Lake Wylie Largemouth Bass Survey (2015−2017)

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Abstract.—This report summarizes the findings of a Largemouth Bass *Micropterus salmoides* electrofishing survey conducted on the North Carolina portion of Lake Wylie in April 2015−2017. This is the first stock assessment on the North Carolina portion of Lake Wylie and will serve as baseline data for subsequent surveys and monitoring efforts. A total of 687 Largemouth Bass were collected during this survey. Mean catch rates were high ranging from 54.7 fish/h (SE = 6.9) in 2016 to 92.7 fish/h (SE = 12.0) in 2015. Sizes ranged from 84−525 mm TL (mean = 327.8 mm TL; SE = 2.7). PSD-P values ranged from 19 in 2017 to 29 in 2015, and there was a PSD-M value of 1 in 2015; 2016 and 2017 produced zero memorable-length Largemouth Bass. There were no trophy-length (≥630 mm TL) fish collected during this survey. Largemouth Bass condition was moderate; mean W_r ranged from 83.8 (SE = 0.53) in 2016 to 90.9 (SE = 0.48) in 2015. The Largemouth Bass population in Lake Wylie consisted of multiple age classes, and fish up to age 8 were captured. The von Bertalanffy growth curve explained 97% of the variation in mean total length at age. Largemouth Bass approached harvestable size (356 mm TL) in 3.3 years. Total annual mortality was estimated to be 0.36. The Lake Wylie Largemouth Bass population is characterized by high catch rates of stock- to quality-length fish, with average growth, and moderate condition. Mortality is average and multiple age classes exist suggesting suitable recruitment and low levels of exploitation.

Background

Lake Wylie is a 5,440-ha impoundment of the Catawba River in the Piedmont physiographic region bisected by the North Carolina-South Carolina state border (Figure 1). The reservoir provides hydropower and cooling water for three Duke Energy facilities, as well as drinking water for Belmont, NC, and Rock Hill, SC. The lake is classified as eutrophic (NCDENR 2003) and consists of 523 km of shoreline that is heavily developed with residential communities. Historically, the Largemouth Bass *Micropterus salmoides* population in Lake Wylie was not assessed by the North Carolina Wildlife Resources Commission (NCWRC). In 2015, biologists determined there was a need to conduct a thorough stock assessment on the NC portion of Lake Wylie to provide baseline population structure data and anglers with contemporary information about the fishery. This report summarizes the findings of a Largemouth Bass electrofishing survey conducted on Lake Wylie in the spring of 2015−2017.

Methods

Field Collections.—Largemouth Bass were sampled in April 2015−2017 via boat mounted, 120-V pulsed direct current electrofishing equipment (4–6 A). Sample sites consisted of 12, 300-m shoreline transects in the mainstem Catawba and South Fork River arms of Lake Wylie (Figure 1). All Largemouth Bass collected were weighed (g) and measured for total length (TL; mm). In 2016, a subsample of 5 fish per 10-mm size-class were collected for age and growth analyses.

Catch-per-unit-effort.—Abundance was indexed as catch-per-unit-effort (CPUE) of electrofishing time and expressed as number of fish/h.

Size Structure.—Length-frequency histograms were developed to describe patterns in size distribution. Proportional size distributions (PSDs) were calculated following Anderson and Neumann (1996) and Guy et al. (2007). Length classes used for Largemouth Bass were stock (≥200 mm TL), quality (≥300 mm TL), preferred (≥380 mm TL), memorable (≥510 mm TL), and trophy (≥630 mm TL).

Age and Growth.—Sagittal otoliths from a subset of Largemouth Bass collected during the 2016 survey were mounted on fully-frosted, cytological microscope slides using cyanoacrylate glue and sectioned transversely through the dorsoventral plane into two 0.5-mm sections using a Buehler Isomet low-speed diamond wheel saw (Allen et al. 2003). Sections then were mounted onto glass microscope slides using Thermo Shandon synthetic mountant, and annuli were counted using a compound microscope (Hoyer et. al. 1985; Heidinger and Clodfelter 1987). Otoliths were read independently by two readers, and any aging discrepancies between the readers were rectified by jointly reading the otolith. An age-length key was used to expand age information from the subsample of sacrificed fish to the entire sample in 2016 using Fishery Analysis and Modeling Simulator (FAMS; Slipke and Maceina 2014) software.

Annulus formation is due to substantial changes in fish growth (Devries and Frie 1996). Consequently, newly formed annuli of temperate fishes should become apparent in the spring when growth rates dramatically increase following a winter-time lull. Taubert and Tranquilli (1982) found that annulus formation for Largemouth Bass generally occurred between April and June in Lake Sangchris, Illinois. Thus, if fish are collected during the period of annulus formation, managers must ensure that the developing annulus is not omitted during age assignment. Therefore, once all visible annuli were enumerated for each fish in our survey, we assigned an additional year to the annuli count, accounting for annulus formation during the period of capture.

Length- and age-frequency histograms were constructed to describe patterns in age, size, and growth. In addition, total lengths at age were used to estimate growth rate using the von Bertalanffy growth equation (Van Den Avyle and Hayward 1999), which is defined as:

$$L_t = L_\infty \left(1 - e^{-K\,(t\,-\,t_o)}\right),$$

where L_t is the predicted TL at time t, L_∞ is the mean maximum TL of the population, K is the growth parameter, t is time in years, and t_o is the time at which L_t is zero.

Index of Condition.—Relative weight (W_r) values were calculated for Largemouth Bass greater than 150 mm TL using the following equation:

$$W_r = W / W_s \times 100,$$

where W_r is the relative weight, W is the wet weight, and W_s is the length-specific standard weight of an individual. The standard weight equation for Largemouth Bass (Anderson and Neumann 1996) is:

$$\log_{10} W_s = -5.316 + 3.191 \log_{10} TL,$$

Mortality.—Annual mortality rate (*A*) was calculated for Largemouth Bass collected in 2016 using the Chapman-Robson method. Fish < age 2 did not fully recruit to the sampling gear and were omitted from consideration. In addition, age classes that contained fewer than five individuals were not used to estimate *A* (Ricker 1975; Robson and Chapman 1961; Wheeler et al. 2003).

Results and Discussion

Catch-per-unit-effort.—A total of 687 Largemouth Bass were collected during this survey. No other black bass species were observed. Mean CPUE was average to high for piedmont reservoirs, ranging from 54.7 (SE = 6.9) in 2016 to 92.7 (SE = 12.0) in 2015 (Oakley and Dorsey 2013; Table 1).

Size Structure.—Sizes of Largemouth Bass collected during this survey ranged from 84−525 mm TL (mean = 327.8 mm TL; SE = 2.7). Approximately 39% of the Largemouth Bass collected were of harvestable size (≥356 mm TL; Table 1; Figure 2).

Proportional size distributions were high and consistent among years. Approximately 29%, 23%, and 19% of Largemouth Bass were in the preferred (≥380 mm TL) length-class for 2015, 2016, 2017, respectively. One percent were in the memorable (≥510 mm TL) length-class in 2015 and no memorable-length fish were collected in 2016 or 2017. No fish in the trophy (≥630 mm TL) length-class were captured during this survey (Table 1).

Age and Growth.—Largemouth Bass up to age 8 were collected during 2016 when fish were aged, and multiple year classes were observed (Figure 3). The von Bertalanffy growth curve,

$$TL = 404.8 * (1 – e^{(-0.638\ (age+0.008)})$$

explained 97% of the variation in mean total length at age (Figure 4). Largemouth Bass reached harvestable size in 3.3 years, which is within the average range for a NC piedmont reservoir (Oakley and Dorsey 2013). Thirty-seven percent of the total Largemouth Bass catch was age 2 or less, and the age distributions were distributed over multiple age classes, suggesting that recruitment and retention were not a concern during the survey period.

Condition.—Mean W_r values were moderate and ranged from 83.8 (SE = 0.53) in 2016 to 90.9 (SE = 0.48) in 2015 (Figure 5). Mean relative weights for the various length classes were similar among survey years (Table 2).

Mortality.—Total annual mortality (*A*) was estimated to be 0.36. Beamesderfer and North (1995) evaluated 698 populations of Largemouth Bass in North America and found *A* to average 0.35. Therefore, the estimated *A* of 0.36 calculated during this survey is average when compared to Largemouth Bass mortality estimates reported in the literature.

Conclusions

The Lake Wylie Largemouth Bass population is characterized by high catch rates of stock- to quality-length fish, average growth, and moderate condition. Mortality is average, and multiple age classes exist, suggesting suitable recruitment and low levels of exploitation. These data fill a gap that can be utilized during future surveys to evaluate long-term trends in the Lake Wylie Largemouth Bass population in NC.

Management Recommendations

1. Continue to manage the NC portion of Lake Wylie under the current statewide regulation.
2. Sample Largemouth Bass in the spring of 2021.

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TABLE 1.—Results for Largemouth Bass collected during the 2015–2017 electrofishing survey on Lake Wylie, NC. Total catch (N), mean catch-per-unit-effort (CPUE; fish/h) with associated standard error (SE), total length (TL; mm) range, mean TL with associated SE, Proportional size distribution (PSD; ≥300 mm TL), PSD-preferred (PSD-P; ≥380 mm TL), and PSD-memorable (PSD-M; ≥510 mm TL) values are shown.

Year	N	CPUE (SE)	Size Range	Mean Size (SE)	PSD	PSD-P	PSD-M
2015	309	92.7 (12.0)	84–525	325 (4.5)	78	29	1
2016	164	54.7 (6.9)	109–458	334 (5.1)	81	23	0
2017	214	80.3 (8.2)	92–470	326 (4.3)	82	19	0

TABLE 2.—Mean relative weights (W_r) of stock- (≥200 mm TL), quality- (PSD; ≥300), preferred- (PSD-P; ≥380), and memorable- (PSD-M; ≥510 mm TL) length Largemouth Bass with associated standard errors collected during the 2015–2017 electrofishing survey, Lake Wylie, NC.

Year	*Wr* Stock	*Wr* PSD	*Wr* PSD-P	*Wr* PSD-M
2015	91(.4)	92(.5)	93(.8)	85(6.0)
2016	84(.5)	85(.6)	85(1.2)	
2017	87(1.0)	87(.6)	84(.9)	

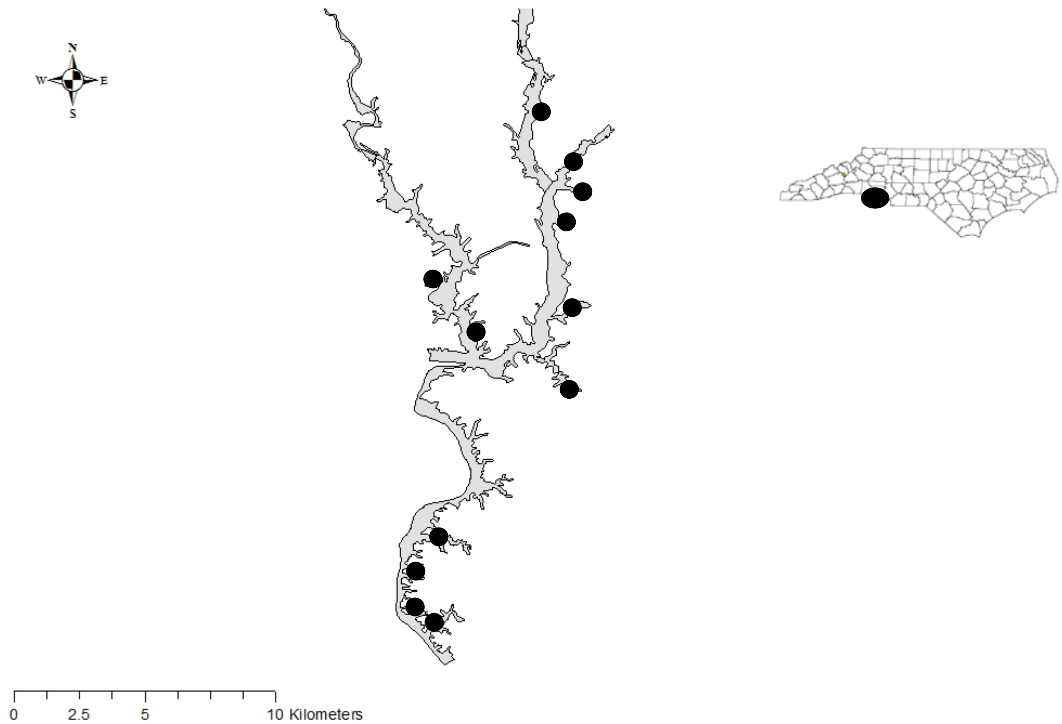

FIGURE 1.—Map of Lake Wylie, North Carolina, and Largemouth Bass 2015–2017 electrofishing sampling locations (dark dots).

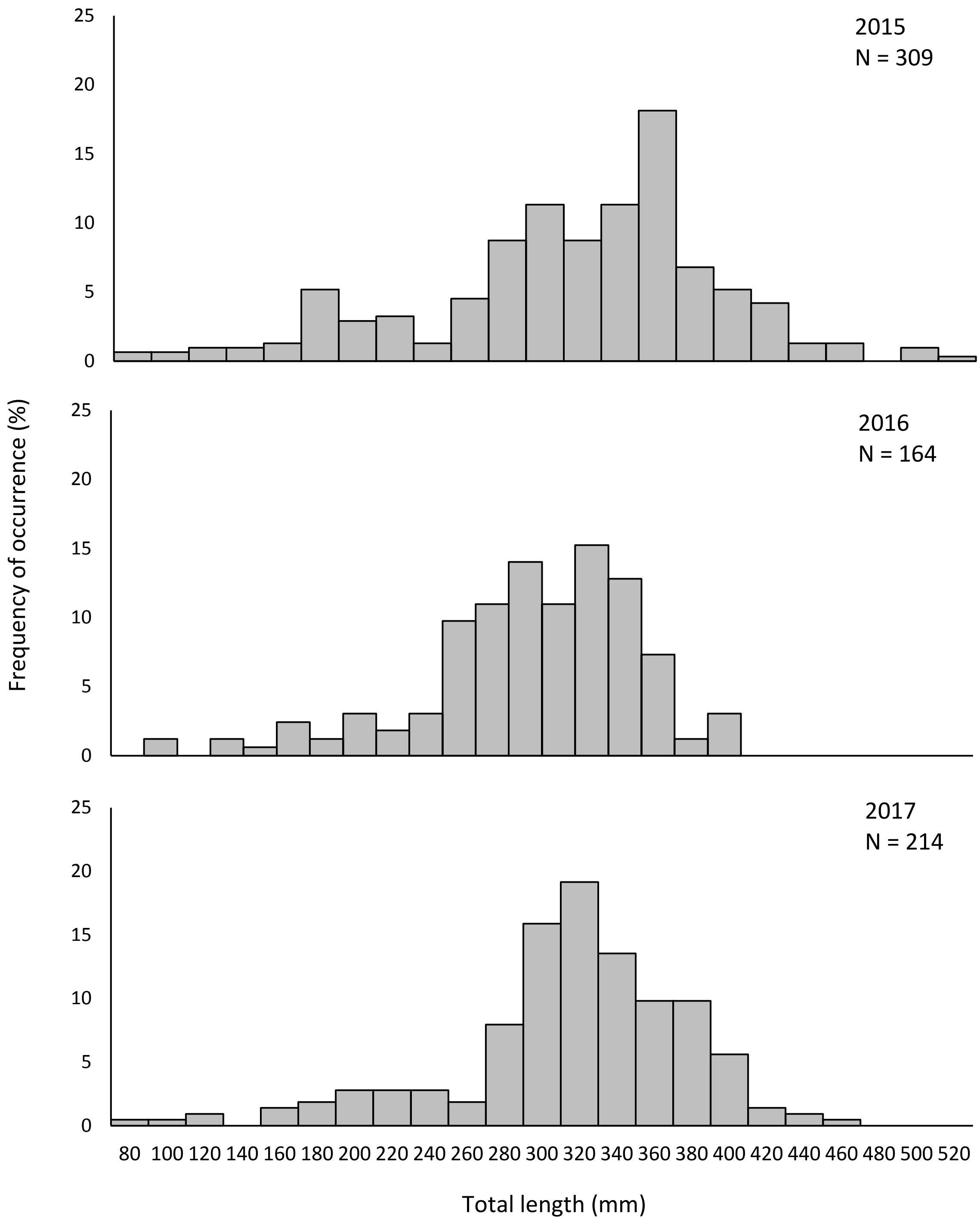

FIGURE 2.—Length-frequency distributions of Largemouth Bass collected during the 2015–2017 electrofishing survey, Lake Wylie, NC. Fish are grouped in 20-mm size classes.

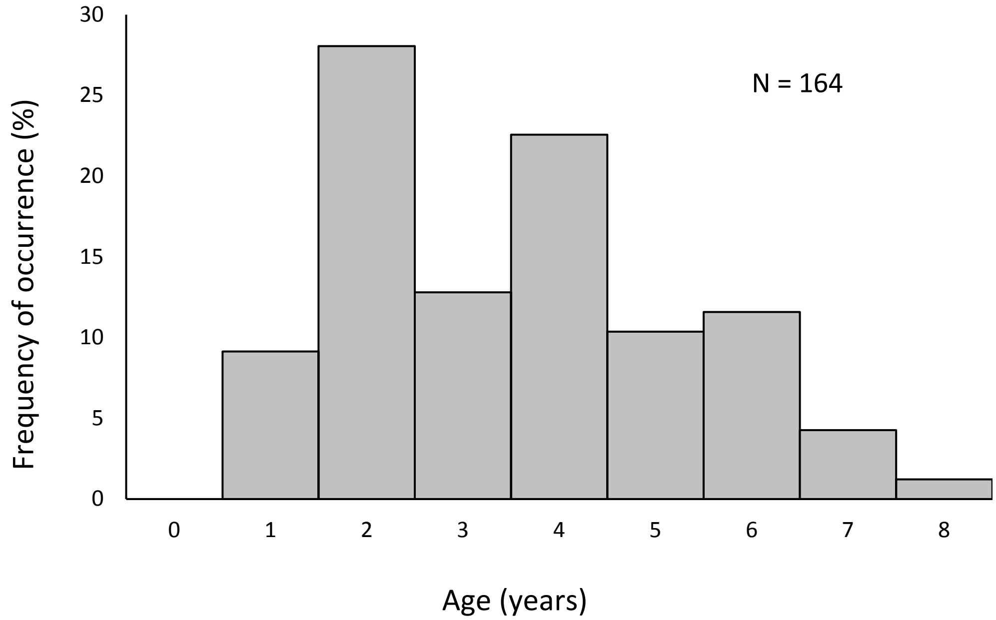

FIGURE 3.—Age-frequency distributions of Largemouth Bass collected during the 2015–2017 electrofishing survey, Lake Wylie, NC.

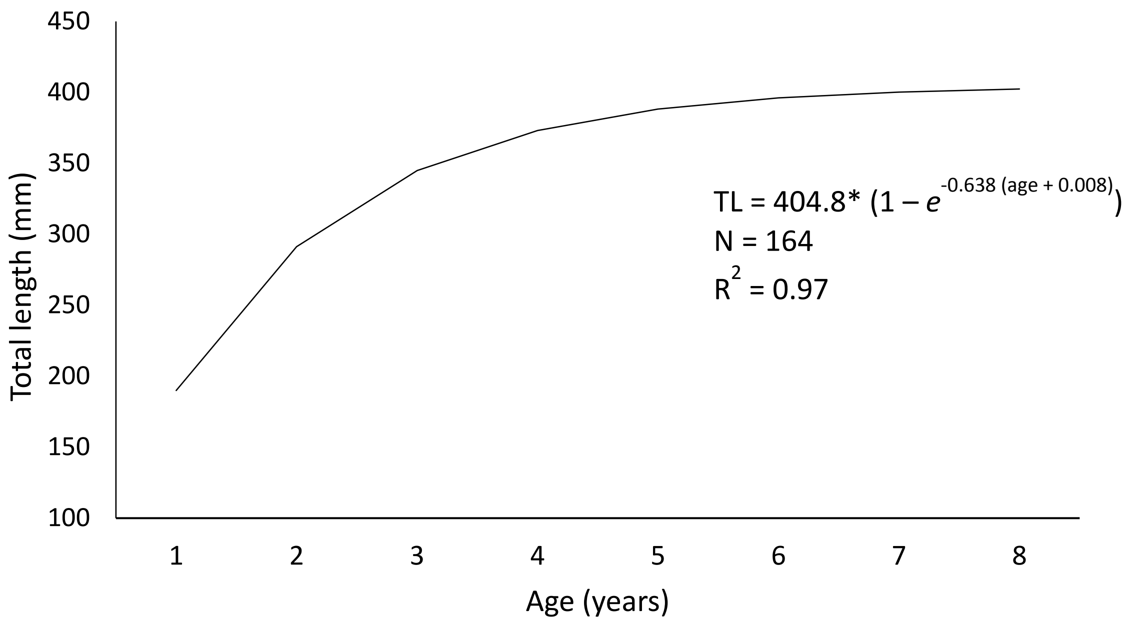

FIGURE 4.—von Bertalanffy growth curve of Largemouth Bass collected during the 2015–2017 electrofishing survey, Lake Wylie, NC.

FIGURE 5.—Relative weight (W_r) values for Largemouth Bass collected during the 2015−2017 electrofishing survey, Lake Wylie, North Carolina.