W. KERR SCOTT RESERVOIR BLACK BASS SURVEY, 2011

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Abstract.— Boat mounted electrofishing gear was used to sample the black bass community of W. Kerr Scott Reservoir during the spring of 2011. The W. Kerr Scott Reservoir black bass community consists primarily of Largemouth Bass *Micropterus salmoides* and Spotted Bass *M. Punctulatus*, although a small number of Smallmouth Bass *M. Dolomieu* are also present. We collected 168 Largemouth Bass, 133 Spotted Bass, one Smallmouth Bass, and three bass identified as Spotted Bass x Smallmouth Bass hybrids in 5.1 hours of electrofishing. Total black bass CPUE was 61 fish/hour. For Largemouth Bass, Spotted Bass, and Smallmouth Bass (including Smallmouth Bass x Spotted Bass hybrids), CPUE values were 33 (SE = 3.9), 27 (SE = 3.0), and 0.8 (SE = 0.4) fish/hour, in that order. Largemouth Bass ranged in length from 112 to 557 mm, with values for PSD and PSD-M being higher than during any previous surveys. Spotted Bass ranged in length from 98 to 434 mm, with size-structure indices being within the range observed during previous surveys. Relative weights of Largemouth and Spotted Bass averaged 91 and 90, respectively, and increased in a linear fashion as total length increased for both species. Ages of Largemouth Bass ranged from 1 to 13 while Spotted Bass ages ranged from 1 to 9. Survival of both species appeared to be high, with total annual mortality rates of 22% for Largemouth Bass and 33% for Spotted Bass. Largemouth Bass grew faster than Spotted Bass at all ages, with Largemouth Bass generally attaining harvestable size (354 mm) by age 4 and Spotted Bass reaching harvestable size at age 6.

W. Kerr Scott Reservoir was impounded in 1962 when the U.S. Army Corps of Engineers built W. Kerr Scott Dam on the Yadkin River west of Wilkesboro and North Wilkesboro, North Carolina. The primary purpose of the dam is flood control and it was built in response to major floods in 1886, 1916, and 1940 that caused significant damage in Wilkesboro and downstream communities. Other uses include low-flow augmentation and recreation. Covering 597 hectares, the impoundment has an average depth of 11.7 meters and its trophic state varies between oligotrophic and mesotrophic. The primary black bass species in W. Kerr Scott Reservoir are Largemouth Bass *Micropterus salmoides* and Spotted Bass *M. Punctulatus.* Smallmouth Bass *M. dolomieu* are also present, but not in sufficient numbers to support a targeted fishery. Additional sport fisheries include those for Striped Bass *Morone saxatilis* and Hybrid Striped Bass *M. chrysops x M. saxatilis*, crappie *Pomoxis spp*., sunfish *Lepomis spp*., and several species of catfishes *Ictalurus, Pylodictis*, and *Ameiurus spp*.

Largemouth Bass were initially the primary black bass species present in the reservoir. Between 1976 and 1979, over 14,000 Spotted Bass fingerlings were stocked into W. Kerr Scott Reservoir in hopes of providing an additional sport fishery. Little targeted effort had been directed at assessing the reservoir's Largemouth Bass population prior to the introduction of Spotted Bass, due largely to the lack of electrofishing equipment in the region. Shortly after stocking Spotted Bass in the reservoir, survey effort on the black bass populations of WKS increased. In 1980, Spotted Bass reproduction was documented in the reservoir (Mickey 1980) and soon after, interest arose in stocking them into other mountain reservoirs. Beginning in the late-1980's, further studies were conducted to evaluate the contribution of Spotted Bass to the fishery and to determine what impacts they might be having on the Largemouth Bass population, with the minimum length limit for Spotted Bass subsequently being removed as a result (Simpson et al. 1988). In the early-to-mid 1990's, a series of surveys were conducted to evaluate the effects of the minimum length limit removal on Spotted Bass and to compare the accuracy of scales and otoliths in age determination (Buckmeier 1997), and routine monitoring surveys to assess the status of the black bass fishery were conducted in 2000 and 2001 (Hodges 2002).

Historically, there was no standardization of methods used during electrofishing surveys at W. Kerr Scott Reservoir. Samples were collected during multiple seasons (spring and fall) and times of day (night and day), with no consistency in site selection. Beginning in 1997, twenty fixed sites encompassing a representative variety of substrate types and depths were established throughout the lake, and these same sites were used in the 2000–2001 surveys. Additionally, the decision was made to discontinue night sampling during future surveys following the 2001 survey after analyses of previous results suggested that there was no discernable difference between daytime and nighttime catch rates.

Given the length of time that had passed since the 2000–2001 surveys, follow up surveys of the W. Kerr Scott black bass community were carried out in 2011. This report summarizes the

findings of the 2011 survey and provides updated data on the relative abundance, size structure, condition, age structure and growth rates of Largemouth and Spotted Bass in W. Kerr Scott Reservoir.

Methods

Boat-mounted electrofishing gear was used to collect black bass from 20 fixed transects throughout W. Kerr Scott Reservoir during daylight hours on April 28 – May 4, 2011. Analysis of site-specific catch data between 1997 and 2001 revealed 6 sites with consistently poor catch rates. To ensure that sample sizes were large enough to permit meaningful analysis, sampling at these sites was discontinued and 6 new sites with higher quality habitat were selected to replace them during the 2011 survey. All transects were 300 m in length and were evenly distributed throughout the lake (Figure 1). Electrofishing settings of 1000 V, 4 A, and 120 pulses per second were used throughout the study. All black bass collected were identified to species (including hybrids) and measured for total length (mm) and weight (g). Catch per unit effort (CPUE) was indexed as the number of bass collected per hour of electrofishing time. Length distribution histograms were constructed and size structure indices were calculated. The lengths for stock, quality, preferred, and memorable-sized Largemouth and Spotted Bass were those proposed by Gabelhouse (1984) and refined by Guy et al. (2007). Relative weights for Largemouth and Spotted Bass were computed using the equations of Wege and Anderson (1978) and Wiens et al. (1996).

Sagittal otoliths were removed from a randomly selected sample of black bass for age determination. Otoliths from fish ≤ 3 years old were submerged in a shallow dish of water and read in whole view using a dissecting microscope. For fish > 3 years old, otoliths were prepared for reading by breaking them in half perpendicular to their longest axis and polishing the broken end using 320–400 grit sandpaper. The otolith section was then submerged in a shallow dish of water, with the unbroken end embedded in a layer of clay lining the bottom of the dish. The otolith section was illuminated from the side with a fiber optic light and read under a dissecting microscope. Otoliths were read independently by two readers, and discrepancies in annuli counts between readers were rectified at a joint reading. No age was assigned in situations where discrepancies could not be rectified after a joint reading.

The reported age of fish in this survey is not always equal to the number of annuli that were present on otoliths. Previous work in Illinois has shown that annulus formation in Largemouth Bass occurs between April and June (Taubert and Tranquilli 1982). For most fish collected in this survey, the annulus for the year in which they were collected had not yet begun to form and there was significant growth between the last annulus and the otolith radius. In these cases, fish were assigned an age equal to the number of annuli plus one since annulus formation was imminent. For all fish aged in this survey, it was assumed that length at age at

time of capture was approximately equal to true length at age since the survey coincided with the period of annulus formation.

Age distribution histograms were constructed and mean length at age was determined for each year class. Since the subsample of fish kept for age determination was randomly selected, it was not necessary to use an age-length key to determine overall age structure or mean length at age. Total annual mortality rates (A) were calculated for Largemouth and Spotted Bass via unweighted catch curve regression.

Results and Discussion

Abundance

We collected 168 Largemouth Bass, 133 Spotted Bass, one Smallmouth Bass, and three bass identified as Smallmouth Bass x Spotted Bass hybrids in 5.1 hours of electrofishing. Total black bass CPUE was 61 fish/hour. For Largemouth Bass, Spotted Bass, and Smallmouth Bass (including Smallmouth Bass x Spotted Bass hybrids), CPUE values were 33 (SE = 3.9), 27 (SE = 3.0), and 0.8 (SE = 0.4) fish/hour, in that order. Catch rates for all black bass species combined were similar to the range of values (39-60 fish/hour) obtained in 2004-06 from Lake James, the only other lake in the area with multiple species of black bass (Rash 2006).

Catch rates of Largemouth Bass were the highest ever obtained at W. Kerr Scott Reservoir. The highest catch rate previously observed was obtained in 1996 when 30 Largemouth Bass per hour were collected, and catch rates for all surveys conducted between 1989 and 2001 have only averaged 22 fish/hour (Hodges 2002). Spotted Bass catch rates were slightly lower than the historical average of 31 fish/hour collected between 1989 and 2001. Interestingly, this is the first time since springtime electrofishing surveys began that Largemouth Bass catch rates exceeded those of Spotted Bass. It is not clear if this represents an actual shift in species ratios within the lake or if it is just an artifact of sampling conditions during this survey.

Size Structure

Largemouth Bass captured during this survey ranged in length from 112 to 557 mm. The length-frequency histogram was multi-modal with fish being well distributed throughout the entire range of lengths collected (Figure 2). As noted in previous surveys, Largemouth Bass ≤ 200 mm are not always collected with electrofishing gear in W. Kerr Scott Reservoir (Hodges 2002). However, 45 fish in this size range were collected in 2011. Additionally, more fish >500 mm in length (n = 18) were collected in this survey than in previous years, with at least one fish >500 mm being collected from 13 of the 20 sites sampled.

PSD, PSD-P, and PSD-M values for Largemouth Bass were 82, 54, and 13, respectively. PSD and PSD-M values were the highest on record in W. Kerr Scott Reservoir, with PSD-P being

second only to the value of 61 obtained in 1997. While the PSD value obtained during this survey is higher than what is considered ideal, it is similar to values obtained during 1997 (77) and 2001 (74). In comparison to stock indices from recent surveys of Lake James and Lookout Shoals Lake, PSD was similar between lakes while PSD-M was substantially higher in W. Kerr Scott Reservoir (Hining 2014; Wood 2013).

Spotted Bass captured during this survey ranged in length from 98 to 434 mm with most fish being <300 mm in length (Figure 2). PSD, PSD-P, and PSD-M values were 36, 16, and 1, respectively. PSD values were lower than those obtained in 2000 (44) or 2001 (49). However, total numbers of quality sized Spotted Bass collected were similar among all three surveys and the lower PSD value in 2011 would appear to be related to the higher number of stock-sized fish that were collected in 2011 relative to the earlier surveys.

Based on data collected during previous surveys, Spotted Bass size structure does not appear to have been affected by changes in size limits that have occurred over time. Spotted Bass in W. Kerr Scott Reservoir were initially managed with the default 305-mm (12-inch) minimum size limit with a 2-fish exception that applied statewide to Spotted and Smallmouth Bass. During electrofishing surveys of the W. Kerr Scott black bass community in 1987, few Spotted Bass > 300 mm in length were collected, none of which were > 4 years old, suggesting that growth and survival were poor. Accordingly, the 305-mm minimum size limit was removed in 1990 in an effort to encourage more angler harvest of Spotted Bass. It was hoped that increased harvest would improve body condition and growth rates, and consequently the size structure, of the Spotted Bass population (Simpson et al. 1988). Additional surveys were conducted prior to the implementation of the regulation change in 1989 and 1990 in which greater numbers of quality-sized Spotted Bass were collected than in 1987, suggesting that quality-sized Spotted Bass were more abundant than originally believed (NCWRC unpublished data). The size distributions of Spotted Bass in 1989 and 1990 while the length limit was still in effect were similar to those obtained during subsequent surveys in 1995–1996 and 2000–2001 when no minimum size limit was in place (Hodges 2002; NCWRC unpublished data). Following the 2000–2001 surveys it became apparent that the original justification for removing the 305-mm minimum size limit was flawed and it was reinstated in 2003. Despite the reinstatement of the size limit in 2003, Spotted Bass size distributions from this survey were similar to those obtained between 1995 and 2001 when no size limit was in effect. This suggests that angler harvest rates have not played a role in influencing the size structure of the Spotted Bass population, which is not surprising in light of the low angler harvest rates documented during a 2001 creel survey (NCWRC unpublished data). Subsequent to the current survey and in light of ongoing stock assessment work throughout the region that revealed that growth rates for Spotted and Smallmouth Bass were faster than initially believed, the statewide default regulation for all three black bass species was changed to a 354-mm (14-inch) minimum size limit with a 2-fish exception in 2012. Given the low historical angler harvest rates and the lack

of changes in size structure observed after previous regulation changes, it is not anticipated that the most recent change to a 354-mm minimum size limit will have any effects on the W. Kerr Scott Reservoir Spotted Bass population.

Condition

Relative weights of Largemouth and Spotted Bass averaged 91 and 90, respectively (Figure 3). Relative weights increased in a linear fashion as total length increased for both species, suggesting that forage availability improves as fish size increases. Similar relative weight values and relationships between fish size and body condition have been observed in previous surveys of black bass in W. Kerr Scott Reservoir (Hodges 2002; NCWRC unpublished data). Relative weight values obtained during this survey are slightly lower than those obtained in Lookout Shoals Lake and are similar to those observed in Lake James (Hining 2014; Wood 2013). While relative weight did not consistently increase in relation to fish length in Lookout Shoals Lake, the same positive relationship between fish length and body condition was observed in Lake James.

Age Structure and Mortality

Ages of Largemouth Bass ranged from 1 to 13, with 90% of fish being ≤ 7 years old (Figure 4). The most abundant age class in the survey was age 1, which comprised 23% of the total sample, suggesting that Largemouth Bass are fully recruited to electrofishing gear in W. Kerr Scott Reservoir at this age. Year-class production appears to be relatively consistent, although weaker year classes appear to have been formed in 2009 and 2006. Spotted Bass ranged in age from 1 to 9, with 84% of fish being ≤ 4 years old (Figure 4). Although Spotted Bass appear to be fully recruited to the electrofishing gear used in this survey at age 1, the most abundant age class was age 3, suggesting that an especially strong year class was formed in 2008.

Our ability to compare the age structure of black bass obtained during this survey against historical data is limited. Most previous data on W. Kerr Scott Reservoir black bass age structure came from surveys that used scales to determine fish age (McNaughton 1966; Crowell 1968; Crowell 1971; Mickey 1980; Simpson et al. 1988). Additionally, sampling gear used in these surveys included cove rotenones, gill nets, and electrofishing, with samples being conducted spring through fall. In general, fish > age 5 were rarely collected in these earlier surveys, which can likely be attributed to a combination of the selectivity of the gear being used and the fact that the accuracy of scales in determining fish age is known to be suspect (Beamish and McFarlane 1987; Buckmeier 1996).

Otoliths were collected during a 1996 survey conducted to compare the accuracy of scales and otoliths in Largemouth and Spotted Bass age determination. The range of ages determined using otoliths in the 1996 survey was similar to that from the current survey, with good

numbers of Largemouth and Spotted Bass surviving to ages 7 and 6, respectively (Buckmeier 1996). However, greater proportions of age-1 fish of both species were captured in 2011 than in 1996. Without having age data from other surveys to compare against, it is not clear if more age-1 fish were actually present in 2011 or if they were just more susceptible to the electrofishing gear.

Survival appeared to be high for both Largemouth and Spotted Bass collected during this survey. Total annual mortality was estimated to be 22% for Largemouth Bass and 33% for Spotted Bass, both of which are lower than the nationwide average of 35% reported by Beamesderfer and North (1995). The mortality estimate for Largemouth Bass is similar to that of Lookout Shoals Lake (A = 26%; Hining 2011) and substantially lower than that of Lake James (A = 44%; Wood 2013). Total annual mortality (A) was calculated using ages 1-10 for Largemouth Bass and ages 1-9 for Spotted Bass. It should be noted that the assumption of constant recruitment needed to determine mortality via catch curve regression was not completely met for either species. Although both catch curves did generally descend downward from age one, the descent was interrupted by several year classes that were either stronger or weaker than others. Additional estimates of mortality from future surveys are needed to confirm the accuracy of the estimates obtained using data collected in this survey.

Growth

Largemouth Bass in W. Kerr Scott Reservoir generally attained harvestable size (354 mm) by age 4 while Spotted Bass did not reach harvestable size until age 6. Length at age was greater for Largemouth Bass than for Spotted Bass at all ages (Table 1). Similar to comparisons involving age structure, it is difficult to make meaningful comparisons of growth rates between this survey and most historical surveys. Growth rates for Largemouth Bass in this survey were generally greater than those obtained during earlier surveys using scales (Simpson et al. 1988). However, given that Buckmeier (1996) demonstrated how poorly scales represented true fish age in W. Kerr Scott Reservoir, growth estimates derived using scales are highly suspect and should not be compared directly against otolith-derived estimates. In the 1996 survey comparing otoliths and scales, length at age using otoliths was determined for both Largemouth and Spotted Bass. Growth rate estimates for both species were comparable to those obtained in the current survey, although estimates were only calculated for fish ≤ 4 years old. Overall, growth rates of Largemouth Bass collected during this survey were similar to those from Lake James and Lookout Shoals Lake (Hining 2011; Wood 2013).

Conclusions and Recommendations

1. Catch rates of Largemouth Bass exceeded those of Spotted Bass for the first time since Spotted Bass became established in W. Kerr Scott Reservoir. Future assessments are needed to determine if there has been an actual shift in species

ratios within the lake or if it this was just an artifact of sampling conditions during this survey.

2. Largemouth and Spotted Bass exhibited favorable size distributions and high rates of survival and should continue to be managed with the statewide black bass regulation.
3. In light of how abundant Largemouth and Spotted Bass are in W. Kerr Scott Reservoir, it is surprising that no obvious Spotted Bass x Largemouth Bass hybrids were encountered during this survey, although they have been encountered in low numbers during fall gill net surveys. Several Smallmouth Bass x Spotted Bass hybrids were encountered during this survey despite Smallmouth Bass being an exceedingly rare component of the W. Kerr Scott Reservoir black bass community.
4. Spotted Bass have been introduced into numerous lakes throughout the region in recent years and are hybridizing with Largemouth Bass in some systems. To gain insight into how much hybridization might have occurred in a system where the black bass community has had time to reach equilibrium after the introduction of Spotted Bass, tissue samples for genetic testing should be collected during the next W. Kerr Scott Reservoir black bass community survey.
5. Despite being prevalent historically, no White Perch *Morone Americana* were collected during this survey. Their absence was also noted during a qualitative electrofishing survey in 2008.

Literature Cited

Beamesderfer, R. C. P., and J. A. North. 1995. Growth, natural mortality, and predicted response to fishing for largemouth bass and smallmouth bass populations in North America. North American Journal of Fisheries Management. 15:688–704.

Beamish, R. J. and G. A. McFarlane. 1987. Current trends in age determination methodology. Pages 15-42 *in* R. C. Summerfelt and G. E. Hall, eds. Age and growth of fish. Iowa State University Press, Ames.

Buckmeier, D. L. 1997. Investigation of scales and whole otoliths as aging structures for Largemouth and Spotted Bass. North Carolina Wildlife Resources Commission, Federal Aid in Fish Restoration, Survey Report, Raleigh.

Crowell, T. E. 1968. Study IX: River basin studies, Job IX-D: Effects of impoundment upon upper Yadkin River fishes. North Carolina Wildlife Resources Commission, Federal Aid in Fish Restoration, Survey Report, Raleigh.

Crowell, T. E. 1971. Study IX: River basin studies, Job IX-D: Effects of impoundment upon upper Yadkin River fishes: Final Report. North Carolina Wildlife Resources Commission, Federal Aid in Fish Restoration, Survey Report, Raleigh.

Gabelhouse, D. W., Jr. 1984. A length-categorization system to assess fish stocks. North American Journal of Fisheries Management 4:273–285.

Guy, C. S., R. M. Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional size

distribution (PSD): A further refinement of population size structure index terminology. Fisheries 32 (7):348.

Hining, K. 2011. Lookout Shoals Lake Largemouth Bass Survey, 2008–2010. North Carolina Wildlife Resources Commission, Federal Aid in Fish Restoration, F-24-13, Survey Report, Raleigh.

Hining, K. 2014. Lookout Shoals Lake Largemouth Bass Survey, 2013. North Carolina Wildlife Resources Commission, Federal Aid in Fish Restoration, F-24-13, Survey Report, Raleigh.

Hodges, K. B. 2002. Stock assessments of Largemouth Bass and Spotted Bass in W. Kerr Scott Reservoir, 2000-2001. North Carolina Wildlife Resources Commission, Federal Aid in Fish Restoration, Survey Report, Raleigh.

McNaughton, W. D. 1966. Upper Catawba and Upper Yadkin River River reservoirs: 1965 Surveys. North Carolina Wildlife Resources Commission, Federal Aid in Fish Restoration, Survey report, Raleigh.

Mickey, J. H., Jr. 1980 Preinvertebrate stocking studies on W. Kerr Scott Reservoir. North Carolina Wildlife Resources Commission, Federal Aid in Fish Restoration, Survey report, Raleigh.

Rash, J. 2006. Lake James black bass survey (2004-2006). North Carolina Wildlife Resources Commission, Federal Aid in Fish Restoration, F-24-13, Survey Report, Raleigh.

Simpson, A. J., J. E. Mickey, Jr., and J. C. Borawa. 1988. Investigation of Largemouth and Spotted Bass populations in W. Kerr Scott Reservoir. N.C. Wildlife Resources Commission, Federal Aid Project F-24-12, Raleigh.

Taubert, B. D. and J. A. Tranqulli. 1982. Verification of the formation of annuli in otoliths of Largemouth Bass. Transactions of the American Fisheries Society. 111:531–534.

Wege, G. J., and R. O. Anderson. 1978. Relative weight (Wr): a new index of condition for largemouth bass. Pages 79–91 in G. Novinger and J. Dillard, editors. New approaches to the management of small impoundments. American Fisheries Society, North Central Division, Special Publication 5, Bethesda, Maryland.

Wiens, J. R., C. S. Guy, and M. L. Brown. 1996. A revised standard weight (WS) equation for Spotted Bass, North American Journal of Fisheries Management, 16:958–959.

Wood, C. 2013. Lake James Largemouth Bass survey (2010−2011). North Carolina Wildlife Resources Commission, Federal Aid in Fish Restoration, F-24-13, Survey Report, Raleigh.

TABLE 1.— Mean length at age, with range, standard error (SE), and sample size (n), for W. Kerr Scott Reservoir Largemouth and Spotted Bass, 2011.

	Largemouth Bass				Spotted Bass			
Age	Mean	Range	SE	n	Mean	Range	SE	n
1	159	125–205	3.8	29	126	98-165	3.7	23
2	282	202-466	19.9	13	228	160-300	8.1	21
3	340	260-543	13.3	19	254	200-346	6.6	27
4	370	292-507	13.1	15	319	238-382	16.4	10
5	454	380-530	15.3	9	287	232-362	32.6	4
6	410	252-467	17.1	13	383	331-402	13.2	5
7	447	353-526	14.6	13	368	339-397	29	2
8	465	419-505	14.3	5	405	391-418	13.5	2
9	542			1	434			1
10	495	435-557	23.4	5				
11								
12								
13	455	382-527	72.5	2				

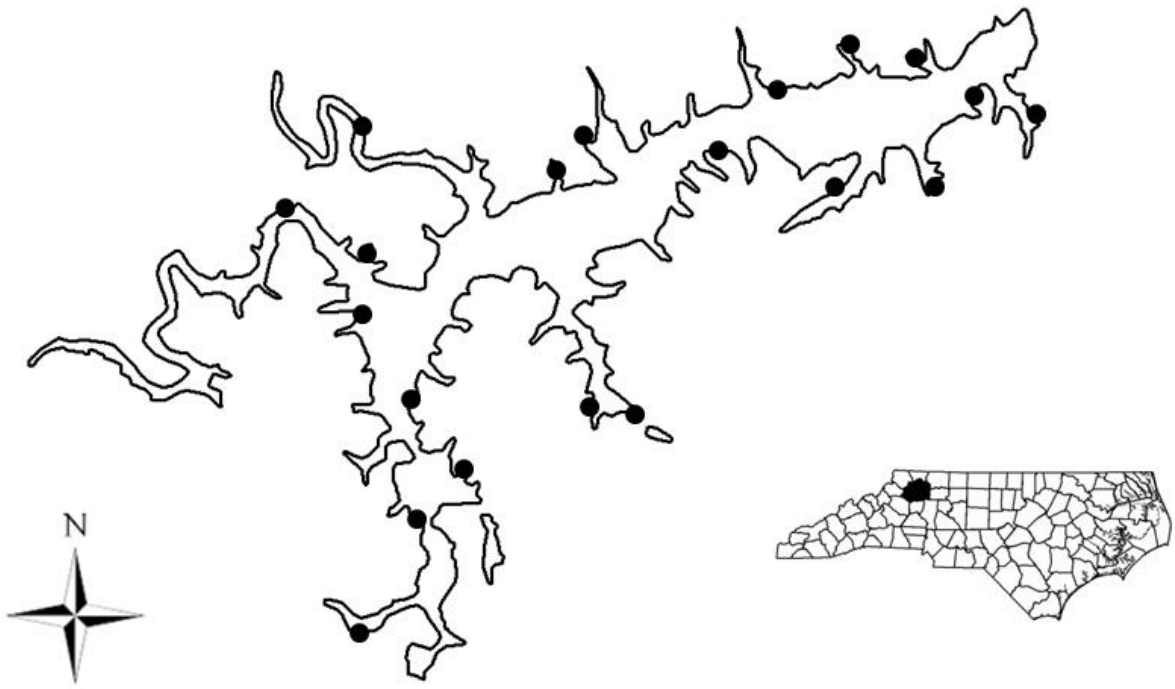

FIGURE 1.—Map of W. Kerr Scott Reservoir, North Carolina, with electrofishing sites (black dots).

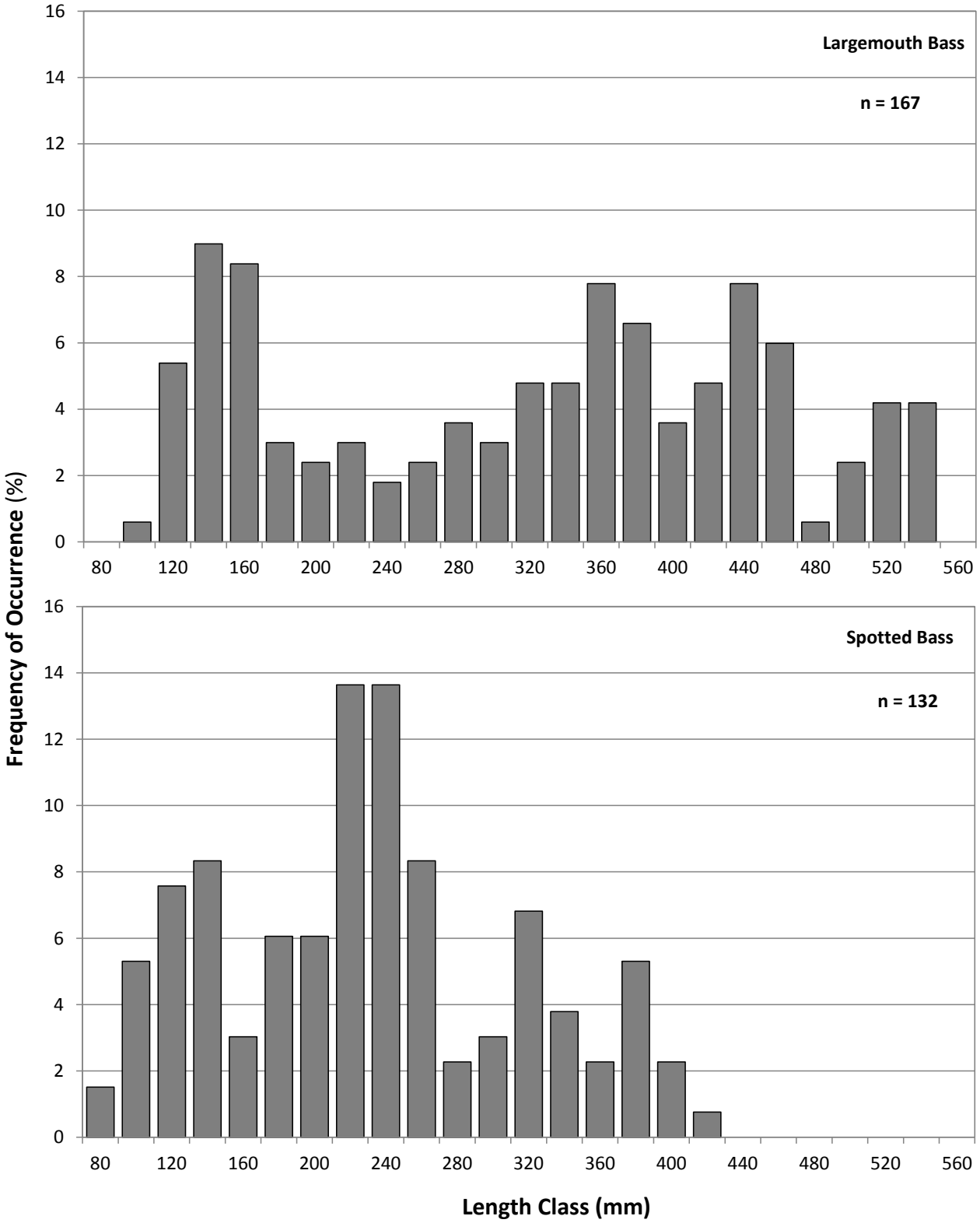

FIGURE 2.— Length-frequency distributions of W. Kerr Scott Reservoir Largemouth and Spotted Bass, 2011.

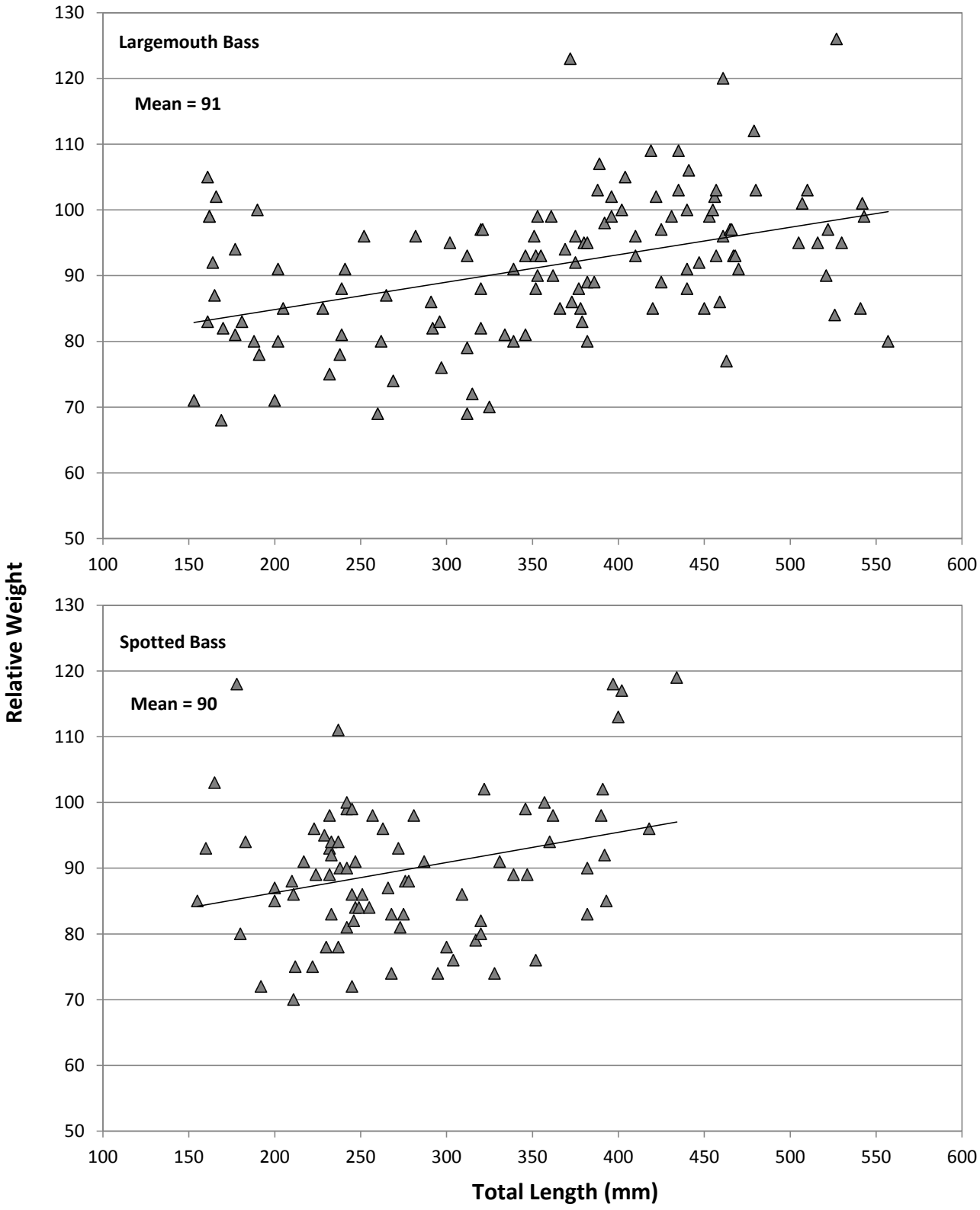

FIGURE 3.— Relative weights of W. Kerr Scott Reservoir Largemouth and Spotted Bass, 2011.

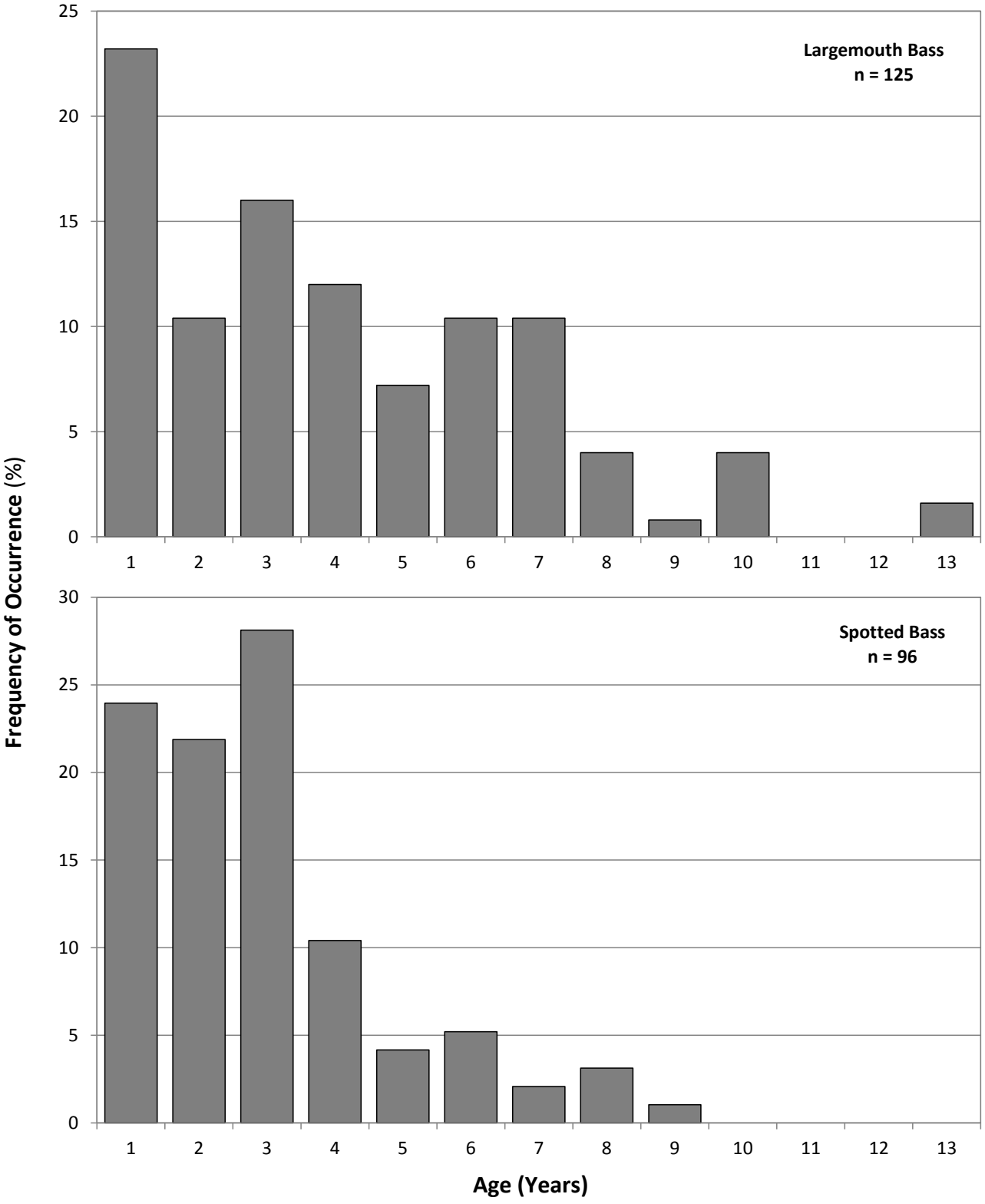

FIGURE 4.— Age-frequency distributions of W. Kerr Scott Reservoir Largemouth and Spotted Bass, 2011.