LAKE JAMES BLACK BASS INVESTIGATION
SURVEY SUMMARY 2005

Mountain Fisheries Investigations

Federal Aid in Fish Restoration Project F-24

Project Type: Survey

Winthrop E. Taylor
District 8 Fisheries Biologist

North Carolina Wildlife Resources Commission
Division of Inland Fisheries
Raleigh, North Carolina

2005


SPORT FISH RESTORATION

Abstract.—This report summarizes the findings of a black bass *Micropterus spp*. shoreline electrofishing survey conducted on the Catawba River arm of Lake James in May 2005. The largemouth *M. salmoides* and smallmouth bass *M. dolomieu* populations in Lake James are spatially segregated based on water quality differences associated with the two impounded river basins. Due to equipment failures, night time survey efforts on the Linville arm were prohibited during the 2005 survey. The 2005 survey was only conducted on the Catawba River arm of Lake James during the day. A total of 136 largemouth bass and 36 smallmouth bass were collected during this survey. Catch rates of largemouth bass (39.2 fish/hour) were higher than smallmouth bass catch rates (9.8 fish/hour). Largemouth bass ranged from 75-521 mm total length compared to 118-512 mm total length for smallmouth bass. Of the largemouth bass collected 35% were in the preferred (>380 mm) and 1% were in the memorable (>510 mm) size class, with no trophy fish collected. Forty-three percent of the smallmouth bass were in the preferred (>350 mm) size class, 20% were in the memorable (>430 mm) size class, and 3% were in the trophy (>510 mm) size class. Mean relative weights of largemouth bass (113) and smallmouth bass (102) were significantly higher than previous sample years. Largemouth bass up to age-13 were found, with the majority of fish ≤ age-5. Smallmouth bass up to age-8 were found, with the majority of fish ≤ age-4. The presence of older black bass age classes suggest that recruitment is fairly consistent. Mortality rates of largemouth bass (40%) and smallmouth bass (31%) were moderate. Largemouth bass reached legal harvestable size (356 mm) by age-4, while smallmouth bass reached legal harvestable size (305 mm) sometime prior to age-3. Overall, the black bass population on the Catawba River arm of Lake James is comprised primarily by stock-sized, relatively fast growing fish in above average condition, which appear to be exploited at low levels. Black bass data will be collected lake wide again in the spring of 2006 and from the Linville arm during the spring of 2007 during a scheduled shoreline electrofishing survey.

Lake James, located in Burke and McDowell counties, is the uppermost reservoir in the Catawba River chain of Duke Power Company lakes. The watershed associated with Lake James is 984 km^2. Lake James was impounded in 1923, covers 2,634 ha at full pool, and has 242 km of shoreline. Average depth is 13.5 m, maximum depth is 43 m, and mean hydraulic retention time is 228 days. Lake James has low alkalinity (9-14 mg/l $CaCO_3$), a pH range of 6.4-7.4, and a typical surface water temperature range of 2-30^o C. The reservoir is classified as oligotrophic and has an average secchi depth of 2.8 m (NCDENR 1998).

Initial black bass *Micropterus* spp. population assessments in Lake James were based on cove rotenone sampling and were inefficient at capturing adult black bass (Brown et al. 1989) which prevented accurate population assessments. In 1989, shoreline electrofishing investigations of the Lake James black bass population were initiated by the NCWRC following a 1987-1988 creel survey which estimated 77% of the black bass were harvested under the 356-mm minimum size limit two fish exemption (Borawa 1989). Catch rates from the 1989-1991 electrofishing surveys were highly variable between years, however the data indicated that recruitment failure and/or over harvest was not impacting black bass populations within Lake James (NCWRC unpublished data). Beginning in 2003, the NCWRC initiated a study to compare day versus nighttime shoreline electrofishing techniques for black bass sampling within three Catawba River reservoirs (Hinning 2004). Based on this initial day versus night electrofishing pilot study, a three year black bass population assessment was initiated on Lake James in the spring of 2004. This report summarizes the findings of a survey conducted on the Catawba River arm of Lake James in the spring of 2005.

Methods

Black bass were collected from 3 May to 4 May, 2005 using boat mounted, 120-V pulsed direct current electrofishing equipment (high voltage setting, 3-4 A). Sample sites consisted of twelve 300-m shoreline transects equally distributed throughout the Catawba River arm of Lake James (Figure 1). The twelve sites located in the Linvile River/ Paddy Creek arm were omitted during the 2005 survey due to night time equipment failures. The Catawba River arm sites were sampled during the day and water temperatures ranged from 15.6-17.8 ºC.

Black bass collected were placed in a plastic bag labeled by site, placed on ice, and returned to the Marion State Fish Hatchery. All black bass collected were identified to species, weighed (g), measured (mm, TL) and sexed. Black bass were considered immature if the gonads were not developed.

Abundance was indexed by catch-per-unit-effort (CPUE) of electrofishing time and expressed as fish per hour. Proportional stock density (PSD) and relative stock densities (RSD) indices were calculated for largemouth *Micropterus salmoides* and *M. dolomieu* independently following Gabelhouse (1984a). Size designations used for largemouth bass were stock (200 mm), quality (300 mm), preferred (380 mm), memorable (510 mm) and trophy (630 mm). Size designations for smallmouth bass were stock (180 mm), quality (280 mm), preferred (350 mm), memorable (430 mm) and trophy (510 mm). Relative weights (Wr) were calculated for largemouth bass >150 mm using the standard weight equations (Ws) of Wedge & Anderson (1978). Wr were calculated for smallmouth bass >150 mm using the Ws equations of Kolander et al. (1993). The Von Bertalanffy growth model was used to estimate growth rates of largemouth and smallmouth bass independently. Unweighted catch curve analysis was used to determine total annual mortality rates for largemouth bass age-2 to age-9 and smallmouth bass age-2 to age-8.

Saggital otoliths were removed from all black bass captured. Otoliths were air-dried for a minimum of 14 days, immersed in water, and read in whole view under a 10X dissecting microscope (Taubert and Tranquilli 1982, Hoyer et al. 1985, Heidinger and Claudfelter 1987). Otoliths aged greater than age-2 in whole view were broken perpendicular to the long axis, polished with 400 grit wet-dry sandpaper, and read under a 10X dissecting scope using a fiber optic light. Otoliths were read independently by two readers. Any aging discrepancies between readings were rectified by jointly reading the otolith. If the age could not be rectified, the age data were not used in further analysis.

Results and Discussion

Largemouth bass:

A total of 136 largemouth bass were collected from the Catawba River arm of Lake James in May 2005. Largemouth mean CPUE for the Catawba River arm was 39.2 fish/hour and is an increase from the 2004 Catawba River arm data set (Taylor 2005a) (Table 1).

Largemouth bass collected ranged from 75-521 mm total length (TL) with the majority of fish in the 275-425 mm size range (Figure 2). Of the largemouth bass collected, 39% were of legal harvestable size (356 mm). The PSD value (78) is above the preferred value range of 40-70%. Of the 136 largemouth bass collected, 35% were in the preferred (>380 mm) size class and 1% were memorable (>510 mm). No trophy (>630 mm) size class fish were obtained. Largemouth bass Wr values for the Catawba River arm of Lake James averaged 113 (Figure 3)

which is a significant increase from the Catawba River arm values seen in 2004 (Taylor 2005a). This increase in condition between years may be attributed to pre or post spawn attributes. Although the sampling dates were similar between years, water temperatures during the 2005 sample were more conducive to pre-spawn fish.

Largemouth bass up to age-13 were collected in 2005 with the majority of fish ≤ age-5 (Figure 4). The presence of these older year classes suggest that recruitment is fairly constant and the population is being exploited at low levels. The overall largemouth bass annual mortality rate was moderate (40%) based on catch curve analysis of age-2 through age-9 fish. Growth rates of largemouth bass up to age-5 are above average for an oligotrophic reservoir, however growth slows dramatically within the older age classes (Figure 5). Largemouth bass reached legal harvestable size (356 mm) by age-4 with some fish reaching their predicted Von Bertalanffy growth model asymptotic maximum length (452 mm) by age-6.

Smallmouth bass:

A total of 36 smallmouth bass were collected from the Catawba River arm of Lake James in May 2005. Smallmouth bass mean CPUE for the Catawba River arm was 9.8 fish/hour and is similar to the 2004 Catawba River arm data set (Taylor 2005a) (Table 1).

Smallmouth bass collected ranged from 118-512 mm total length (TL) with the majority of fish in the 300-400 mm size range (Figure 2). Of the smallmouth bass collected, 81% were of legal harvestable size (305 mm). The PSD value for smallmouth bass was 86. Of the 36 smallmouth bass collected, 43% were in the preferred (>350 mm) size class, 20% were memorable (>430 mm), and 3% were in the trophy (>510 mm) size class. Smallmouth bass Wr values for the Catawba River arm of Lake James averaged 102 (Figure 3) which is a significant increase from the Catawba River arm values seen in 2004 (Taylor 2005a). This increase in condition between years may be attributed to pre or post spawn attributes. Although the sampling dates were similar between years, water temperatures during the 2005 sample were more conducive to pre-spawn fish.

Smallmouth bass up to age-8 were collected in 2005 with the majority of fish ≤ age-4 (Figure 4). The presence of these older year classes suggest that recruitment is fairly consistent and the population is being exploited at low levels. The overall smallmouth bass mortality rate was moderate (31%) based on catch curve analysis of age-2 through age-8 fish. Growth rates of smallmouth bass up to age-4 are above average for an oligotrophic reservoir, however growth slows dramatically within the older age classes (Figure 5). The majority of smallmouth bass reached legal harvestable size (305 mm) prior to age-3 and approached their predicted Von Bertalanffy growth model asymptotic maximum length (552 mm) by age-7.

Conclusions

The spatial segregation between Lake James black bass species associated with differences in water quality between the Catawba River and Linville River/Paddy Creek arms of the lake prevented a complete lake wide comparison between the 2004 and 2005 data sets. The largemouth bass population is primarily confined within the upper nutrient rich portions of the Catawba River arm of Lake James while the smallmouth bass population utilizes the oligotrophic zones throughout Lake James; primarily the Linville River/Paddy Creek arm. The 2005 data set was only used to make comparisons with the 2004 data collected within the Catawba River arm of Lake James.

The 2005 Catawba River arm data set was very similar to the data collected from the Catawba River arm in 2004. There was a significant increase from the Wr values seen in 2004 which may be attributed to pre or post spawn attributes. Although the sampling dates were similar between years, water temperatures during the 2005 sample were more conducive to pre-spawn fish. The black bass populations within the Catawba River arm of Lake James appears to be comprised of multiple year classes represented primarily by stock-sized, relatively fast growing fish, in above average condition.

Recommendations

1) Continue to manage Lake James black bass populations under the current statewide regulation.
2) Sample the black bass population on the Catawba and Paddy Creek/Linville arm again during the spring of 2006.
3) Sample the black bass population on the Paddy Creek/Linville arm at night during the spring of 2007 to compensate for the missing 2005 data set.

References

Borawa, J. C. 1989. Lake James creel survey, 1987-1988. North Carolina Wildlife Resources Commission, Federal Aid in Fish Restoration, F-24-13, Final Report, Raleigh.

Brown, R. J, C. J. Goudreau, and J. C. Borawa. 1989. Evaluation of the fishery resources of Lake James emphasizing walleye management. North Carolina Wildlife Resources Commission, Federal Aid in Fish Restoration, F-24-13, Survey Report, Raleigh.

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

Heidinger, R. C. and K. Clodfelter. 1987. Validity of the otolith for determining age growth of walleye, striped bass, and smallmouth bass in power plant cooling ponds. Pages 241-251 in R. C. Summerfelt and G. E. Hall eds. Age and growth of fish. Iowa State Univ. Press, Ames.

Hinning, K. 2004. Comparison of day and night electrofishing for black bass in three North Carolina reservoirs – survey summary 2003. North Carolina Wildlife Resources Commission, Division of Inland Fisheries, Raleigh.

Hoyer, M. V., J. V. Shireman, and M. J. Maceina. 1985. Use of otoliths to determine age and growth of largemouth bass in Florida. Transactions of the American Fisheries Society 114:307-309.

Kolander, T. D., D. W. Willis, and B. R. Murphy. 1993. Proposed revision of the standard weight (Ws) equation for smallmouth bass. North American Journal of Fisheries Management 13:398-400.

North Carolina Department of Environment and Natural Resources. 1998. Basinwide assessment report: Catawba River basin. 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.

Taylor, W. E. 2005a. Lake James Black Bass Investigation Survey Summary 2004. North Carolina Wildlife Resources Commission, Federal Aid in Fish Restoration, F-24, Final Report, Raleigh.

Wedge, 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.

TABLE 1.—Mean CPUE (fish/hour) of black bass captured during spring electrofishing samples from the Catawba River arm of Lake James, May 2004 and 2005. Values in parenthesis are standard deviations.

Location	All black bass	Largemouth	Smallmouth
Catawba 2004	38.9 (13.3)	28.8 (14.9)	10.1 (9.6)
Catawba 2005	49.0 (19.1)	39.2 (22.7)	9.8 (7.2)

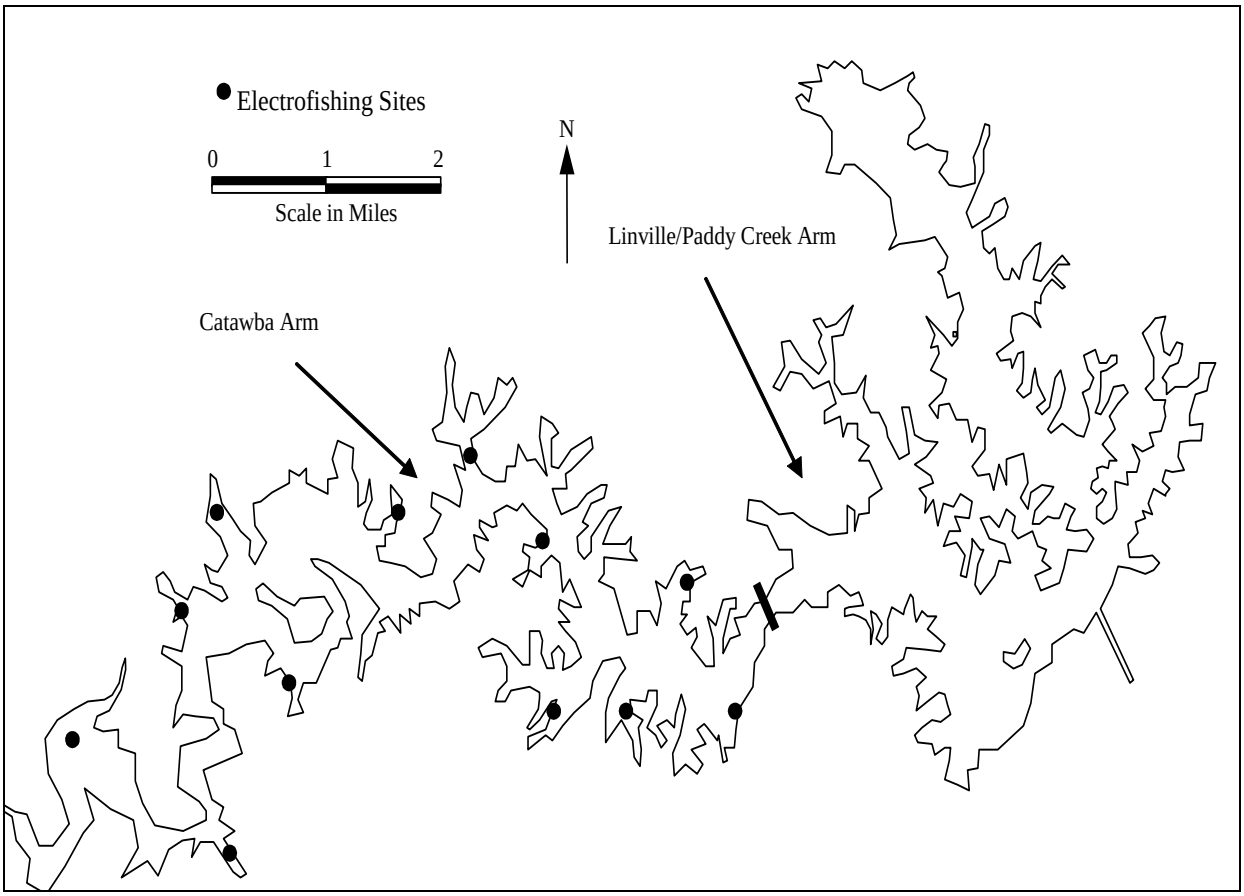
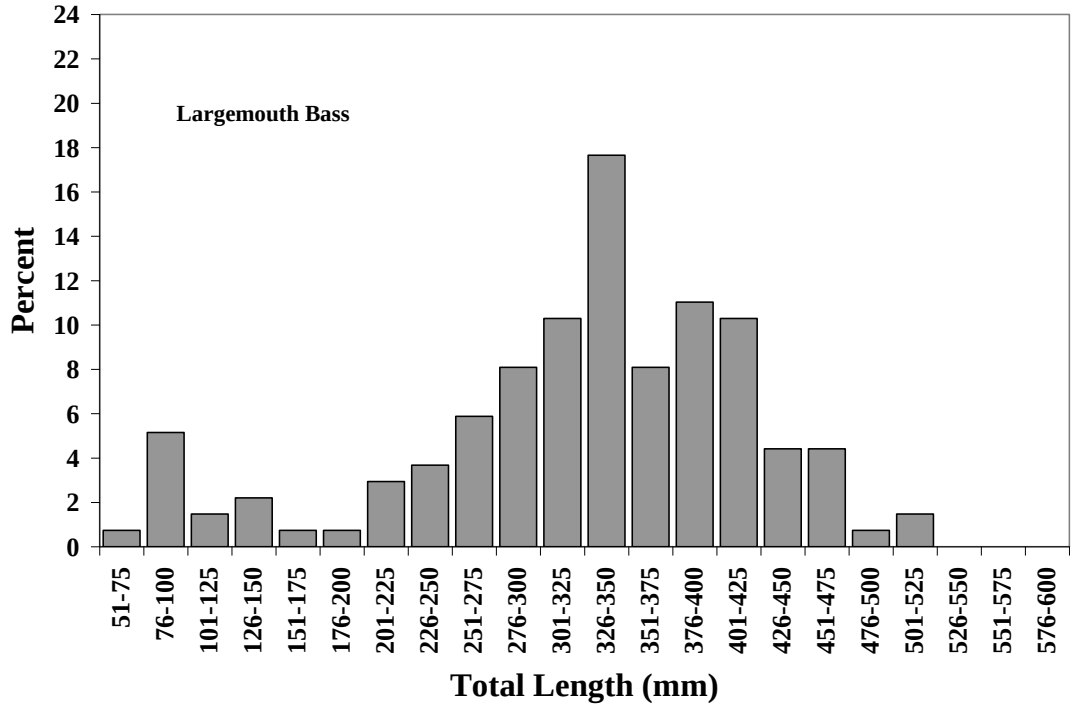


FIGURE 1.—Map of Lake James, Burke and McDowell counties, North Carolina. Catawba and Linville River/Paddy Creek reservoir zones (dark bar) are indicated as well as electrofishing sites (dark dots) on the Catawba River arm of Lake James.



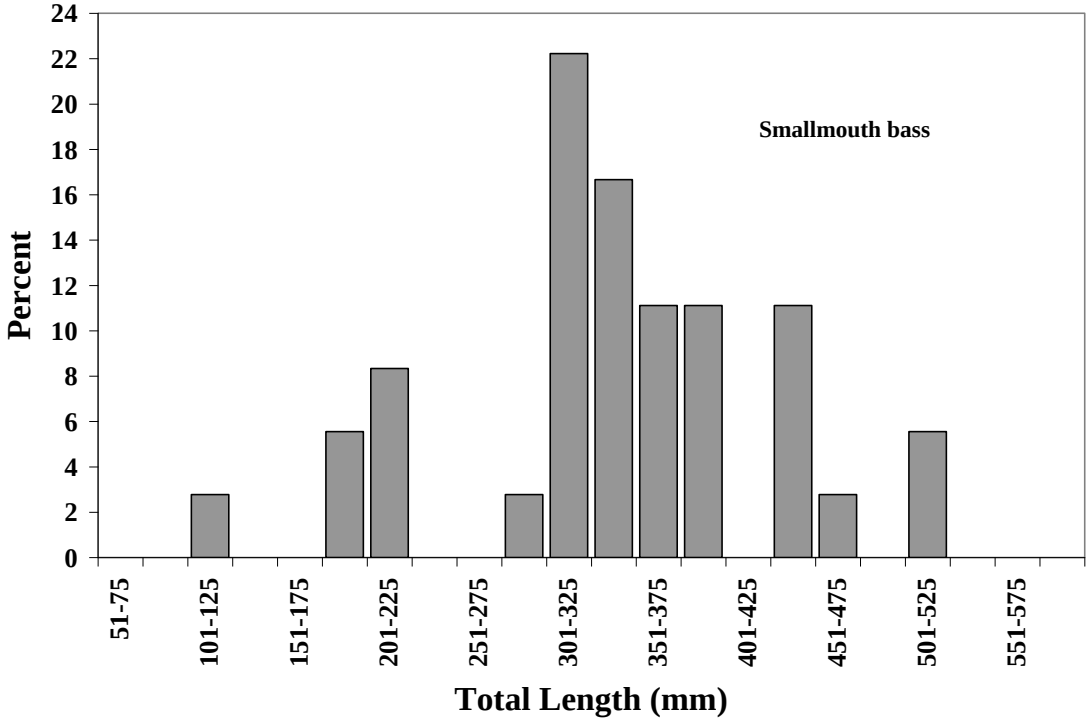
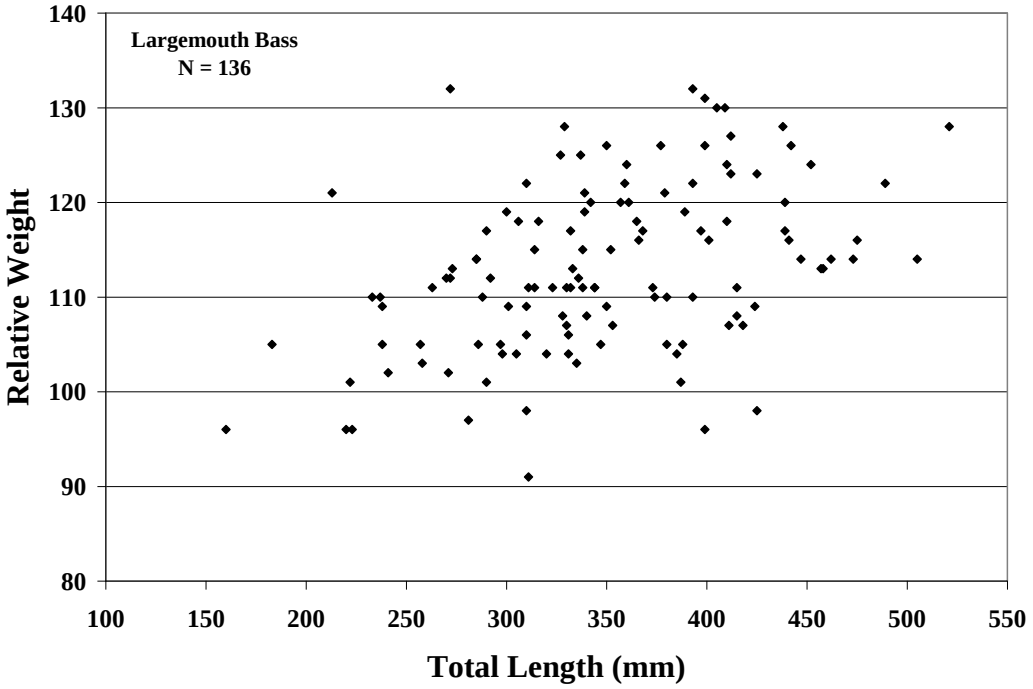


FIGURE 2.—Size structure of largemouth and smallmouth bass captured during spring electrofishing samples from Lake James, 3-4 May 2005.



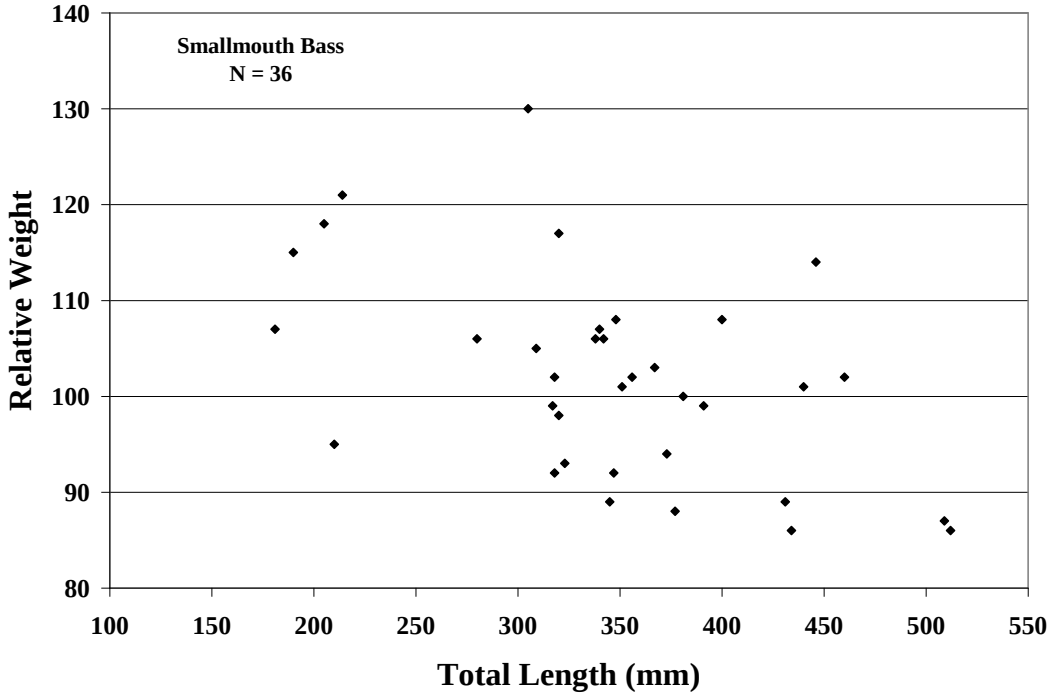


FIGURE 3.—Relative weights of largemouth and smallmouth bass captured during spring electrofishing samples from the Catawba River arm of Lake James, 3-4 May 2005.

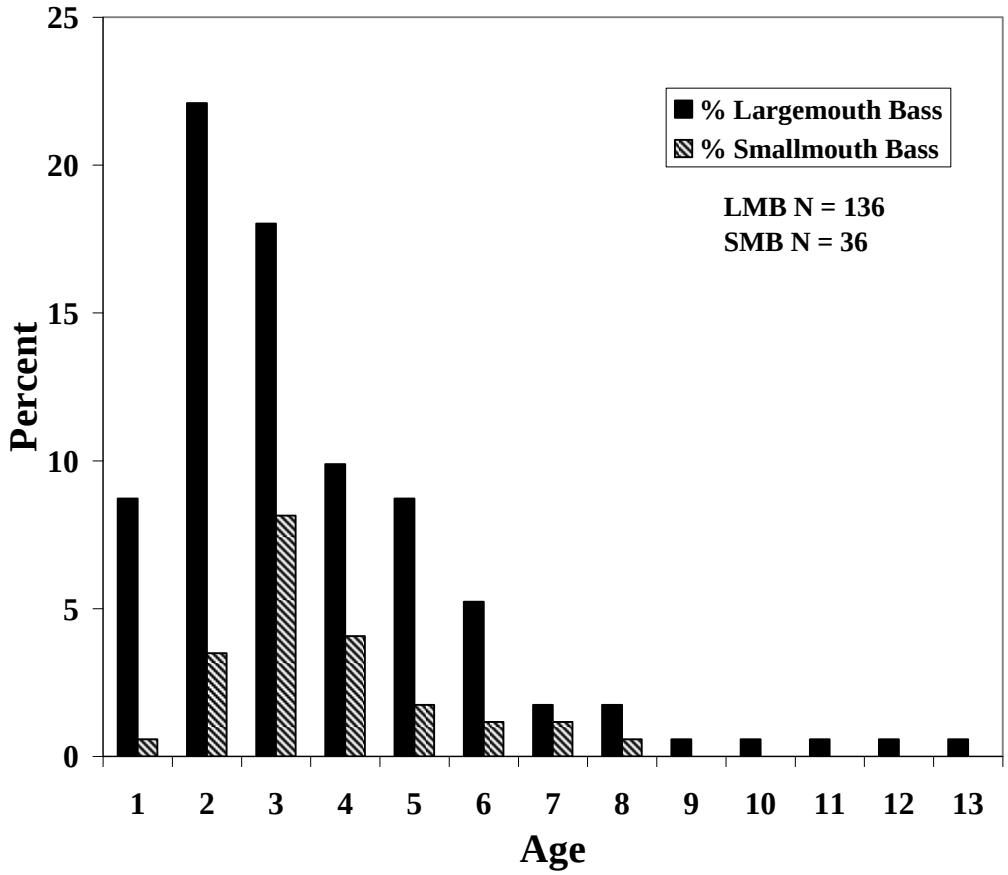


FIGURE 4.—Age distributions of largemouth and smallmouth bass captured during spring electrofishing samples from the Catawba River arm of Lake James, 3-4 May 2005.

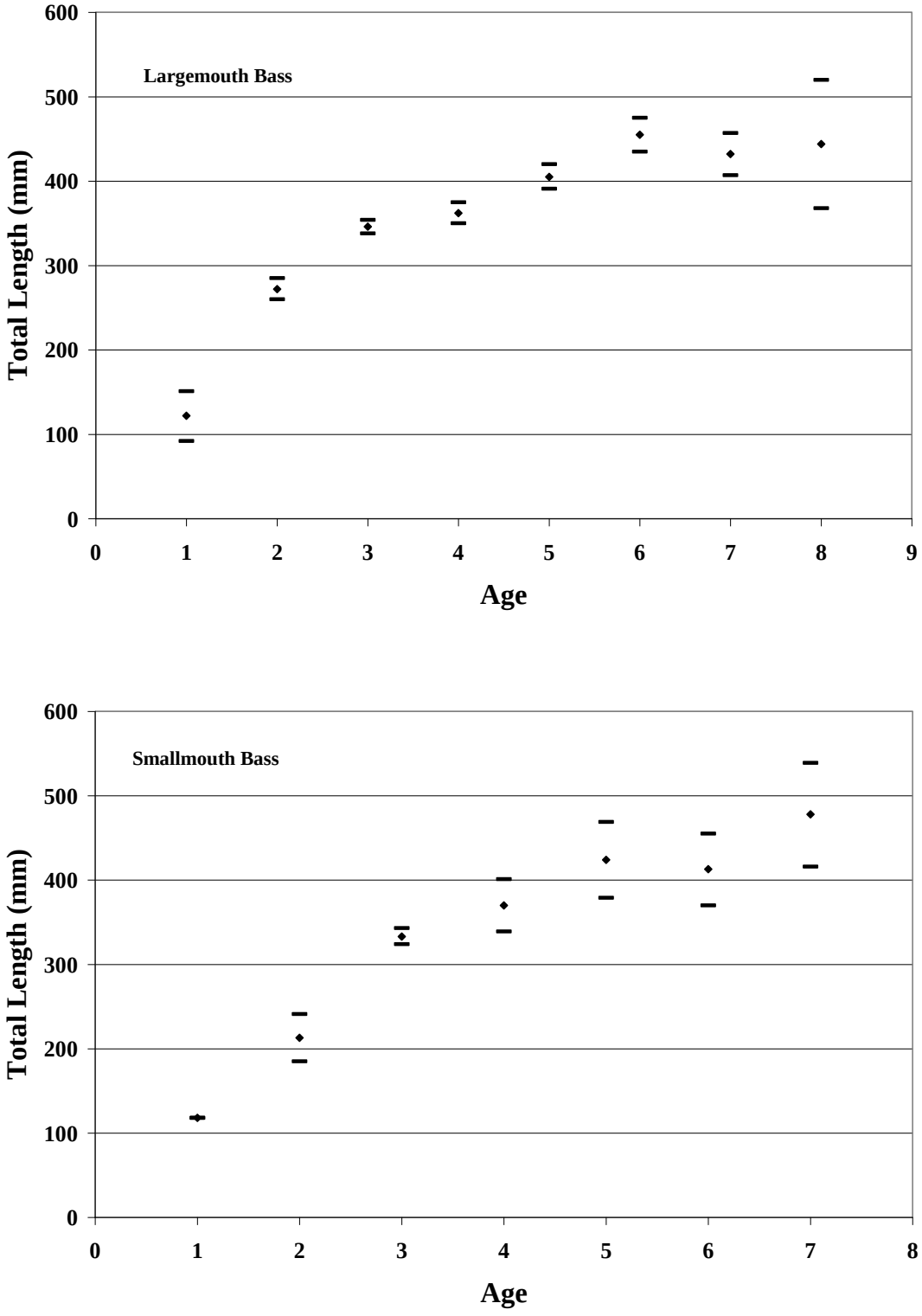


FIGURE 5.—Mean total lengths (mm) at age at capture of largemouth and smallmouth bass captured during spring electrofishing samples from the Catawba River arm of Lake James, 3-4 May 2005.