

LAKE JAMES WALLEYE INVESTIGATION SURVEY SUMMARY 2002

Annual Report

MOUNTAIN FISHERIES INVESTIGATIONS

Federal Aid in Fish Restoration Project
Project F-24

Project Type: Survey

Period Covered: November 2002



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2003



Abstract.—This report summarizes the findings of a walleye *Stizostedion vitreum* gill net survey conducted on Lake James in November 2002. A total of 267 walleye were captured, with an average catch rate of 22.3 walleye/net night (range 11-39). Walleye captured ranged from 225-552 mm total length (TL). Of the 267 walleye collected, only 56% were in the quality (≥ 380 mm) size class and 2% 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 W_r was 88 and ranged from 67-108. In 2002, walleye up to age 12 were found, but the majority of walleye were age 3 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. Overall, walleye reached the 381-mm size limit by age 2; however, by age 3 growth slows dramatically. Male and female walleye reached the minimum size limit by age 2. However, females more than likely reached the minimum size limit sometime at age 1 prior to sexual maturity. Population data for walleye collected in Lake James in 1999, 2000, 2001, and 2002 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 (>400 mm) 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 2003 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 km². 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 CaCO₃), 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 November 2002.

Methods

Gill nets were fished in Lake James during November 2002. 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 three 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 (W_r) were calculated for walleye >150 mm using the standard weight equation (W_s) 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 November 2002. 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 16-17°C. All nets deployed captured walleye.

Catch Per Unit Effort.—Catch rates of walleye were high in the 2002 gill net sample, with a total of 267 walleye captured. Combined gill net mesh size CPUE was 22.3 fish/net night (Table 1). The numbers of walleye captured per net ranged from 11-39. Catch rates among mesh sizes were fairly consistent; however, few walleye were captured in the 51-mm mesh (Table 1). The overall coefficient of variation in walleye CPUE was 40%. Catch rates in the 2002 Lake James walleye sample were very similar to those values reported in 1999 (Besler 2000), 2000 (Besler 2001a), and 2001 (Besler & Taylor 2002).

Size Structure.—The walleye size structure was skewed towards stock- (≥ 250 mm) and quality-sized (≥ 380 mm) walleye. Walleye captured ranged from 225-552 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 56% of the walleye obtained were in the quality size class, which is near the four year sampling average. Of the 267 walleye obtained, 2% 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 315 mm, with the majority completely mature by 375 mm; females began maturing around 350 mm, with the majority completely mature by 415 mm (Figure 2).

The small size structure of walleye obtained in 2002 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 2002 was poor. The average W_r was 88 and ranged from 67-108 (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), and 2001 data (Besler & Taylor 2002). This trend was seen from 1999 to 2001, suggesting 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 2002 to gain some coarse diet information. Overall, 61% of 267 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 76% of the fish species found in the stomachs of the walleye from the 2002 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 can 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 2002, 267 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 3 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 (33%) and were very similar to the 1999 data (Besler 2000), 2000 data (Besler 2001a), and 2001 data (Besler & Taylor 2002). The 2002 data continued to indicate that sexual maturity is influenced by age. The maturity rates of male walleye in 2002 were similar to data from 1999-2001. However, the maturity rates of female walleye in 2002 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. Overall, walleye reached the 381-mm size limit by age 2 (Figure 6). Although the initial first-year growth is good, by age 3 growth slows dramatically. Based on the 2002 growth rates, the Von Bertalanffy growth model predicts walleye in Lake James should reach an asymptotic maximum length of 423 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. 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 in 1999, 2000, 2001, and 2002 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. Collect walleye data again in fall 2002 to further assess the appropriateness of the current 381-mm size limit.
3. Incorporate walleye collections into an ongoing evaluation of the fingerling walleye stocking program (Besler 2001b).

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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, 5-8 November 2002.

Variable	Combined Panels	Bar Mesh Size (mm)				
		25	32	38	44	51
Net Nights	12	12	12	12	12	12
CPUE	22.3	2.2	8.5	8.8	2.1	0.7
SD	8.9	3.4	3.7	5.0	2.0	1.2
C.O.V. (%)	40	157	44	57	95	185

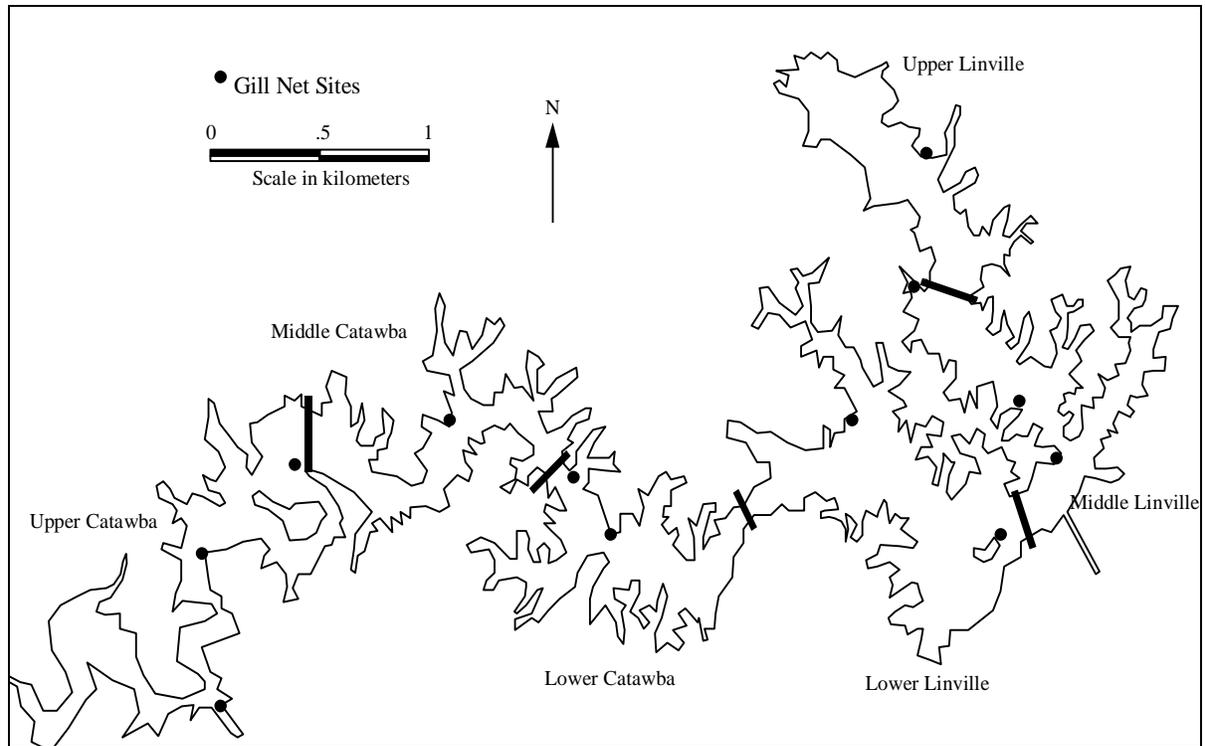


FIGURE 1.—Map of Lake James showing lake regions and the 2002 walleye gill net site locations.

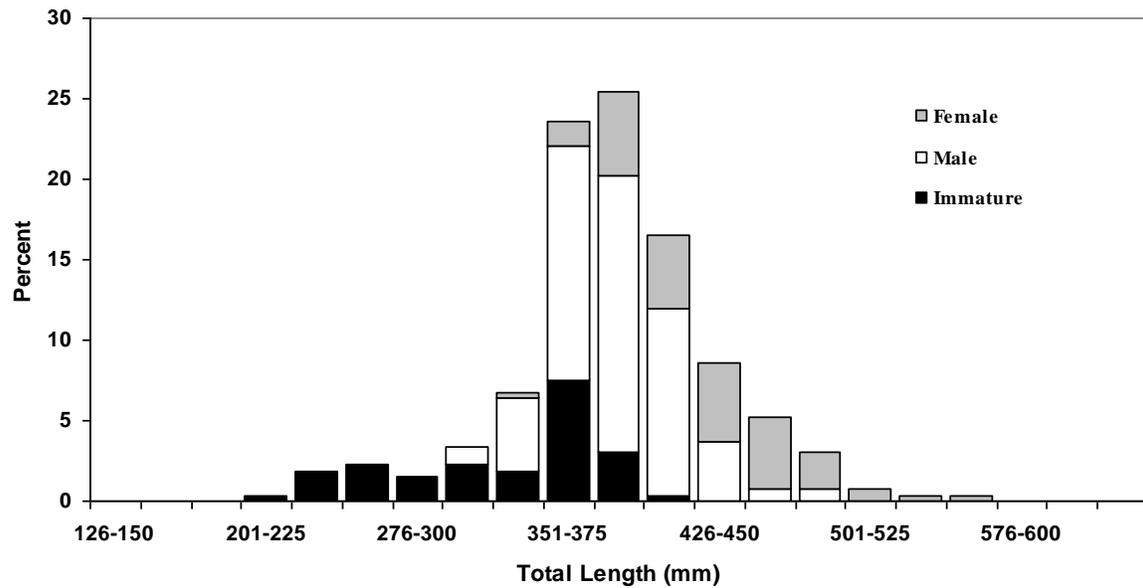


FIGURE 2.—Size distribution of walleye, by sex, captured in gill nets from Lake James, 5-8 November 2002.

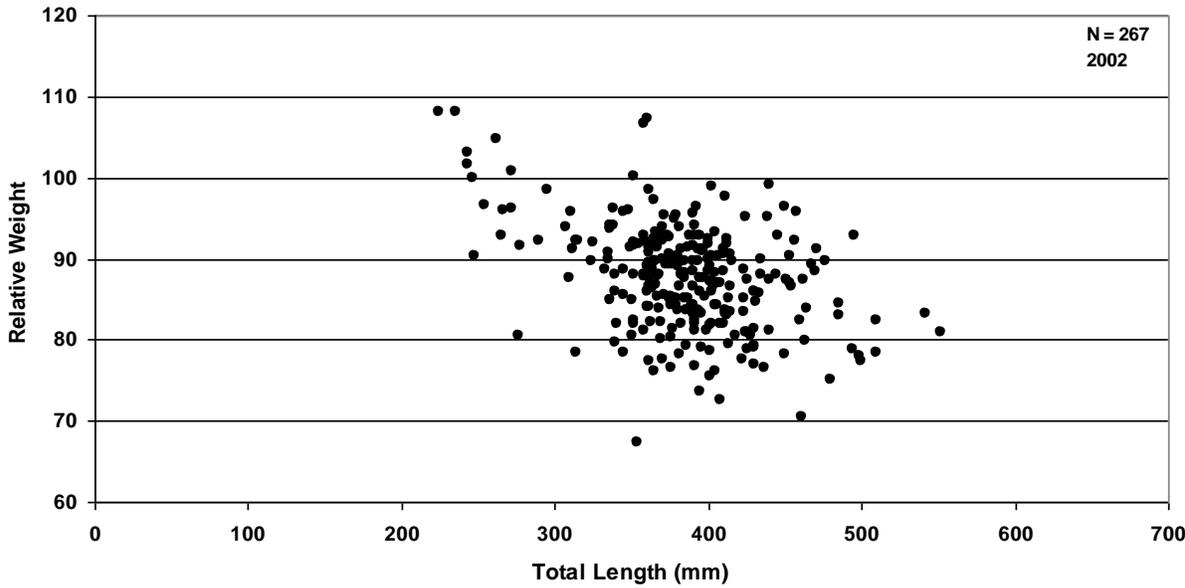


FIGURE 3.—Relative weights of walleye captured in gill nets from Lake James, 5-8 November 2002.

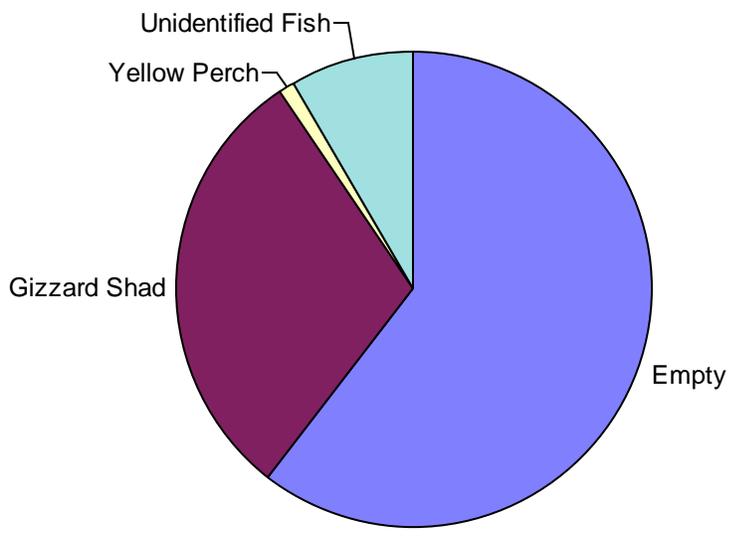


FIGURE 4.—Diet composition of walleye stomachs obtained from gill net samples on Lake James, 5-8 November 2002.

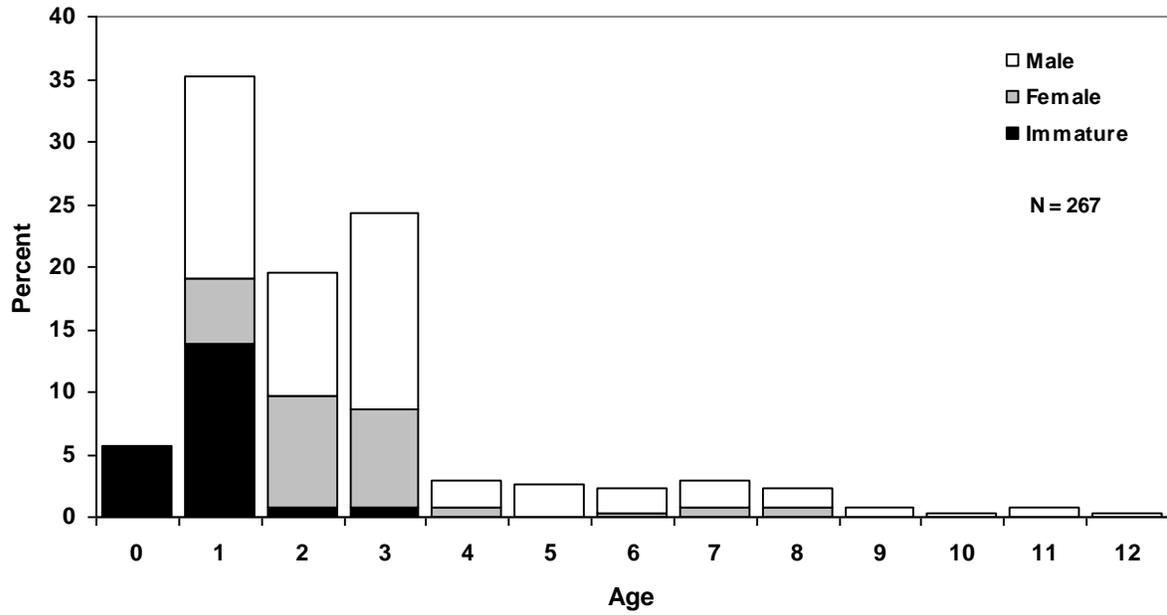


FIGURE 5.—Age distribution of walleye, by sex, captured in gill nets from Lake James, 5-8 November 2002.

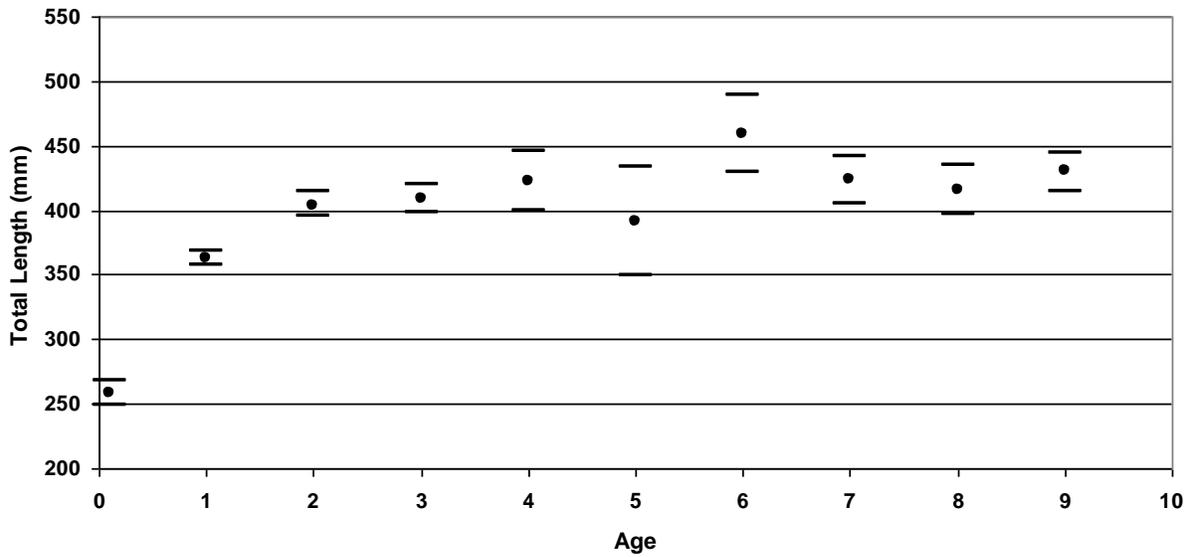


FIGURE 6.—Walleye mean total length (mm) at age at capture, with 95% confidence intervals. Walleye were collected in gill net samples from Lake James, 5-8 November 2002.

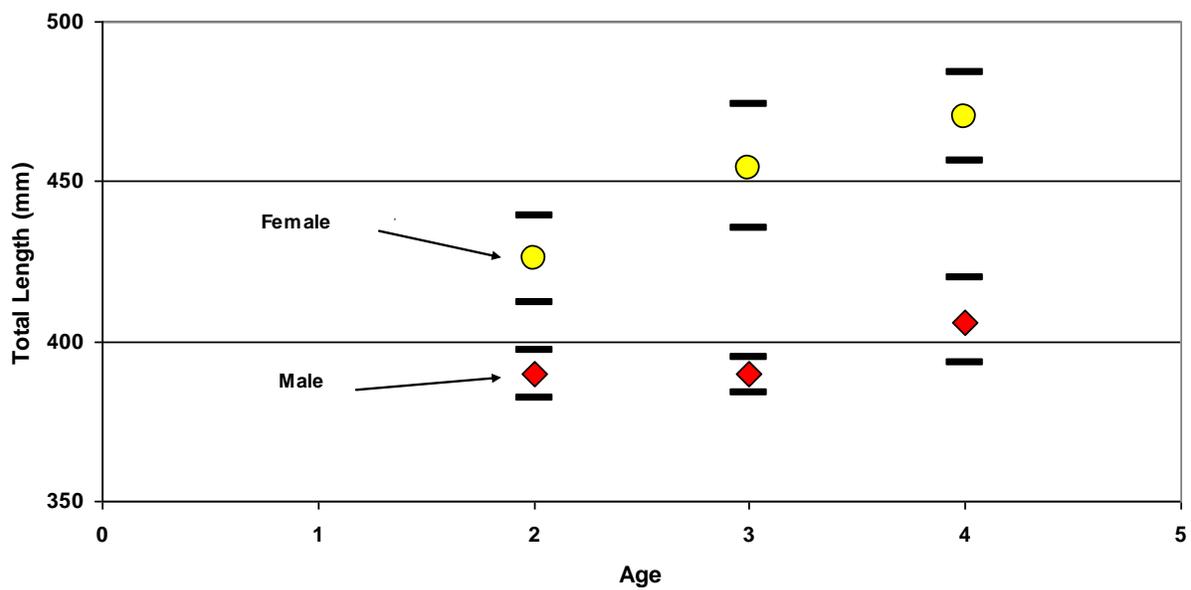


FIGURE 7.—Walleye mean total length (mm) at age, at capture, by sex, with 95% confidence intervals. Walleye were collected in gill net samples on Lake James, 5-8 November 2002.