CHARACTERISTICS OF THE WALLEYE POPULATIONS IN LAKES HICKORY AND RHODHISS

FINAL REPORT

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Abstract.—This report provides a general summation of the walleyes collected as by-catch in striped bass *Morone saxatilis* gill-net samples from lakes Hickory (2003 and 2005) and Rhodhiss (2003, 2004, and 2006), North Carolina. Walleye management in the Catawba River chain of reservoirs has historically been focused in Lake James. Despite the lack of historical attention, walleye densities appear to be increasing in Lake Rhodhiss, while Lake Hickory anglers continue to report catches of walleyes and biologists continue to observe walleyes during routine sampling for other species. A total of 167 walleyes was collected as by-catch from both reservoirs during striped bass sampling, with 34 and 133 walleyes from lakes Hickory and Rhodhiss, respectively. The size structure of walleyes collected from Lake Hickory consisted of individuals with lengths ranging from 338 to 682 mm TL (mean = 459.8 mm TL; SE = 13.8), and individuals collected from Lake Rhodhiss exhibited a size structure that ranged from 314 to 740 mm TL (mean = 484.5 mm TL; SE = 7.9). Walleyes up to age 4 were collected from Lake Hickory (mean = 1.5; SE = 0.3), while walleyes were collected up to age 12 from Lake Rhodhiss (mean = 2.6; SE = 0.2). The von Bertalanffy growth curve, $TL = 767.866 * (1 - e^{(-0.199 (age + 2.635))})$, best fit the data and explained 99% of the variation in total length at age of capture for walleyes collected from Lake Rhodhiss in 2006. Relative weight values ranged from 77.9 to 128.0 (mean = 106.2; SE = 1.8) for fish collected from Lake Hickory, and relative weight values ranged from 68.5 to 164.1 (mean = 103.2; SE = 1.0) for those collected from Lake Rhodhiss. Mechanisms responsible for the apparent emergence of walleyes in these reservoirs are unknown, but these populations are composed of fast growing fish in excellent condition. Rapid growth and heightened condition are likely due to density-dependent mechanisms functioning within highly productive reservoirs. Thus, given the apparent potential of the walleye fisheries in these reservoirs, it may prove prudent to explore the maintenance or enhancement of these additional pelagic fisheries that appear to be developing.

Lakes Hickory and Rhodhiss are impoundments on the upper Catawba River, North Carolina (Figure 1). Lake Hickory was impounded in 1927. The reservoir covers 1,710 ha within Alexander, Burke, Caldwell and Catawba Counties, with an average depth of 9 m and an average retention time of only 32 d. Lake Rhodhiss is located in Burke and Caldwell Counties. Impounded in 1925, the reservoir covers 1,423 ha at full pool and has 145 km of shoreline, with a watershed area of 2,823 km^2. Average water depth is 6 m, with a maximum depth of 15 m, and a mean hydraulic retention time of 21 d. Lakes Hickory and Rhodhiss are classified as eutrophic reservoirs (NCDENR 2003).

Both reservoirs support a variety of sport fishes: largemouth bass *Micropterus salmoides*, striped bass *Morone saxatilis*, crappies *Pomoxis spp*., sunfishes *Lepomis spp*. and several species of catfishes *Ictalurus* and *Ameiurus spp*. However, anglers and North Carolina Wildlife Resources Commission (NCWRC) biologists continue to catch walleyes *Sander vitreus* in each reservoir.

Walleye management in the Catawba River chain of reservoirs has historically been focused on Lake James, the impoundment immediately upstream of Lake Rhodhiss. Walleyes were first introduced into Lake James in 1949, and by the cessation of stockings in 1955, over 1.1 million fry were stocked in the reservoir (Taylor 2005). These initial stockings were successful in establishing a self-sustaining population that continues to maintain the fishery via natural reproduction. However, intense public pressure caused the NCWRC to resume supplemental stockings in 1980, but these stockings were discontinued after 2004, when research demonstrated that hatchery fish only contributed a small percentage (2.1–3.7%) of individuals to the population (Besler 2004). Unlike in Lake James, early stocking efforts to establish walleyes in lakes Hickory (1954 and 1955) and Rhodhiss (1950, 1954, and 1955) were not continued (Besler et al. 2004); as a result, management efforts in these reservoirs have been focused on other species.

Thus, it is not surprising that Lake James is the only water body in the Catawba River drainage where the NCWRC has enacted site-specific regulations to manage walleyes. Walleyes in Lake James (and its tributaries) are managed under a 381-mm total length (TL) size limit, with an eight-fish creel; however, there is no size restriction on walleyes in the Linville River above the reservoir, but anglers are restricted to a four-fish creel limit from the river. Walleyes in lakes Hickory and Rhodhiss are governed by an eight-fish creel, with no size limit.

Despite the lack of historical attention, anglers continue to report catches of walleyes, while biologists continue to observe them during routine sampling for other species in lakes Hickory and Rhodhiss. In addition, angler reports and biological observations seem to indicate that walleye abundance in Lake Rhodhiss is increasing. This report provides a general summation of the walleyes collected as by-catch in striped bass gill-net samples from Lakes Hickory (2003 and 2005) and Rhodhiss (2003, 2004, and 2006).

Methods

Field Collections.—Gill-net samples were utilized to collect striped bass from Lakes Hickory (2003 and 2005) and Rhodhiss (2003, 2004, and 2006). Gill-net dimensions were 3.1 m in height and 61.0 m in length, and each net consisted of a solid panel of 38-, 51-, 64-, or 76-mm bar mesh. All walleyes that were collected as by-catch were retained, and the weight (g) and TL (mm) of each fish was recorded.

Catch per unit effort.—Catch per unit effort was not estimated. Number of sets per mesh size, total number of sets and set duration varied within and among both reservoirs. Thus, estimates of catch per unit effort were deemed inaccurate.

Age and Growth.—Sagittal otoliths were removed from walleyes collected from lakes Hickory (2005) and Rhodhiss (2003, 2004, and 2006), broken perpendicular to the transverse axis, polished with 400 grit wet-dry sandpaper, submersed under water and read under a 10X dissecting scope using transmitted fiber optic light (Hammers and Miranda 1991). Otoliths were read independently by two readers, and discrepancies between the readers were rectified by jointly reading the sectioned otolith. If the age could not be rectified, the age data were not used in further analysis. Length-frequency histograms were interpreted to describe patterns and size distribution in growth. In addition, total lengths at age of capture for fish collected from Lake Rhodhiss in 2006 were used to estimate growth rate via the von Bertalanffy growth equation (Van Den Avyle and Hayward 1999), which is defined as:

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

where L_t is the predicted total length at time t, L_∞ is the mean maximum total length 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. The growth of walleyes in Lake Rhodhiss was compared to the growth rate of walleyes collected from Lake James in 2004. Insufficient data prevented the calculation of additional growth curves for the remaining samples.

Index of Condition.—Relative weight values were calculated for walleyes greater than 150 mm TL via the following equation:

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

where W_r is the relative weight of an individual, W is the wet weight of an individual, and W_s is the length-specific standard weight of an individual. The standard weight equation for walleye (Murphy et al. 1990) is:

$$\log_{10}W_s = -5.453 + 3.180 \log_{10}TL.$$

Mortality.—Lack of sufficient data prevented the accurate calculation of mortality estimates for the walleye populations in lakes Rhodhiss and Hickory.

Results and Discussion

Field Collections.—A total of 167 walleyes was collected as by-catch from striped bass sampling in both reservoirs, with 34 and 133 walleyes from lakes Hickory and Rhodhiss, respectively.

Age and Growth.—The size structure of walleyes collected from Lake Hickory consisted of individuals with lengths ranging from 338 to 682 mm TL (mean = 459.8 mm TL; SE = 13.8) (Figure 2). Individuals collected from Lake Rhodhiss exhibited a size structure that ranged from 314 to 740 mm TL (mean = 484.5 mm TL; SE = 7.9) (Figure 3). Although gear selectivity could be responsible for the large mean sizes from each reservoir, it is apparent that both lakes Hickory and Rhodhiss are capable of producing large walleyes. Few (9%) walleyes collected from Lake James in the 1999–2004 study were greater than 450 mm TL (Taylor 2005).

Walleyes up to age 4 were collected from Lake Hickory (mean = 1.5; SE = 0.3) (Figure 4), while walleyes were collected up to age 12 from Lake Rhodhiss (mean = 2.6; SE = 0.2) (Figure 5). Taylor (2005) reported that the majority of walleyes collected from Lake James during the six-year study period were age 4 or less; walleyes from Lake Rhodhiss exhibit this same characteristic. However, it is apparent that walleyes in Lake Rhodhiss are able to reach these ages while displaying greater growth (Figure 6). The von Bertalanffy growth curve,

$$TL = 767.866 * (1 - e^{(-0.199\,(age + 2.635))}),$$

best fit the data and explained 99% of the variation in total length at age of capture for walleyes collected from Lake Rhodhiss in 2006 (Figure 6).

Index of Condition.— Relative weight values ranged from 77.9 to 128.0 (mean = 106.2; SE = 1.8) for fish collected from Lake Hickory (Figure 7), and relative weight values ranged from 68.5 to 164.1 (mean = 103.2; SE = 1.0) for those collected from Lake Rhodhiss (Figure 8). The relative weight values for walleyes from lakes Hickory and Rhodhiss are certainly higher than those reported for Lake James (mean = 89) during the 1999–2004 study (Taylor 2005).

Conclusions

By-catch data obtained from striped bass samples indicates that the walleye populations in lakes Hickory and Rhodhiss are composed of fast growing fish in excellent condition. Rapid growth and heightened condition are likely due density-dependent mechanisms functioning within highly productive reservoirs. Thus, a limited number of individuals have to share the benefits of stimulated primary productivity, which allows the current number of walleyes to flourish.

Multiple age classes of walleye are present in each reservoir; however, the mechanism responsible for their presence is unclear. Fish emigrating down from Lake James, natural reproduction, and escapement from Table Rock State Fish Hatchery (located within the Lake Rhodhiss watershed) are all potential contributors to the fishery. Increased walleye stocking rates in Lake James from 1999–2004, coupled with record flows in 2004, certainly ushered multiple walleyes downstream of Lake James; however, it is impossible to quantify the amount of fish lost during that event and all other periods in time. In addition, the amount of walleye natural reproduction in Lakes Hickory and Rhodhiss remains unknown, and losses from Table Rock Hatchery are likely minimal (W. E. Wilson, NCWRC, personal communication).

It will become increasingly important to understand the mechanisms driving the walleye fisheries in lakes Hickory and Rhodhiss. If walleyes continue to persist in each reservoir, angler expectations of the fisheries are likely to increase. Ultimately, it may prove prudent explore the potential to maintain or enhance these additional pelagic fisheries that appear to be developing in these two reservoirs.

Recommendations

1. Continue to monitor the walleye populations in lakes Hickory and Rhodhiss, incorporating walleye-specific sampling regimes; additional data will assist the NCWRC in establishing future management recommendations for these walleye populations.

2. Assess the natural reproduction of walleyes in lakes Hickory and Rhodhiss to guide potential management recommendations.

3. Survey anglers on Lakes Hickory and Rhodhiss to obtain objective walleye catch data.

4. Evaluate angler interest in maintaining or enhancing walleye populations in the two reservoirs; manipulation of the walleye populations will likely result in alterations to the current management of the striped bass fisheries in each system, so it will be crucial to gain public opinion prior to seeking management changes.

5. As additional data are gathered, the NCWRC should evaluate whether or not supplemental stockings and/or harvest regulations would be advantageous to these walleye fisheries.

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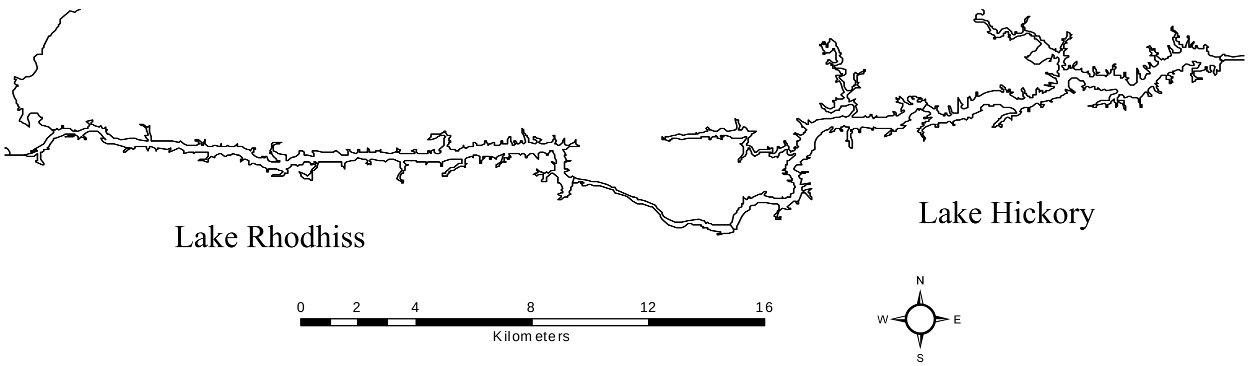

FIGURE 1.—Map of Lakes Rhodhiss and Hickory, North Carolina.

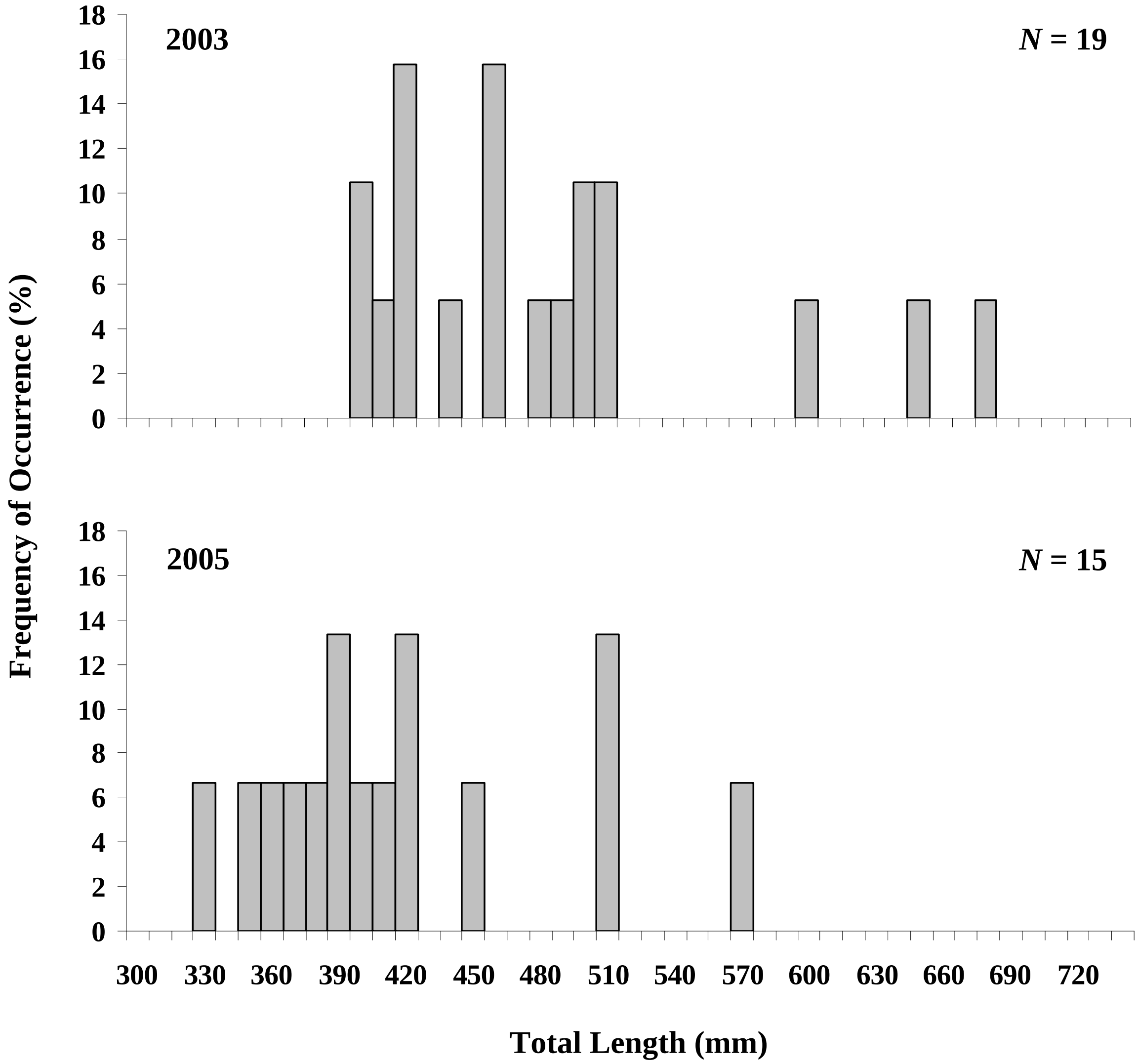

FIGURE 2.—Length-frequency distribution of walleyes collected during the 2003 and 2005 sampling seasons on Lake Hickory, North Carolina. Fish are grouped by 10-mm size class intervals.

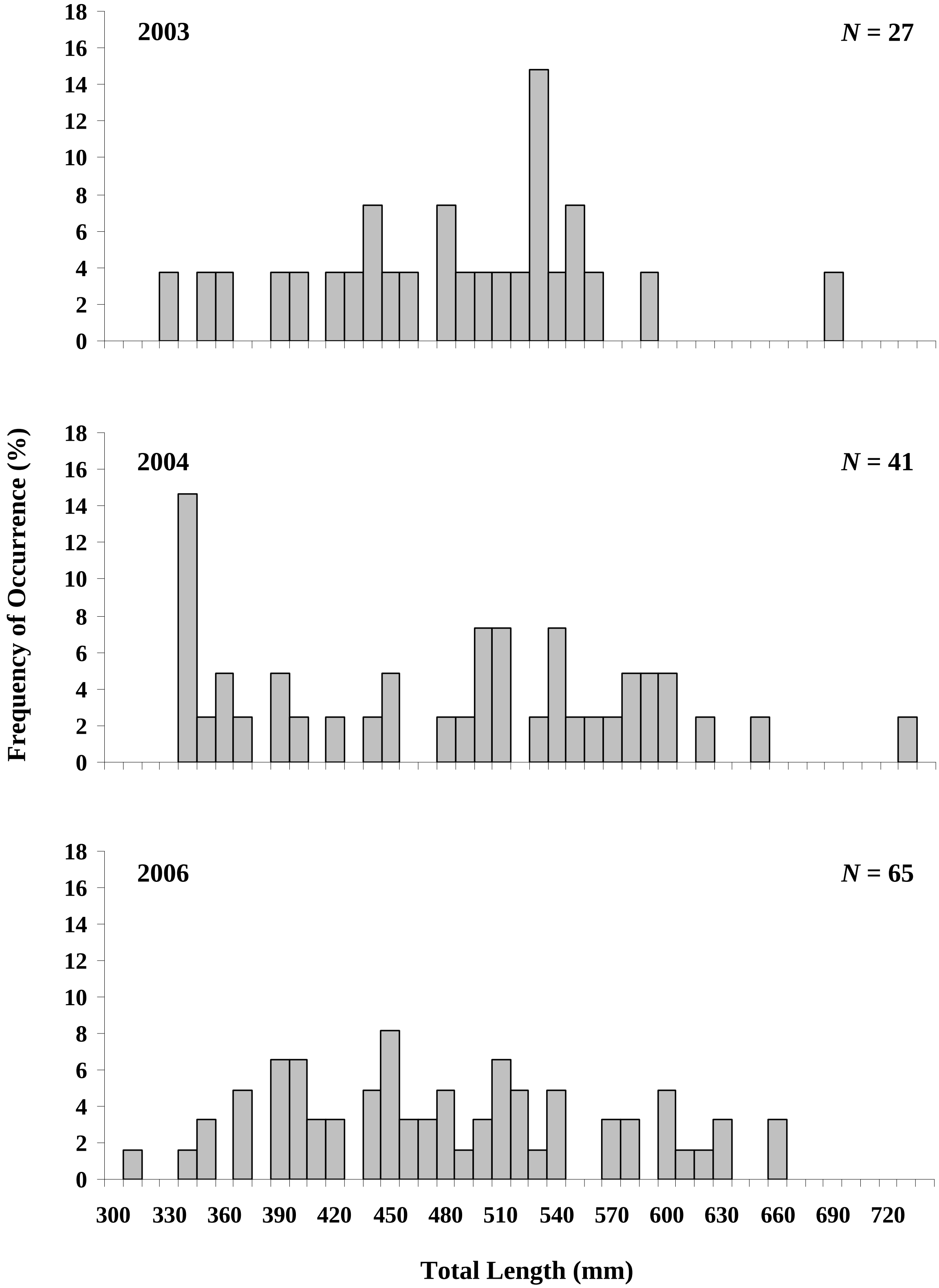

FIGURE 3.—Length-frequency distribution of walleyes collected during the 2003, 2004, and 2006 sampling seasons on Lake Rhodhiss, North Carolina. Fish are grouped by 10-mm size class intervals.

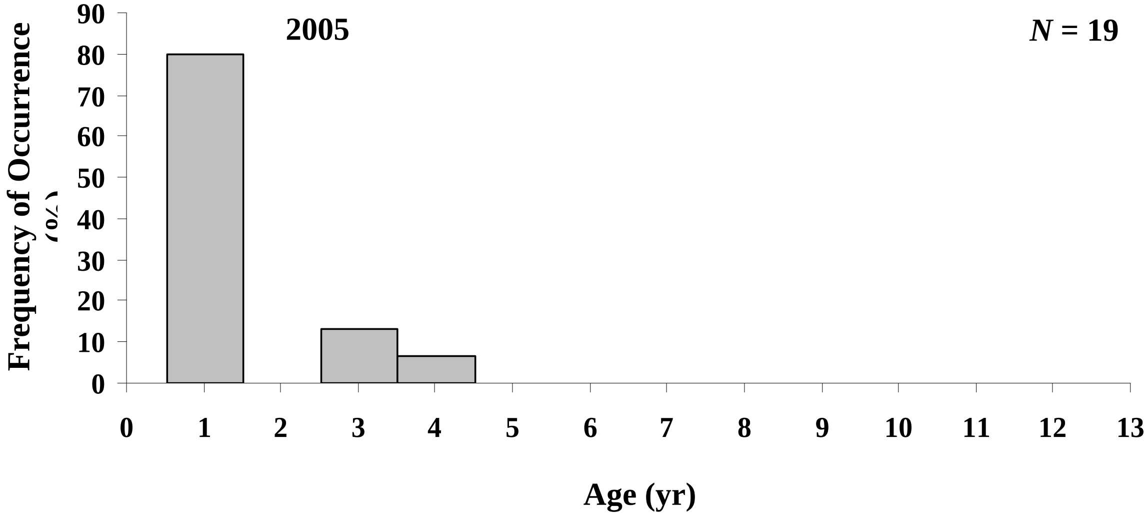

FIGURE 4.—Age distribution of walleyes collected during the 2005 sampling season on Lake Hickory, North Carolina.

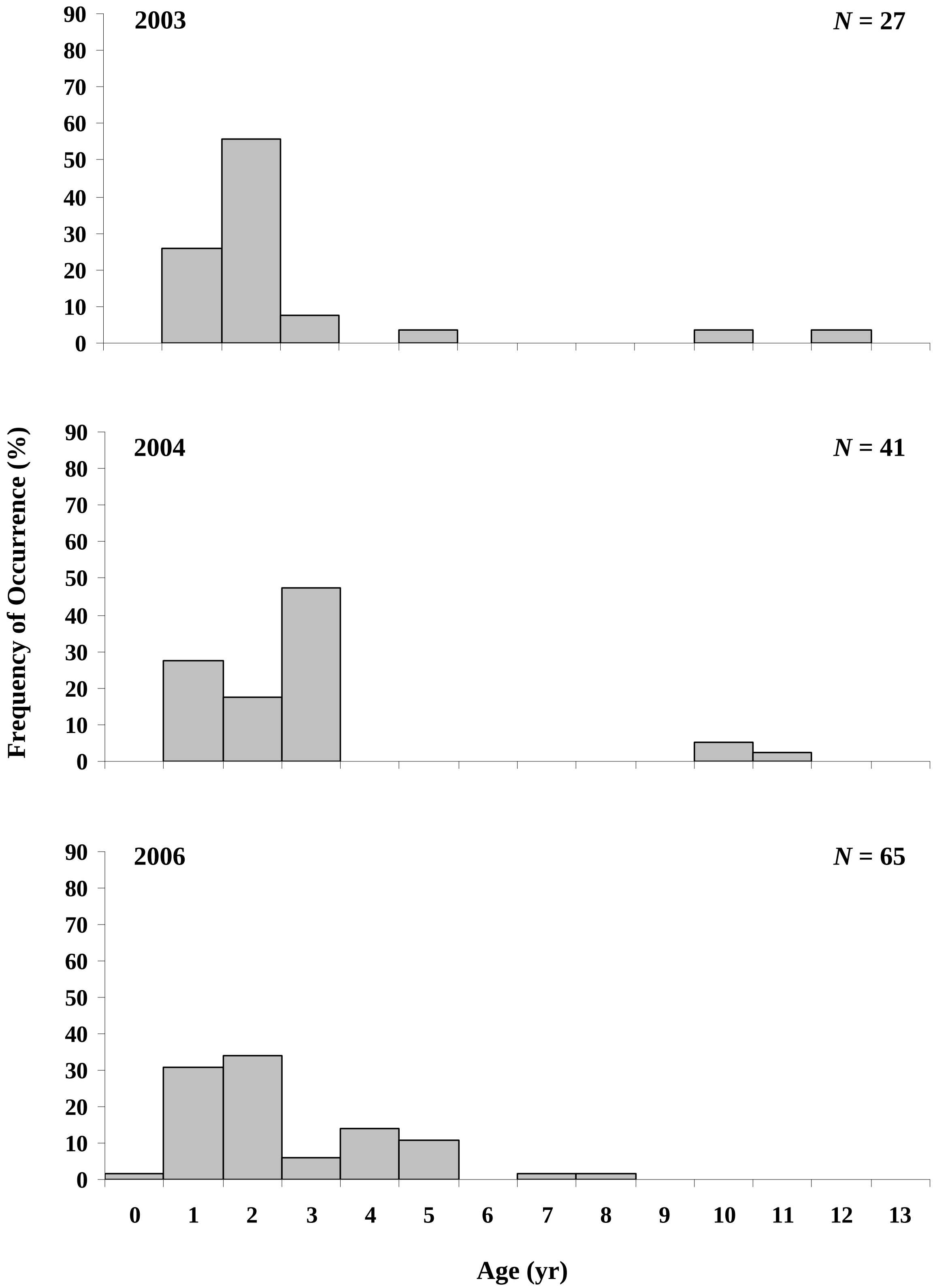

FIGURE 5.—Age distribution of walleyes collected during the 2003, 2004, and 2006 sampling seasons on Lake Rhodhiss, North Carolina.

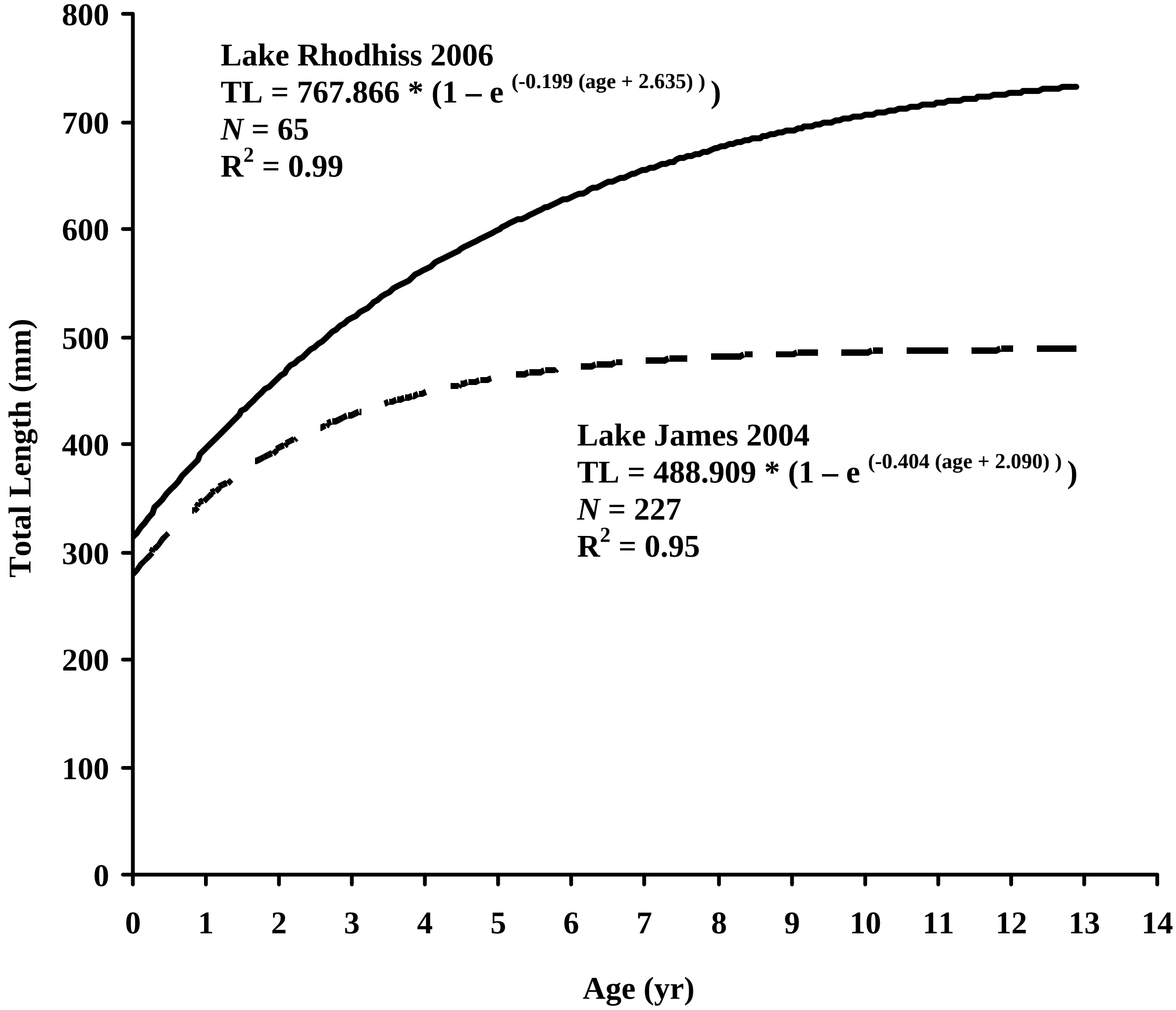

FIGURE 6.—von Bertalanffy growth curves calculated from lengths at age of capture for walleyes collected in 2004 and 2006 from Lakes James (dashed line) and Rhodhiss (solid line), North Carolina, respectively.

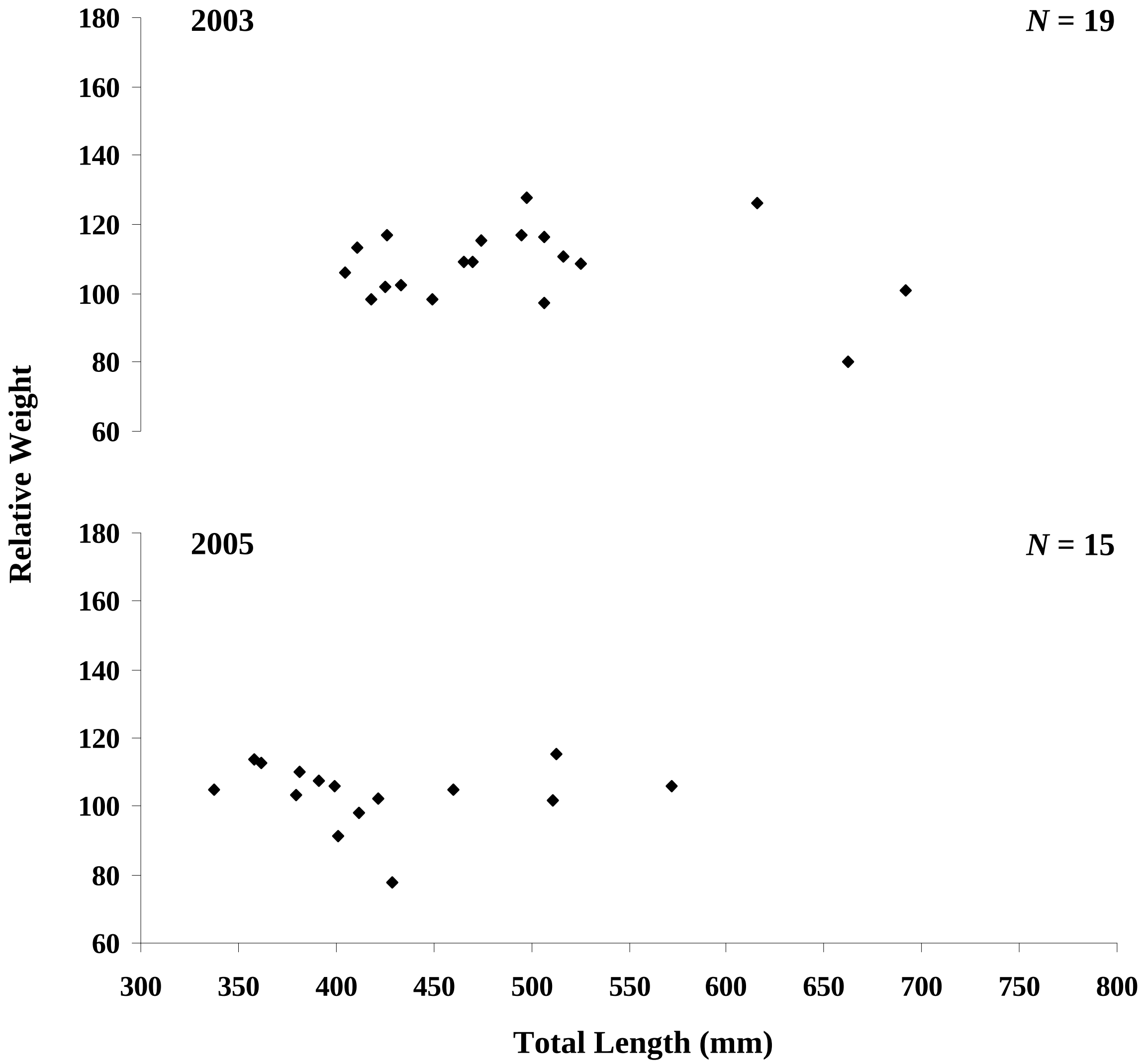

FIGURE 7.—Relative weight values of walleyes collected during the 2003 and 2005 sampling seasons on Lake Hickory, North Carolina.

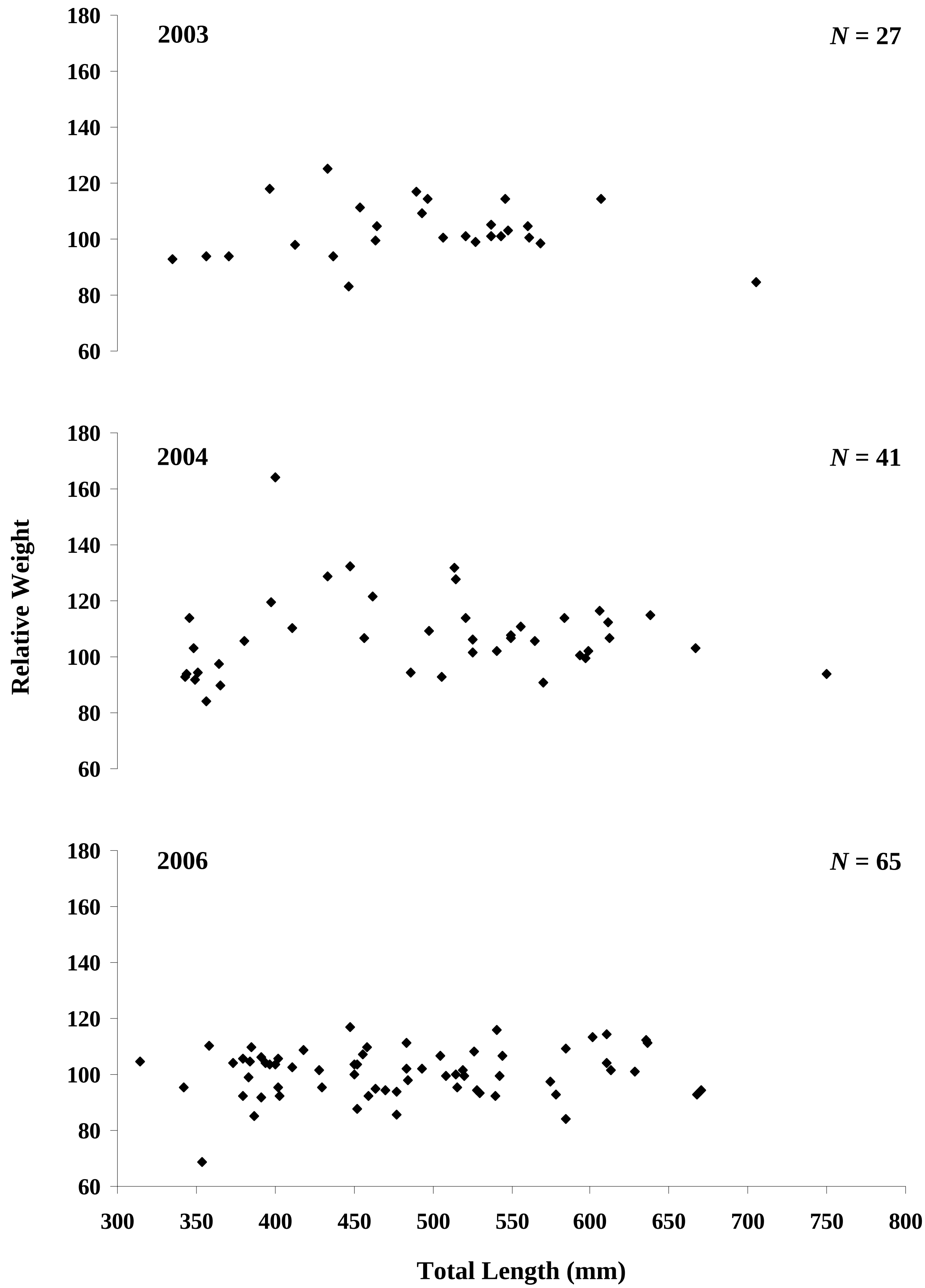

FIGURE 8.—Relative weight values of walleyes collected during the 2003, 2004, and 2006 sampling seasons on Lake Rhodhiss, North Carolina.