveys, for all lakes surveyed in Florence and Forest Counties 2011-2013 (Mean = 10.73).

Table 20. Black crappie relative abundance, indexed using catch per net-night during SN2 surveys, for all lakes surveyed in Florence and Forest Counties 2011-2013.

	BRF	*SECL	S. Rice	*Silver	*Wabikon	*Riley	Mean
BC (SN2)	1.48	1.10	5.69	1.86	6.86	47.38	10.73
**SN2 total	23.35	17.89	12.39	4.975	54.115	97.04	34.96
*Average of two years							
**Panfish species included: BG, PKS, BGxPKS, BC, YP, RKB							

Size Structure

A total of 446 randomly selected black crappie were measured to assess the size structure of the Riley Lake population (Figure 21). The size structure of black crappie in Riley Lake was very similar to that of the Wabikon population with approximately 36% and just under 3% of this sample being $\geq$ 8.0 and 10.0 inches respectively (Table 21). The

current size structure of the black crappie population in Riley Lake is well below average and considered poor (Table 22).

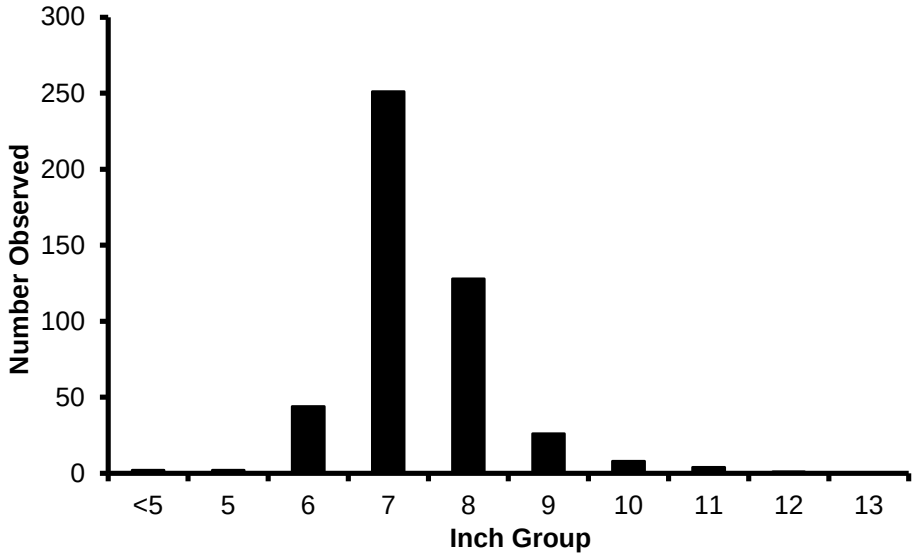


Figure 21. Length frequency of a random sample of black crappie captured during a spring fyke net survey of Riley Lake, Forest County, 2013 (N=466).

Table 21. Size structure, indexed using relative stock density, of a random sample of black crappie captured during a spring fyke net survey of Riley Lake, Forest County, 2013 (N=464).

RSD8	35.99
RSD10	2.80
RSD12	0.22
RSD14	0.00

Table 22. Size structure, indexed using relative stock density, of all significant black crappie populations sampled between 2011-13 in Florence and Forest Counties.

	2011			2012				2013								
	Patten	SECL	Silver	*Ellwood	Emily	Keyes	Sea Lion	Wabikon	Riley	Twin Falls	Fay	**Halsey	Long	Van Zile	Mean	Outliers Omitted
RSD8	95.45	79.49	88.24	100.00	62.26	85.42	66.67	35.91	35.99	41.68	1.29	100.00	25.16	95.24	65.20	59.40
RSD10	63.64	38.46	31.37	100.00	28.30	58.33	4.76	3.64	2.80	11.45	0.00	50.00	7.04	42.86	31.62	24.39
RSD12	36.36	0.00	3.92	100.00	0.00	2.08	0.00	0.00	0.22	0.31	0.00	50.00	2.56	33.33	16.34	6.57
RSD14	0.00	0.00	1.96	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	3.38	0.20

Outliers: *Currently no natural reproduction **6 fish sample

Growth

A sample of structures from 39 black crappie were analyzed to estimate age. Growth was then inferred using average length at age. Black crappie in Riley Lake display growth rates below the average for this region of Wisconsin (Figure 22). Riley Lake black crappie appear to grow relatively slow early in life, but growth rates become more respectable later in life, showing the ability to grow beyond quality size. This data suggests that it takes a Riley Lake black crappie nearly 6 years to achieve a size of 9 inches, and approximately 10 years to reach 12 inches in length.

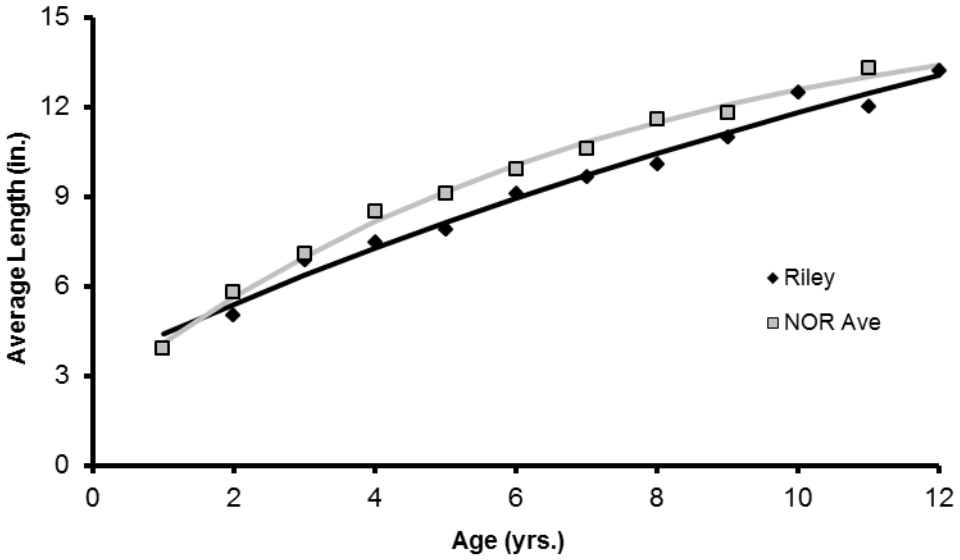


Figure 22. Average length at age of a random sample of black crappie captured during spring surveys of Riley Lake during 2013, fit with von Bertalanffy growth curves and compared to the average length at age for black crappie in the Northern Region of WI (N=39).

III. MANAGEMENT RECOMMENDATIONS

Muskellunge

Wabikon and Riley Lakes both contain high densities of muskellunge. If you compare the density of these fish per volume of water these populations are among the highest in this region of Wisconsin. The surprising thing is that these lakes (more so Riley Lake) still contain a good size structure. Riley Lake has a history of creating trophy muskellunge over 50 inches in length. During 2012 we captured a fish in Riley Lake that was just shy of 50 inches, so the potential is still there, even in these extremely dense populations.

Average body condition of muskellunge in both of these lakes is well below the standard of 100. However, it is rare to have a population with good body condition when muskellunge are as abundant as they are in these two waters. I believe the body condition values of these populations are acceptable in this situation.

Evidence of movement from Wabikon to Riley was documented during the 2012-13 survey. During 2012 a total of 34 fish in Wabikon Lake were marked with a fin clip that was visible for over a year. During 2013, a total of 15 of these fish were recaptured, 3 of which (20%) were captured in Riley Lake. Conversely, there were no fish captured in Riley during 2012 that were found in Wabikon during 2013. This suggests that the movement is primarily one direction. Obviously some fish likely move from Riley back to Wabikon, but it is probably a much lower level than those heading to Riley from Wabikon.

Riley Lake has much more suitable “all season” habitat for muskellunge than Wabikon Lake, which is quite limited. The 2012 population estimate backs up this statement,

showing a higher abundance of fish in Riley Lake (213 acres) than Wabikon Lake (594 acres). After reviewing this data I believe there are ways to make our current stocking plan more efficient for Wabikon and Riley Lakes.

Since 2002, these two waters have been stocked every other year with a target of 807 large fingerling muskellunge (1 fish/acre). These fish have been stocked at the Wabikon Lake boat landing. As mentioned earlier these fish eventually make it to Riley Lake by traveling through Wabikon Lake and the adjoining channel. Since Riley Lake has better habitat an effort should be made to stock Riley Lake directly rather than stock fish only in Wabikon Lake which lacks suitable habitat and forces fish to navigate quite a distance to a lake that has a higher carrying capacity for muskellunge. I recommend splitting the quota of muskellunge for these two lakes, creating a Wabikon Lake quota and a Riley Lake quota. By splitting the quota there should be better survival of stocked fish, allowing the WDNR to stock less fish and achieve the same population. I recommend reducing the quota from 1 fish/acre to 0.75 fish/acre for both lakes. This means instead of 807 fish being stocked in Wabikon, there would be 446 fish stocked in Wabikon and 160 fish stocked into Riley.

A survey should be conducted in the next 10-15 years to evaluate the new stocking strategy. The following abundance and size structure goals should be used in assessing the success of the new stocking plan:

Abundance Goal:

-Wabikon	0.10-0.15 adults/acre
-Riley	0.35-0.45 adults/acre

Size Structure Goal:

-Wabikon	RSD30: 75-90	RSD38: $\geq$ 20	
-Riley	RSD38: $\geq$ 40	RSD42: $\geq$ 10	RSD45: $\geq$ 5

As long as the abundance and size structure goals (2 of 3 for Riley) are met the new stocking plan should be considered a success.

Yellow Perch

Both of these lakes (especially Wabikon Lake) have quite high abundance of yellow perch. Normally populations with high abundance have poor growth rates and poor size structure. However, the size structure of the populations in these two lakes is pretty good, seemingly due to above average growth rates.

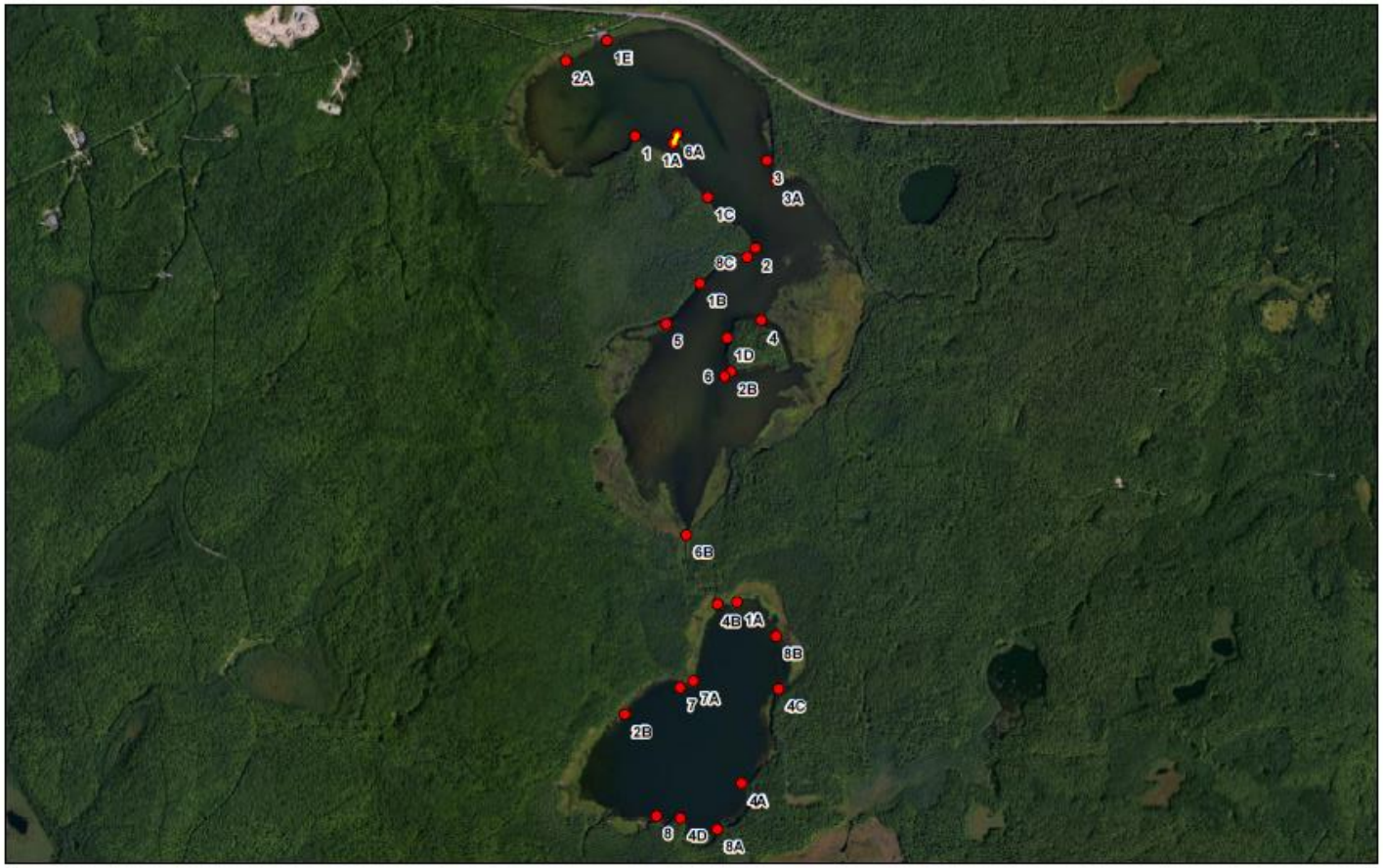
There has not been a creel survey completed on these lakes, but through observations of fishing effort throughout 2013 suggests that angler harvest of panfish (especially yellow perch) is incredibly high. Even though harvest is high the size structure is still more than respectable for this region of Wisconsin. However, a reduction in angler exploitation would likely allow these yellow perch populations to become extremely high quality.

Strong consideration should be given to reducing the daily bag limit on panfish, or even just yellow perch. A regulation similar to a 25 fish daily bag limit of panfish (of which only 10 fish can be yellow perch) per person, would be ideal for Wabikon and Riley Lakes.

Black Crappie

Both of these lakes (especially Riley Lake) have high abundance of black crappie. The size structure of black crappie in both lakes is below the regional average. Growth of black crappie is also below average for Northern Wisconsin, and is likely what is limiting the size structure of this population.

As mentioned earlier panfish harvest on these lakes seems quite intense, and limiting panfish harvest would likely help black crappie size structure. Some consideration should be given to reducing the overall panfish daily bag limit to 10 fish (from the current 25 fish regulation). A 10 fish daily bag limit would likely improve size structure, but with below average growth rates this population will likely never have high size structure. In my opinion the best regulation for panfish in this chain of lakes is a 25 fish daily bag limit of panfish (of which only 10 fish can be yellow perch) per person.



Legend

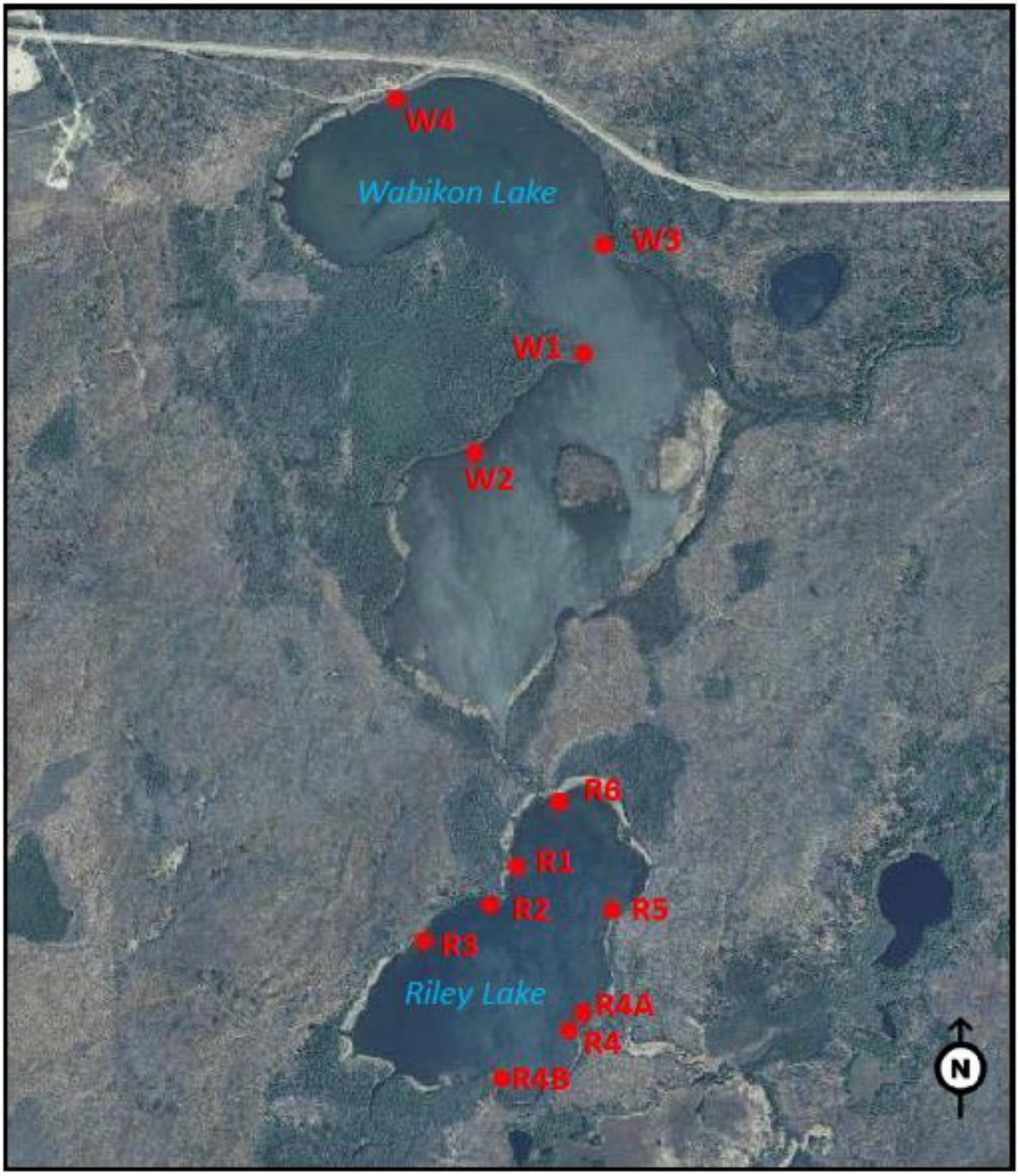
- SN2 4/1 - 4/25 (115 Lifts)
- Double Ended Set

Wabikon - Riley Lakes

Net Locations

2012 Muskellunge Survey

Mapped By: Jake Walcisak
December 7th, 2012



Wabikon and Riley Lakes
Muskellunge Population Estimate – Recapture
5/10 – 5/17/2013 (80 net lifts)