ASSESSMENT OF BLACK CRAPPIE AND WHITE PERCH IN HIGHLAND LAKE, STODDARD-WASHINGTON, NH (2014)

STATE: New Hampshire

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GRANT TITLE: Anadromous and Inland Fisheries Operational Management Investigations

JOB 9: Warmwater and Coolwater Fisheries Population Assessments

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INTRODUCTION

Highland Lake is located in the towns of Stoddard (Cheshire County) and Washington (Sullivan County), NH, and has a surface area of 288 hectares (712 acres). It is classified as mesotrophic with an average depth of 1.6 meters, a maximum depth of 9.6 meters, and is considered a warmwater fishery. Fish species present include: Black crappie (*Pomoxis nigromaculatus*), White perch (*Morone Americana*), Largemouth Bass (*Micropterus salmoides*), Smallmouth Bass (*Micropterus dolomieui*), Common White Sucker (*Catostomus commersoni*), Yellow Perch (*Perca favescens*), Pumpkinseed (*Lepomis gibbosus*), Redbreast Sunfish (*Lepomis auritus*), Chain Pickerel (*Esox niger*), Fallfish (*Semotilus corporalis*), Brown Bullhead (*Ameiurus nebulosus*), Eastern Creek Chubsucker (*Erimyzon oblongus*), and Golden Shiner (*Notemigonus crysoleucas*).

Black Crappie were stocked by the New Hampshire Fish and Game Department (NHFGD) in 1992 into Halfmoon Pond, Washington, which flows into Highland Lake. Based on NHFGD field surveys, Black Crappie made their way into Highland Lake sometime between 1997 and 2003.

White Perch have been present in the lake since the early 1980's, but further details are lacking. During a winter creel survey on Highland Lake in 2013, it was brought to the NHFGD's attention that the White Perch fishing has declined in recent years.

The NHFGD currently has limited data on Black Crappie and White Perch populations. White Perch are an important sport fish in New Hampshire during winter. Black Crappie have quickly become a very popular sport fish in NH in recent years. Accordingly, it is important for the NHFGD to learn more about their populations, age, and growth, in order to better manage these fisheries.

METHODS

From April 28 to May 16, 2014, five New Hampshire design fyke nets were fished in Highland Lake, Stoddard/Washington in order to assess Black Crappie and White Perch populations (Figure 1). Nets were set in areas to intercept Black Crappie and White Perch during their pre-spawning to spawning movements. Nets were checked seven times. Net number 5 was pulled on the fifth day of checking nets due to lack of fish being captured.

Black Crappie and White Perch, along with any black bass (largemouth bass and smallmouth bass), were measured to the nearest millimeter, total length (TL), weighed to the nearest gram, marked (upper caudal fin clip on unclipped fish to identify recaptures), and checked for fin clips. For aging purposes, scale samples were taken from Black Crappie, White Perch, and black bass in the region below the lateral line and slightly posterior to the pectoral fin on the left side of the fish. Scale samples were taken from a subsample (a maximum of 5 fish per 10 mm size class) of each speceis. Scales were cataloged, then permanently recorded in an acetate impression and aged using an Eyecom 1100 microfiche projector. Fish were processed shortly after capture and then released at least 200 yards from the fyke net. In this report, only fish aged as $\leq$ 6 years of

age and having scales with ageing confidence ratings of 1 or 2 (very confident or confident) were analyzed.

Proportional Stock Density (PSD) measures for Black Crappie, White Perch, and black bass were determined according to length categories (based on total length) described in Gablehouse (1984): for Black Crappie and White Perch: stock 130-199 mm; quality 200-249 mm; preferred 250-299 mm; memorable 300-379 mm; and trophy > 380 mm; for Smallmouth Bass: stock 180-279 mm; quality 280-349 mm; preferred 350-429 mm; memorable 430-509 mm; and trophy > 510 mm; for Largemouth Bass: stock 200-299 mm; quality 300-379 mm; preferred 380-509 mm; memorable 510-629 mm; and trophy > 630 mm.

$$PSD = \frac{number\ \ of\ \ fish \geq quality}{number\ \ of\ \ fish \geq stock} \bullet 100$$

Confidence intervals were calculated for PSD estimates at the 80% confidence level using formulas based on Zar, J.H. (1984). A PSD value ranging from 30 to 60 indicates a balanced fish population for Black Crappie and White Perch; a balanced fish population is defined as one that is intermediate between the extremes of a large number of small fish and a small number of large fish and indicates that rates of recruitment, growth and mortality rates may be satisfactory (Gablehouse 1984). Values < 30 indicate an extreme number of small fish when compared to the number of large fish. Values > 60 indicate an extreme number of large fish when compared to the number of small fish.

Relative weight (W_r) values were derived as a measure of condition of individual fish. Relative weight values were calculated for Black Crappie ≥ 100 mm (TL), White Perch ≥ 80 mm (TL), and black bass ≥ 150. This index compares the actual weight of an individual (W) with a standard weight (W_s) for a fish of the same length:

$$W_r = W/W_s \cdot 100$$

The standard weight equation used for Black Crappie was $\log_{10} W_s$ (g) = - 5.618 + 3.345 x $\log_{10}$ TL (mm), proposed by Neumann and Murphy (1991). The equation used for White Perch was $\log_{10} W_s$ (g) = -5.122 + 3.136 x $\log_{10}$ TL (mm), proposed by Bister et al (2000). The equation used for Largemouth Bass was $\log_{10} W_s$ (g) = -5.316 + 3.191 x $\log_{10}$ TL (mm), proposed by Wege and Anderson (1978). The equation used for Smallmouth Bass was $\log_{10} W_s$ (g) = - 5.329 + 3.20 x $\log_{10}$ TL (mm), proposed by Kolander et al. (1993). Relative weight values > 90 may be considered good, with values > 100 considered excellent.

Schumacher population estimators (multiple mark and multiple recapture) were used to estimate population size of target species (Ricker 1975) and associated 95% confidence intervals.

All reported mean values include estimated standard deviations, unless otherwise noted. Linear regression was used to examine the relationship of fish total length to relative weight. The level of significance for all statistical analyses was 0.10.

RESULTS

A total of 505 Black Crappie were sampled (Figure 2). The PSD for Black Crappie was 77 (lower and upper 80% CI's: 75, 80; Table 1) compared to the statewide mean of 70. Mean relative weight values for Black Crappie were calculated by length category (Table 2). Mean relative weight values for Black Crappie were similar for stock size fish and lower for quality, preferred, and memorable size fish when compared to statewide mean values. The relationship between Black Crappie total length and relative weight was significant with a negative trend ($P = 0.03$; $R^2 = 0.0114$; Figure 2), but should be interpreted with caution due to the extremely low R^2 value.

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, and age at quality size for Black Crappie are presented in Table 3 and Figure 3. Black Crappie took an average of 3.45 years to reach quality size (200 mm). No comparison was made to a statewide average due to lack of Black Crappie age and growth data.

The Schumacher population estimate of Black Crappie in Highland Lake during the spring 2014 sampling period with associated 95% confidence intervals was 7,538 (CI:4,527 – 22,511). This estimate should be interpreted with caution due to the wide confidence intervals.

A total of 45 White Perch were sampled (Figure 4). Mean relative weight values for White Perch were calculated by length category (Table 4). Mean relative weight values for White Perch were above average for quality and preferred size fish when compared to statewide mean values. No stock size fish were sampled. White Perch PSD values and growth data were not compared or categorized, and population estimates were not calculated due to low sample size.

A total of 17 Largemouth Bass were sampled (Figure 5). Mean relative weight values for Largemouth Bass were calculated by length category (Table 5). Mean relative weight values for Largemouth Bass were below average for stock and preferred size fish when compared to statewide mean values. No quality size fish were sampled. Largemouth Bass PSD values and growth data were not compared or categorized, and population estimates were not calculated due to low sample size.

A total of 8 Smallmouth Bass were sampled (Figure 6). Mean relative weight values for Smallmouth Bass were calculated by length category (Table 6). Mean relative weight values for Smallmouth Bass were above average for stock, below average for quality, and similar for preferred size fish when compared to statewide mean values. Smallmouth Bass PSD values and growth data were not compared or categorized, and population estimates were not calculated due to a low sample size.

Fish species captured, but not processed included: Common White Sucker (*Catostomus commersoni*), Yellow Perch (*Perca favescens*), Pumpkinseed (*Lepomis gibbosus*), Chain Pickerel (*Esox niger*), Fallfish (*Semotilus corporalis*), Brown Bullhead (*Ameiurus nebulosus*), Eastern Creek Chubsucker (*Erimyzon oblongus*), and Golden Shiner (*Notemigonus crysoleucas*).

DISCUSSION

For Black Crappie, a PSD value ranging from 30 to 60 indicates a structurally balanced population. Values < 30 indicate an extreme number of small fish when compared to the number of large fish. Values > 60 indicate an extreme number of large fish when compared to the number of small fish. The PSD value calculated for Black Crappie in Highland Lake was 77, indicating an unbalanced population with an extreme number of large fish when compared to the number of small fish (Table 1).

Relative weight values > 90 may be considered good, with values > 100 considered excellent. One of the four Black Crappie size categories had Wr values > 90 (Table 2). Two of the three size categories for White Perch had Wr values > 90 (Table 4). Two of the three size categories for Largemouth Bass had Wr values > 90 (Table 5). One of the four size categories for Smallmouth Bass was > 100 and the other three categories were <90 (Table 6). Observed values are acceptable from a management standpoint, as no exceptional values were documented.

RECOMMENDATIONS

The NHFGD should continue to assess Black Crappie and White Perch populations throughout the state and continue to update the statewide database. This database will allow biologists to target specific water bodies for more detailed assessments and make well-informed management recommendations to preserve and improve the quality of Black Crappie and White Perch populations state-wide.

ACKNOWLEDGMENTS

We would like to thank Ed Massucco and Rodney Ebinhausen for their assistance in this study.

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Table 1. Proportional Stock Density (80% confidence intervals) of Black Crappie assessed in Highland Lake 2014.

Water body	Sample Date	Lower CI 80%	PSD	Upper CI 80%	≥ Quality Size	≥ Stock Size
Highland Lake	May 2014	75	77	80	388	501

Table 2. Sample size, mean relative weight value and one standard deviation by length category for Black Crappie assessed in Highland Lake 2014.

		Total Length Interval (mm)											
		Stock			Quality			Preferred			Memorable		
	Sample	130-199			200-249			250-299			300-379		
Water body	Date	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD
Highland Lake	May 2014	105	97.0	83.3	242	89.1	4.8	56	86.0	4.6	6	80.3	5.9
Statewide average	1997-2011	25[a]	97.6	6.5	28[a]	98.6	13.1	27[a]	89.3	4.8	10[a]	92.5	2.5

[a.] *n* represents the number of waterbodies (some waterbodies provided more than one sample)

Table 3. Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient and age at quality size for Black Crappie in Highland Lake 2014.

Water body	Sample Year(s)	Species	Maximum age used for back-calculations	Mean back-calculated length (mm) at age						Number of fish aged		R^{2b}	Age at quality size 200 mm
				1	2	3	4	5	6	≥1	5-6		
Highland Lake	2014	BC	6	76	134	186	222	238	257	60	6	0.99	3.45

b. Correlation coefficient for logarithmic trendline.

Table 4. Sample size, mean relative weight value and one standard deviation by length category for White Perch assessed in Highland Lake 2014.

		Total Length Interval (mm)											
		Stock			Quality			Preferred			Memorable		
	Sample	130-199			200-249			250-299			300-379		
Waterbody	Date	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD
Highland Lake	May 2014	-	-	-	7	90.6	5.4	37	90.1	4.5	1	85.4	-
Statewide average	1997-2011	14[a]	81.6	7.1	21[a]	82.5	6.9	19[a]	84.1	5.3	7[a]	86.1	5.5

[a.] n represents the number of waterbodies (some waterbodies provided more than one sample)

Table 5. Sample size, mean relative weight value and one standard deviation by length category for Largemouth Bass assessed in Highland Lake 2014.

		Total Length Interval (mm)											
		Stock			Quality			Preferred			Memorable		
	Sample	200-299			300-379			380-509			510-629		
Water body	Date	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD
Highland Lake	May 2014	10	83.0	8.5	-	-	-	6	92.6	6.9	1	95.8	-
Statewide average[a]	1997-2005	115[b]	99.1	12.4	118[b]	93.2	8.2	112[b]	93.4	8.5	40[b]	97.3	12.4

[a.] Reprinted from Racine (2006).

[b.] *n* represents the number of waterbodies.

Table 6. Sample size, mean relative weight value and one standard deviation by length category for Smallmouth Bass assessed in Highland Lake 2014.

		Total Length Interval (mm)											
		Stock			Quality			Preferred			Memorable		
	Sample	180-279			280-349			350-429			430-509		
Water body	Date	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD
Highland Lake	May 2014	2	157.4	117.5	2	80.6	4.1	2	85.8	6.6	2	74.2	1.976
Statewide average[a]	1997-2005	48[b]	96.2	8.6	41[b]	90.1	9.2	34[b]	86.9	7.7	14[b]	86.9	8.6

[a.] Reprinted from Racine (2006).

[b.] *n* represents the number of waterbodies.

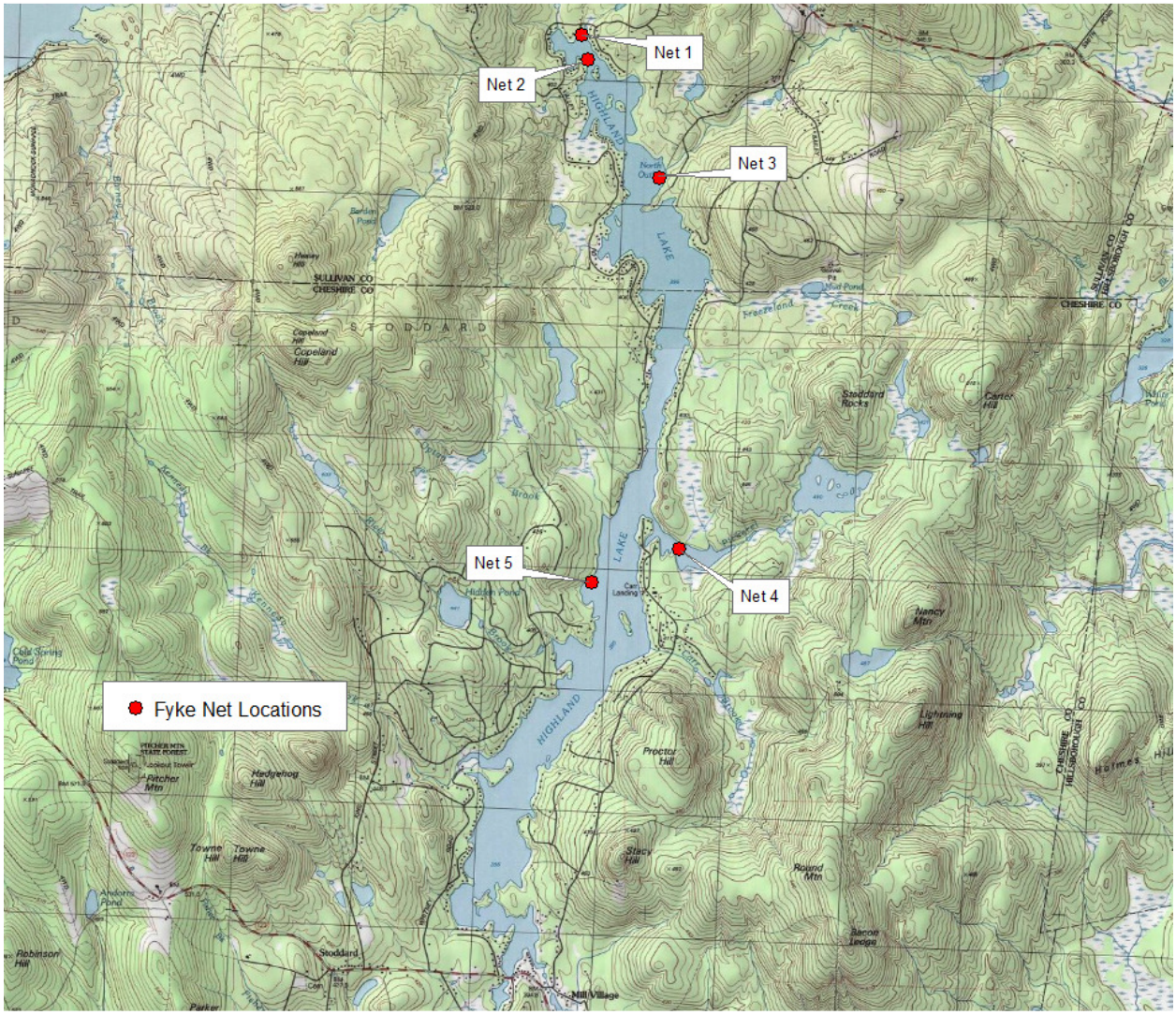
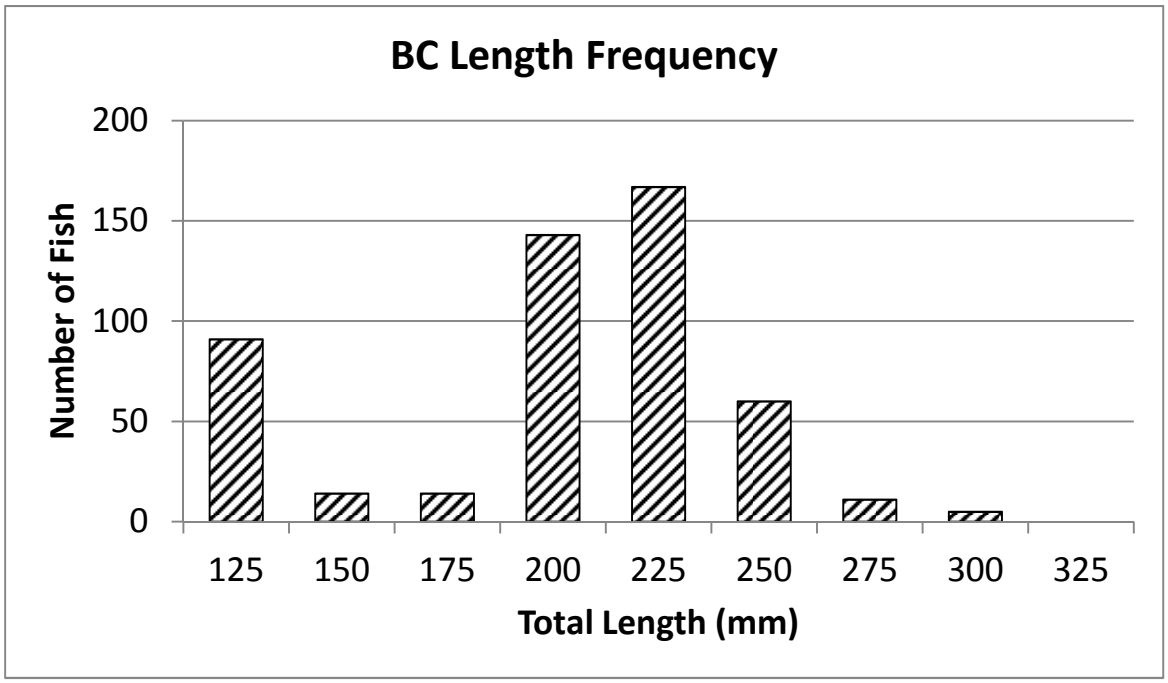


Figure 1. Fyke net locations on Highland Lake 2014.



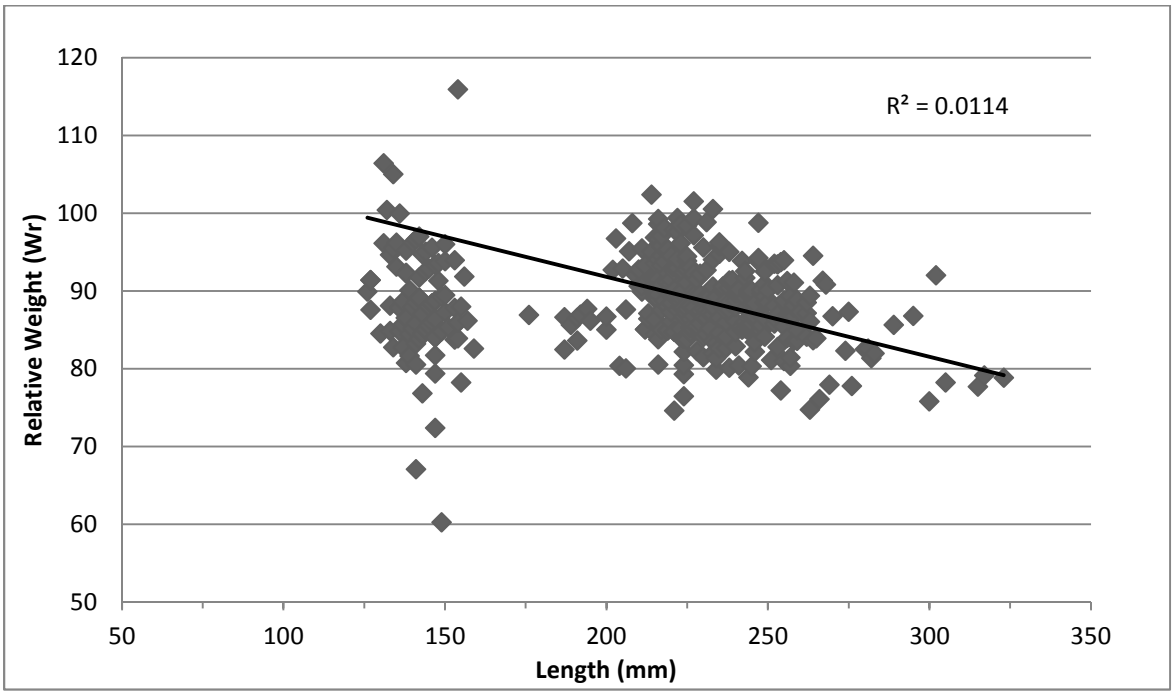


Figure 2. Length-frequency distribution (n = 505) and relationship of total length to relative weight (Wr; n = 409) for Black Crappie assessed in Highland Lake 2014.

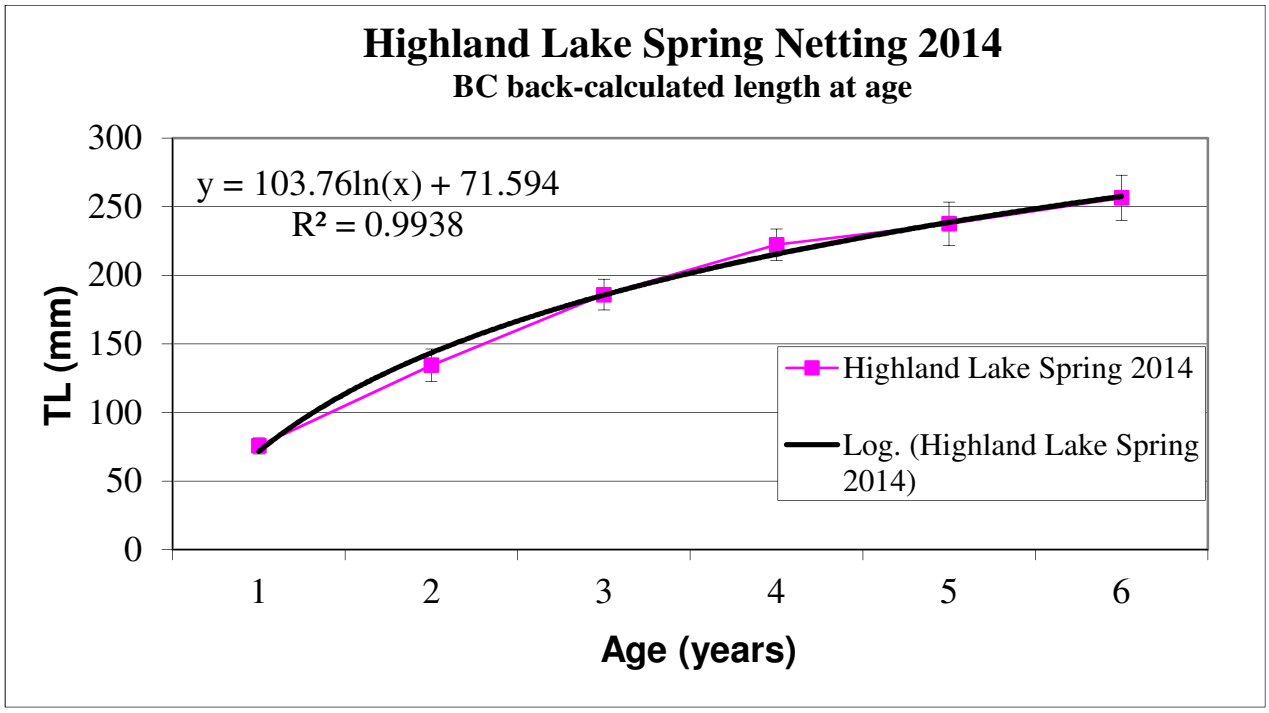


Figure 3. Average back-calculated length at age for Black Crappie sampled in Highland Lake in 2014 (± 1 SD), and corresponding logarithmic trendline and equation.

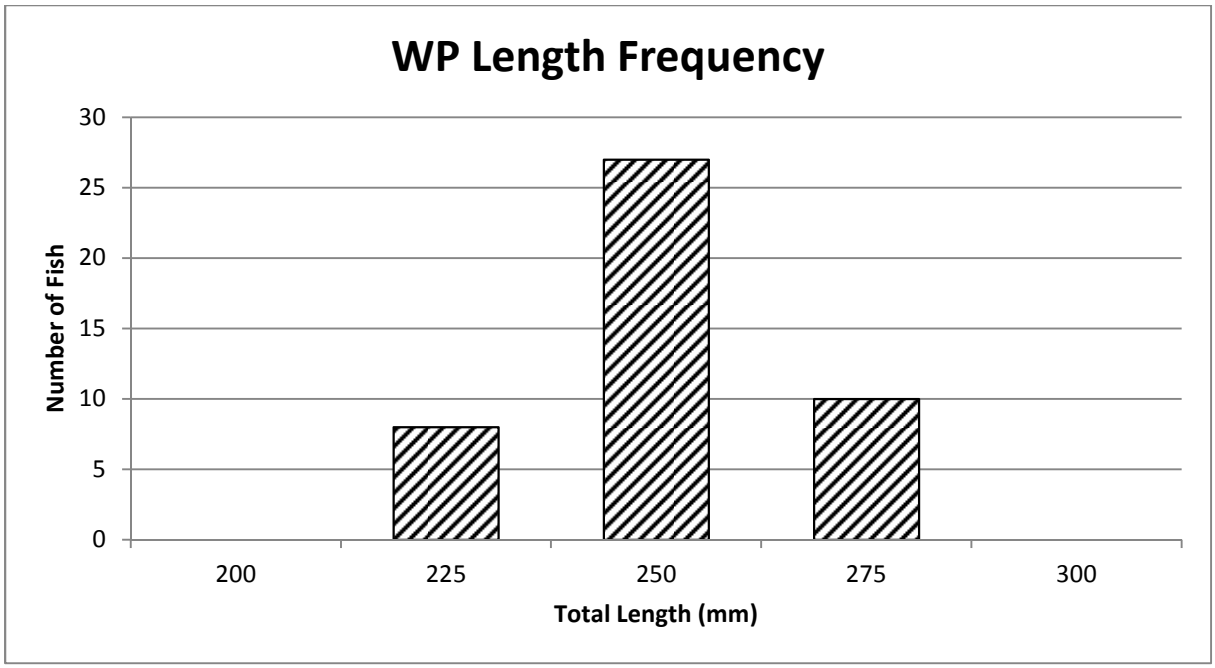


Figure 4. Length frequency distribution (n = 45) for White Perch assessed in Highland Lake 2014.

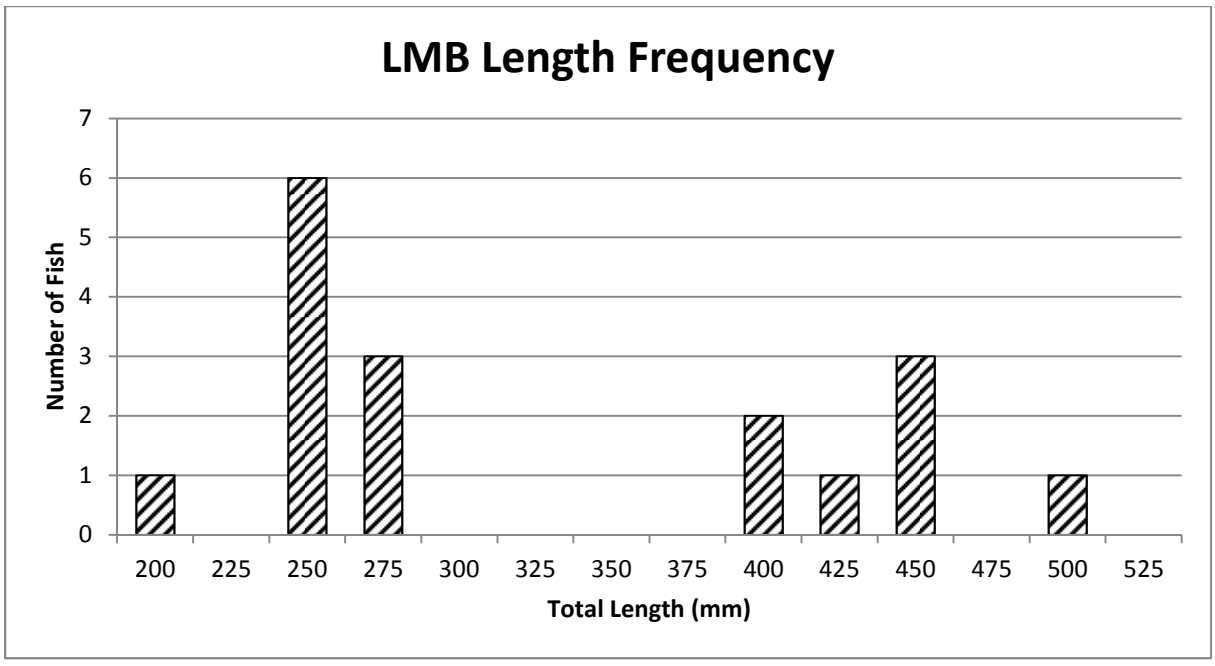


Figure 5. Length frequency distribution (n = 17) for Largemouth Bass assessed in Highland Lake 2014.

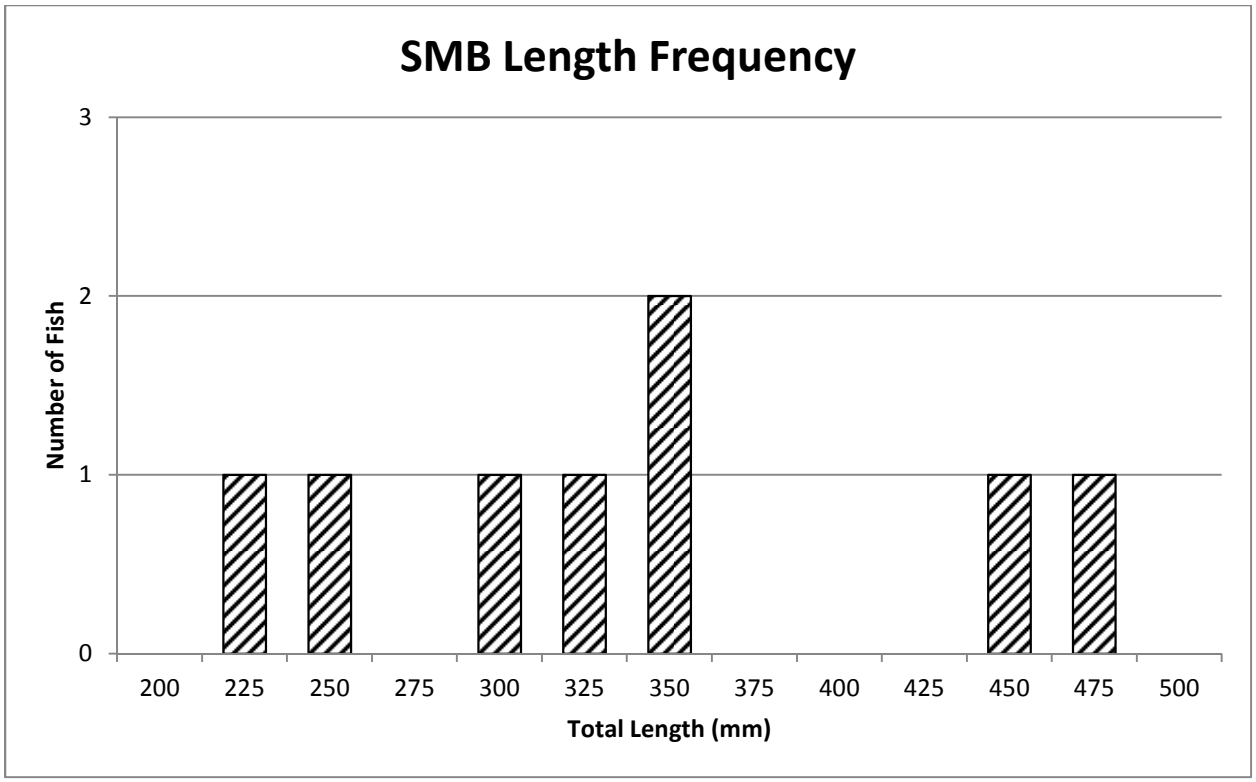


Figure 6. Length frequency distribution (n = 8) for Smallmouth Bass assessed in Highland Lake 2014.