LAKE JAMES WALLEYE INVESTIGATION
SURVEY SUMMARY 2003

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SPORT FISH RESTORATION

Abstract.—This report summarizes the findings of a walleye *Stizostedion vitreum* gill net survey conducted on Lake James in October 2003. A total of 231 walleye were captured, with an average catch rate of 19.3 walleye/net night (range 6-38). Walleye captured ranged from 236-565 mm total length (TL). Of the 231 walleye collected, only 55% were in the quality (≥ 380 mm) size class and 3% were in the preferred (≥ 510 mm) size class, with no memorable (≥ 630 mm) or trophy (≥ 760 mm) fish obtained. Although the current size distribution shows very few large fish, the majority (55%) of walleye sampled were of legal harvestable size (≥ 381 mm). Walleye condition in Lake James was poor; the average Wr was 85 and ranged from 71-110. In 2003, walleye up to age 12 were found, but the majority of walleye were age 4 or less. Male and female walleye began maturing at age 1 with the majority mature by age 2. Walleye growth rates in Lake James are slow and differ by sex. Walleye reached the 381-mm size limit sometime between age 1 and age 2; however, by age 3 growth slows dramatically. The majority of male walleye reached the minimum size limit by age 2. Females exceeded the minimum size limit by age 2 and more than likely reached the minimum size limit sometime at age 1 prior to sexual maturity. Population data for walleye collected in Lake James from 1999-2003 were virtually identical. The walleye population in Lake James is characterized by high numbers of stock-sized, slow growing fish in poor condition, which appear to be exploited at low levels. Walleye in Lake James, particularly large (>400mm) individuals, do not appear to be able to exploit the gizzard shad *Dorosoma cepedianum* prey base effectively. Exploitation rates of gizzard shad are similar to the previous forage base of threadfin shad *D. petenense*. The inability of walleye to utilize threadfin shad or gizzard shad may be limiting the growth rates and sizes of walleye in Lake James. Gill net data on walleye will be obtained again in fall 2004 during a scheduled gill net survey.

Lake James, located in Burke and McDowell counties, is the uppermost reservoir on the Catawba River chain of Duke Power Company lakes. Impounded in 1923, the reservoir covers 2,634 ha at full pool, and has 242 km of shoreline with a watershed area of 984 km^2. Average water depth is 13.5 m, with a maximum depth of 43 m, and a mean hydraulic retention time of 228 days. Lake James is classified as an oligotrophic reservoir, with low alkalinity (9-14 mg/l $CaCO_3$), a pH range of 6.4-7.4, typical surface water temperature ranges of 2-28°C, and an average Secchi depth of 2.8 m (NCDENR 1998).

In 1949, the North Carolina Wildlife Resources Commission (NCWRC) first introduced 35,000 walleye fry into Lake James. By 1955, over 1.1 million fry had been introduced. As a result of these stockings, walleye became established and have remained a major game fish in Lake James.

Walleye stockings were halted after 1955 and the population sustained itself through natural reproduction. Historically, spawning has occurred in the Linville River, Catawba River, and in the main body of the reservoir. A section of the Linville River is closed to angling from 15 February through 15 April to protect spawning walleye. Walleye in Lake James are currently managed under a 381-mm minimum size limit and an 8-fish daily creel limit.

As a result of public pressure, the NCWRC resumed walleye stockings in 1980 to bolster natural reproduction. Approximately 1.5 million fry were stocked annually through 1985. Fingerling walleye stockings began in 1986 at a rate of 11/ha, or approximately 30,000 fingerlings annually. Actual numbers of walleye fingerlings stocked annually since 1986 ranged from 30,000-313,659 (mean 102,844). The large variations in annual numbers stocked were the result of public pressure to stock all walleye produced into Lake James. Stocking rates since 1999 have been stabilized at 30,000 fingerlings annually.

Cove rotenone samples were conducted on Lake James through the 1980's, but were designed to gather information on all fish species and did not provide detailed information on the walleye population. Intensive gill net and electrofishing surveys to gather population data on walleye were first initiated by the NCWRC in 1983. These initial surveys were designed to gain a better understanding of walleye population dynamics, to determine relative abundance of year-classes, and to determine if the supplemental stocking of walleye fingerlings was having any noticeable impact on year class strength and the walleye fishery (Brown and Kearson 1984; Brown and Kearson 1986; Brown and Kearson 1987; Brown et al. 1987; Brown et al. 1989). Baseline data on walleye relative abundance, size structure, and some age and growth information was obtained during this time. No information was gathered on walleye in Lake James between 1990-1998. Gill net sampling for walleye was resumed by the NCWRC in 1999 (Besler 2000) and 2000 (Besler 2001a). This report summarizes a walleye gill net survey on Lake James in October 2003.

Methods

Gill nets were fished in Lake James during October 2003. Experimental gill net dimensions were 2.4 x 76.3 m and consisted of five 2.4 x 15.3 panels with 25-, 32-, 38-, 44-, and 51-mm bar mesh. Permanent gill net sites were chosen off lake points based on a stratified design. The gill net sites were identified in 1999 within the upper, middle, and lower regions of the Catawba and Linville arms of Lake James and were based on historical gill net sampling records, slope, and substrate. Gill nets were bottom-set perpendicular to shore in water >3 m depth. The direction of mesh to shore, 25- or 51-mm bar mesh, was randomly chosen for the first net set of each day and alternated for each additional set. Nets were checked after 24 h, and water temperatures were recorded at each site.

All fish collected were separated by species. Non-target species were released or discarded. Walleye were placed in a plastic bag labeled by site and gill net mesh size, placed on ice, and returned to the Marion State Fish Hatchery. All walleye were weighed (g), measured (TL, mm) and sexed. Walleye were considered immature if the gonads were not developed. Saggital otoliths were removed from all walleye. Otoliths were air-dried for >14 days, broken perpendicular to the long axis, polished with 400 grit wet-dry sandpaper, and read under a 10X dissecting microscope using transmitted fiber optic light (Hammers & Miranda 1991). All otoliths were read independently by two readers. Age discrepancies among readers were rectified by jointly reading the age structure. If agreement could not be reached, the fish was omitted from age estimates.

Catch per unit effort (CPUE) was determined as the number of walleye captured per net night (24 h). Relative weights (Wr) were calculated for walleye >150 mm using the standard weight equation (Ws) of Murphy et al. (1990). Various relative stock density (RSD) indices were calculated for individual and combined species data following Gabelhouse (1984). The Von Bertalanffy growth model was used to estimate growth rates.

Results and Discussion

Effort.–A total effort of 12 net nights was expended on Lake James in October 2003. Effort was distributed relatively evenly throughout the reservoir (Figure 1). Overall, the Catawba arm of the reservoir received six gill net nights effort and the Linville received six gill net nights effort. Surface water temperatures ranged from 18-20^{o}C. All nets deployed captured walleye.

Catch Per Unit Effort.–Catch rates of walleye were high in the 2003 gill net sample, with a total of 231 walleye captured. Combined gill net mesh size CPUE was 19.3 fish/net night (Table 1). The numbers of walleye captured per net ranged from 6-38. Catch rates among mesh sizes were fairly consistent; however, few walleye were captured in the 25- and 51-mm mesh (Table 1). The overall coefficient of variation in walleye CPUE was 53%. Catch rates in the 2003 Lake James walleye sample were very similar to those values reported in 1999 (Besler 2000), 2000 (Besler 2001a), 2001 (Besler & Taylor 2002), and 2002 (Taylor 2003).

Size Structure.–The walleye size structure was skewed towards stock- (≥250 mm) and quality-sized (≥380 mm) walleye. Walleye captured ranged from 236-565 mm (Figure 2). Few fish over 500 mm were obtained. The majority of walleye over 450 mm were females while males and immature fish dominated the size classes <400 mm. Overall, only 55% of the walleye obtained were in the quality size class, which is near the four year sampling average. Of the 231 walleye obtained, 3% were in the preferred (≥510 mm) size class, and no memorable (≥630 mm) or trophy (≥760 mm) fish were captured.

Sexual maturity for walleye was strongly influenced by size. Male walleye on Lake James began to mature around 325 mm, with the majority completely mature by 375 mm; females began maturing around 350 mm, with the majority completely mature by 425 mm (Figure 2).

The small size structure of walleye obtained in 2003 was typical of past samples. In general, very few walleye over 450 mm were obtained in the gill net samples. Although the current size distribution shows very few large fish, the majority (55%) of walleye sampled were of legal harvestable size.

Condition and Diet.–Walleye condition in Lake James in 2003 was poor. The average Wr was 85 and ranged from 71-110 (Figure 3). Relative weights decreased linearly ($P = 0.001$) with increasing total length and were similar to the 1999 data (Besler 2000), 2000 data (Besler 2001a), 2001 data (Besler & Taylor 2002) and 2002 data (Taylor 2003). This trend suggests that the larger walleye are less able to compete for forage than other piscivores in the lake.

Stomach contents of all captured walleye were qualitatively examined in 2003 to gain some coarse diet information. Overall, 51% of 231 walleye stomachs examined were empty (Figure 4). No other prey items beside fish were present in the stomach samples. Due to a winter kill of threadfin shad between the 2000 and 2001 samples, walleye are exploiting gizzard shad as the primary forage base. Gizzard shad accounted for 80% of the fish species found in the stomachs of the walleye from the 2003 sample. The 2000 stomach analysis data (Besler 2001a) indicated 90% of the fish species found were threadfin shad. However, it is possible that some gizzard shad were misidentified in the 2000 stomach analysis. It was previously suggested that the adult walleye in Lake James are very much linked to the threadfin shad forage base, however it appears that gizzard shad do provide a similar forage base for walleye. Although walleye are pelagic in nature, walleye in Lake James are routinely captured at depths >30 m in NCWRC gill net samples. Threadfin shad and gizzard shad are typically found within the pelagic zone above the thermocline. Even with the change in forage base, overall condition indices imply that walleye are unable to exploit shad species effectively in Lake James due in part to the two species not occupying the same time and space for extended periods of time.

Age and Growth.–In 2003, 231 walleye were obtained for age and growth analysis. All age classes of walleye, including age 0, were recruited to the gill net mesh sizes used. Electrofishing data on age-0 walleye from Lake James in 2000 indicated that only the largest age-0 individuals are recruited to the smallest (25-mm bar mesh) panels used (Besler 2001b). Walleye up to age 12 were captured, but the majority of walleye were age 4 or less (Figure 5). The presence of consistent year classes up to age 12 suggests that recruitment is fairly constant and the population is being exploited at low levels. Mortality rates appear to be low (39%) and were very similar to the 1999 data (Besler 2000), 2000 data (Besler 2001a), 2001 data (Besler & Taylor 2002), 2002 data (Taylor 2003). The 2003 data continued to indicate that sexual maturity is influenced by age. The maturity rates of male walleye in 2002 were similar to the data from 1999-2002. However, the maturity rates of female walleye in 2003 indicate that the majority were mature by age 2 compared to age 3 maturation rates seen in previous data years. Walleye growth rates in Lake James were very slow and strongly influenced by sex. Walleye reached the 381-mm size limit by age 2 (Figure 6). Although the initial growth is good, by age 3 growth slows dramatically. Based on the 2003 growth rates, the Von Bertalanffy growth model predicts walleye in Lake James should reach an asymptotic maximum length of 427 mm. That rate of growth predicts that very few preferred, memorable, or trophy walleye will be produced in Lake James.

Walleye growth was also strongly influenced by sex. The majority of male walleye reached the 381-mm size limit by age 2 (Figure 7). Females, however, exceeded the minimum size limit by age 2 and more than likely reached it sometime at age 1 prior to sexual maturity.

Conclusions

The walleye population in Lake James is characterized by high numbers of stock-sized, slow-growing fish in poor condition. The walleye resource in Lake James does not appear to be over-harvested by anglers. Walleye in Lake James are apparently unable to effectively exploit the shad prey base, particularly at sizes >400 mm. Data from the white bass population in Lake James suggests that other predators are capable of having excellent growth rates, condition factors, and size structures utilizing the same prey base (Besler 2001c). In addition, the strong sexual dimorphism may be causing anglers to differentially exploit female walleye in Lake James since the females are eligible for harvest 1-2 years before any males from the same year class.

Population data collected from 1999-2003 on walleye in Lake James were virtually identical. It does not appear that the 381-mm size limit is improving the overall sizes of walleye in Lake

James. In fact, it is likely that the current size limit is compounding slow growth through density dependent mechanisms, and is indirectly increasing the exploitation of the larger females. In addition, the removal of the larger females reduces the reproductive potential of the population.

Recommendations

1. Continue to manage walleye on Lake James under the current statewide creel limit.

2. Discontinue the fingerling walleye stocking program in Lake James based on the evaluation by Besler (2001b).

3. Collect walleye data again in fall 2004 to further assess the appropriateness of the current 381-mm size limit and to establish an additional data set prior to discontinuing the stocking program.

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TABLE 1.–CPUE (fish/net night), standard deviations (SD) and coefficient of variation (C.O.V.) of walleye captured in gill nets, by mesh size, 20-24 October 2003.

		Bar Mesh Size (mm)				
Variable	Combined Panels	25	32	38	44	51
Net Nights	12	12	12	12	12	12
CPUE	19.3	1.8	7.8	6.3	2.2	1.3
SD	10.1	2.5	6.2	4.4	2.8	2.3
C.O.V. (%)	53	142	80	71	129	173

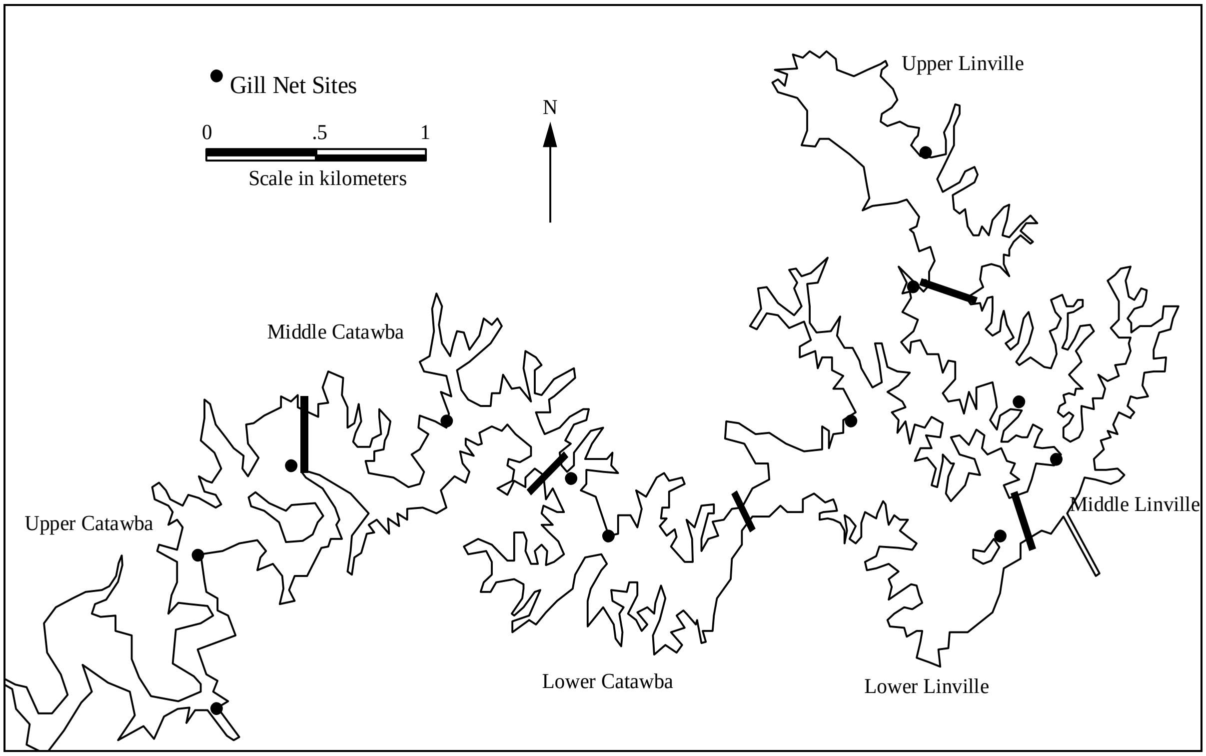

FIGURE 1.–Map of Lake James showing lake regions and the 2003 walleye gill net site locations.

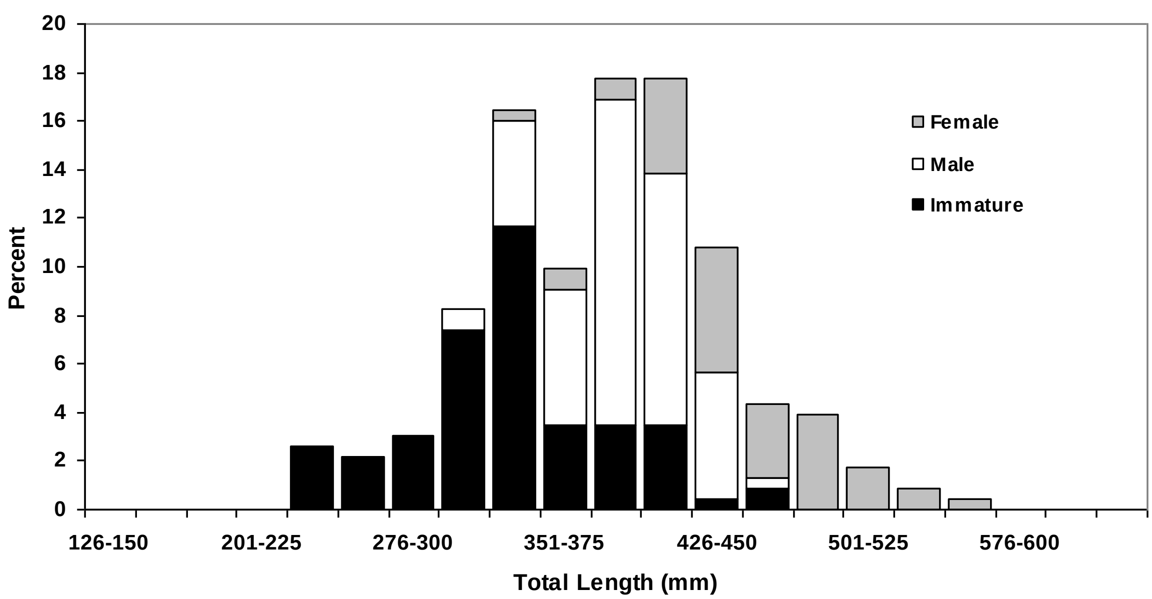

FIGURE 2.–Size distribution of walleye, by sex, captured in gill nets from Lake James, 20-24 October 2003.

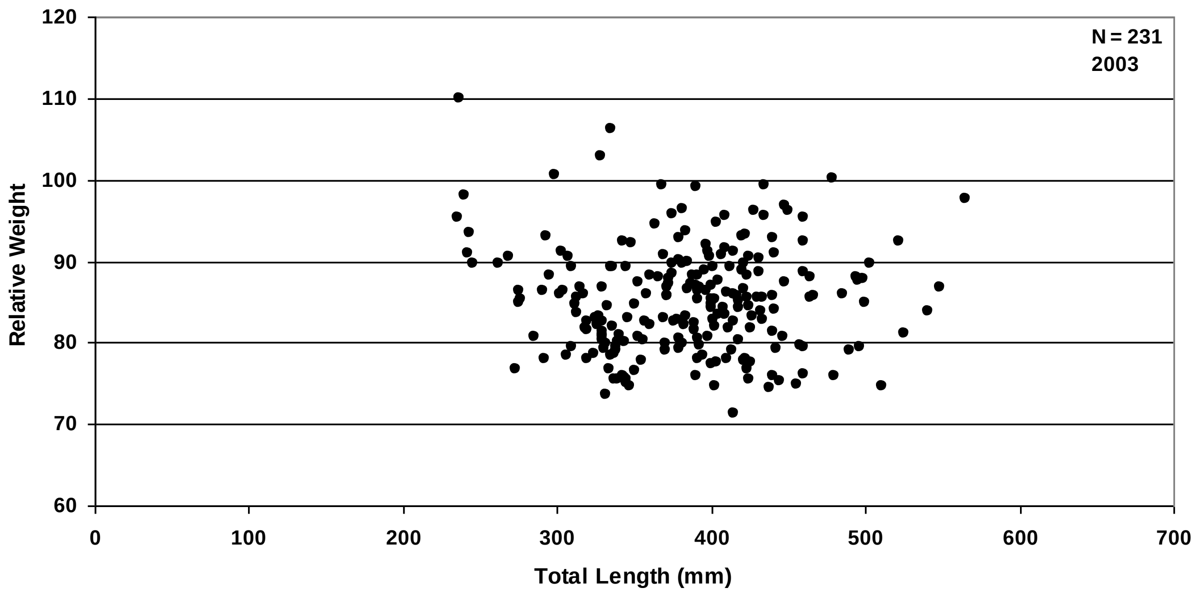

FIGURE 3.–Relative weights of walleye captured in gill nets from Lake James, 20-24 October 2003.

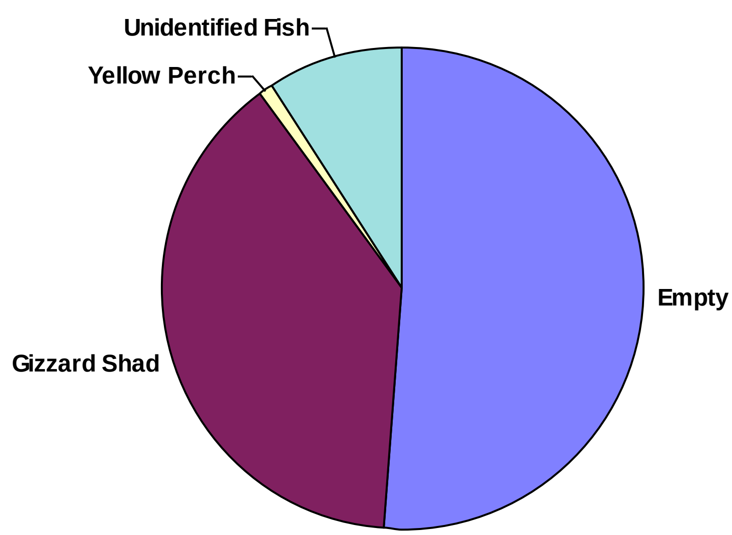

FIGURE 4.–Diet composition of walleye stomachs obtained from gill net samples on Lake James, 20-24 October 2003.

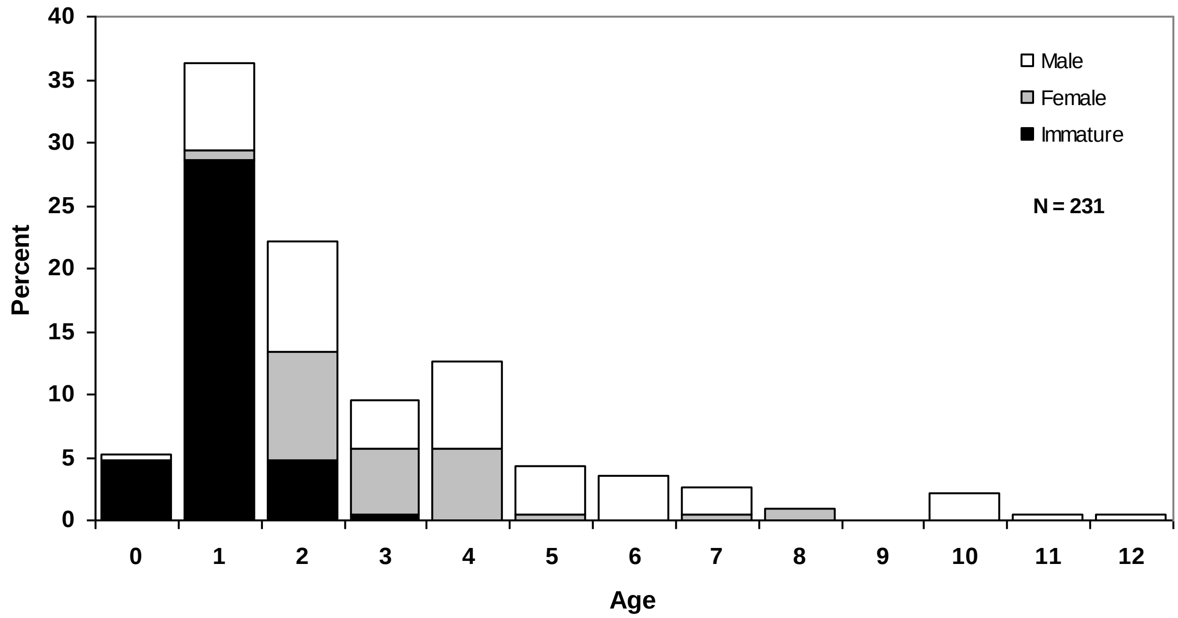

FIGURE 5.–Age distribution of walleye, by sex, captured in gill nets from Lake James, 20-24 October 2003.

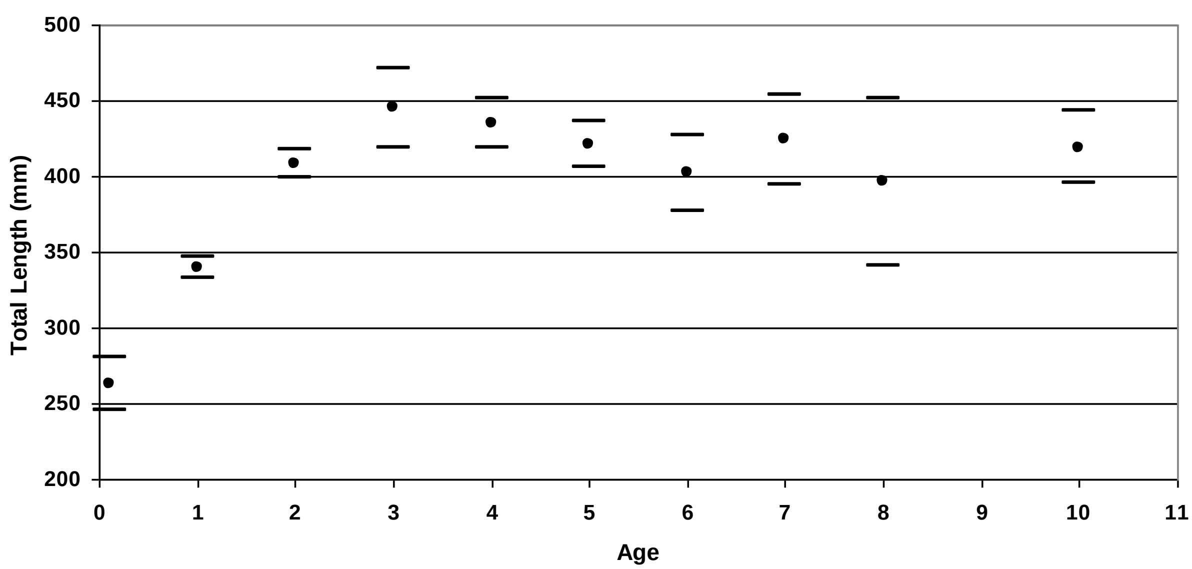

FIGURE 6.–Walleye mean total length (mm) at age at capture, with 95% confidence intervals. Walleye were collected in gill net samples from Lake James, 20-24 October 2003.

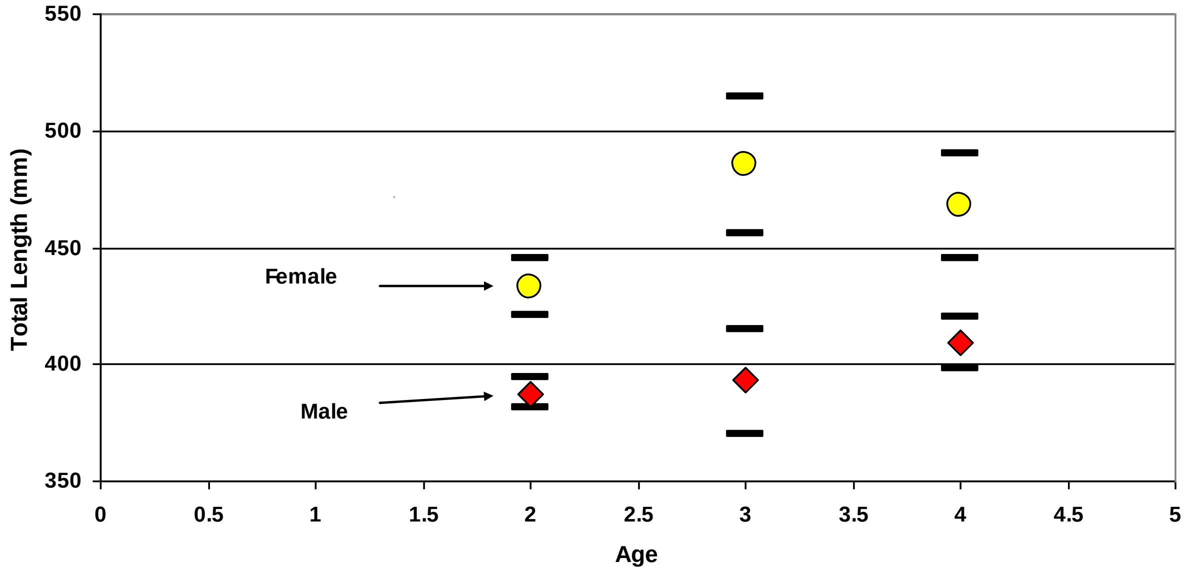

FIGURE 7.–Walleye mean total length (mm) at age, at capture, by sex, with 95% confidence intervals. Walleye were collected in gill net samples on Lake James, 20-24 October 2003.