# Contribution of Stocked Fingerling Walleye in Lake James

Interim Report

MOUNTAIN FISHERIES INVESTIGATIONS

Federal Aid in Restoration
Project F-24

Project Type: Survey

Period Covered: March 2001 – December 2001

Douglas A. Besler

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

2002

SPORT FISH RESTORATION

Abstract - In 1949, the North Carolina Wildlife Resources Commission (NCWRC) introduced walleye Stizostedion vitreum fry into Lake James and a population developed. Walleye stockings were halted after 1955 and the population was maintained by natural reproduction. Due to public pressure, the NCWRC resumed walleye stocking in 1980 to supplement natural reproduction. The objective of this study was to measure the contribution of stocked fingerling walleye in Lake James. Approximately 30,000 walleye fingerlings were marked with oxytetracycline hydrochloride (OTC) and stocked in Lake James in May 2000. Gillnetting was a conducted one year later in November 2001. During the gill net samples, 53 age-1 walleye were captured and 3.7% were OTC marked. The proportionate contribution reported was below the 25% management criteria used to determine stocking success. This study will be repeated in 2002

In 1949, the North Carolina Wildlife Resources Commission (NCWRC) introduced 35,000 walleye *Stizostedion vitreum* fry into Lake James. By 1955, 1.1 million fry had been stocked. 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 was maintained by natural reproduction. Historically, spawning has occurred in the Linville and Catawba rivers. Some reproduction may also occur within the reservoir (Brown and Kearson 1986). A section of the Linville River is closed to angling from 15 February through 15 April to protect spawning walleye.

As a result of public pressure, the NCWRC resumed walleye stocking in 1980 to supplement 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 variation in numbers stocked was the result of public pressure to stock all walleye produced at the Table Rock State Fish Hatchery back into Lake James. Stocking rates since 1999 have been stabilized at 30,000 fingerlings.

Supplemental stocking of walleye is a common management practice in the U.S., although its effectiveness has not been widely investigated (Li et al. 1996a). Walleye stocking program goals are usually designed to establish, supplement, or maintain populations (Laarman 1978). To be successful, supplementally stocked walleye must contribute to the abundance of the fishable population. Li et al. (1996a) concluded, after reviewing data on 200 Minnesota lakes, that stocking walleye fingerlings in lakes with natural reproduction did not improve age-1 recruitment and such lakes should not be stocked. It was also found that although the abundance of a naturally reproduced year class was increased with supplemental stocking on some lakes, the abundance of year classes one year younger and one year older was decreased (Li et al. 1996b). Nate et al. (2000) found that total walleye abundance was higher in Wisconsin lakes with natural reproduction compared to those sustained through stocking; they concluded that poor first-year survival of stocked walleye may be a factor contributing to the consistently lower recruitment. Of the studies reviewed by Laarman (1978), only 5% of all supplemental stocking programs were considered successful.

Supplemental stocking of walleye fry or fingerlings has been successful in systems with limited natural reproduction or recruitment. McWilliams and Larscheid (1992) found that 50-150 mm walleye fingerlings stocked at a rate of 30-68/ha into West Okoboji Lake, Iowa, comprised from 70-99% of the age-0 population. Recruitment in this system was limiting, however, and first year mortality of stocked walleye was 2-16 times greater than naturally reproduced fish. Other studies have reported successful maintenance walleye stocking programs in systems with little natural reproduction or recruitment (Fielder 1992; Kayle 1992).

Recruitment of walleye and formation of year-class size is often highly variable and can be affected by both density-independent and density-dependent mechanisms. Madenjian et al. (1996) found that 98% of the variation in western Lake Erie walleye recruitment was a function of spawning stock size, water temperature, and the density of gizzard shad *Dorosoma cepedianum*. Cannibalism was listed as a major factor regulating recruitment of walleye in Oneida Lake, New York, and was found to be inversely related to walleye growth rates (Forney 1976). Hansen et al. (1998) found the number of age-0 walleye produced and surviving through their first summer was regulated largely by early mortality associated with cannibalism, intraspecific competition, and water temperatures.

The supplemental stocking of walleye fingerlings in Lake James costs the NCWRC an estimated US$5,000 annually (M.G. Martin, NCWRC, personal communication). The cost of a stocked walleye creeled on Lake James is unknown. A study of supplemental stocking in Virginia estimated that a stocked walleye returned to the creel cost an average of $27.00 per fish (Murphy et al. 1983). In order to allow better use of limited NCWRC resources and manpower, the contribution of supplementally stocked walleye in Lake James needs to be addressed. The objective of this study was to measure the contribution of stocked fingerling walleye in Lake James.

## Methods

Thirty thousand walleye fry were pond-reared up to 50 mm mean total length and OTC marked in May 2000 at the Table Rock State Fish Hatchery. Walleye fingerlings were immersed in 500 mg/L oxytetracycline hydrochloride OTC and 1000 mg/L sodium chloride, buffered with tris to a pH of 6.5-6.9, for six hours in a 1.8 m diameter round fiberglass tank. A subsample of 400 walleye fingerlings were held in a fiberglass tank for 30 days and fed a diet of fathead minnow *Pimephales promelas* fry. Walleye fingerlings were stocked at a rate of approximately 11 fish/ha by boat in main channel areas throughout Lake James. A random subsample of 100 walleye fingerlings from the stocking tank were placed in a 0.9-$m^3$ net pen placed in Lake James to estimate 24-h post-stocking survival.

After 30 days post-marking, saggittal otoliths were removed from a random subsample of 100 walleye and checked for mark efficacy. One whole otolith from each walleye was bonded to a microscope slide using ethyl cyanoacrylate and viewed whole under a Nikon Eclipse E400™ compound microscope under transmitted epiflourescent light. If no mark was found, the otolith was then lightly sanded (4-5 strokes) using 400 grit wet-dry sandpaper and viewed under the microscope. This process was repeated until the OTC mark was identified or the focus had been reached. The presence or absence of an OTC mark was recorded for each age-0 walleye. The quality of the OTC marks were rated from 0-3: 0 = no mark, 1 = poor, 2 = fair, and 3 = good quality (Lorson and Mudrak 1987).

Twelve fixed gill net locations were established on Lake James in 1999 to sample walleye. These sites were located on lake points with a moderate slope of 25 - 45$^o$ using a stratified non-random design to represent all areas of the lake. Experimental gill nets were set in November 2001. Gill net dimensions were 2.4 X 76.3 m and consisted of five 2.4 X 15.3-m panels with 25-, 32-, 38-, 44- and 51-mm bar mesh. All nets were bottom-set perpendicular to shore for 24 hours. The mesh size towards shore was randomly selected for each net set. Gill nets were run in the same order they were set. All walleye captured were separated by site and mesh size, bagged with an identifying site label, placed on ice, and returned to the Marion State Fish Hatchery.

Walleye returned to the hatchery were measured for total length (TL, mm) and weight (g), and given a unique identification number. Saggittal otoliths were removed and placed in plastic otolith vials with the corresponding unique identification number, stored in the dark, and allowed to air-dry for 14 days. Otoliths were then immersed in water, and viewed under reflected light using a 10X dissecting microscope (Hammers and Miranda 1991). Otoliths were read independently by two readers to verify the age.

Age-1 otoliths were then viewed whole the epiflourescent microscope using the same methods as the mark efficacy portion of the study. The presence or absence and quality of an OTC mark was recorded for each age-1 walleye.

One gill net night was used as the unit of effort. The mean number of marked and unmarked age-1 walleye captured per net night was used as a measure of relative abundance. Relative abundance of stocked and naturally reproduced age-1 walleye was compared using a Mann-Whitney test. All statistical tests declared significance at $\alpha = 0.10$ and utilized the SYSTAT computer software package (2000).

The proportionate contribution of stocked walleye to its year-class was estimated by dividing the number of marked age-1 walleye, adjusted for OTC mark loss, by the total number of age-1 walleye captured. Mark loss was accounted for by multiplying the number of marked fish by 1.X, where X equals the percent rate of mark loss.

## Results and Discussion

Approximately 30,000 walleye fingerlings were stocked in Lake James by boat on 19 May 2000. Mean TL at stocking was 45.3 mm. Twenty-four hour post-stocking survival was 96%. Otolith OTC mark retention was 100% at 30 days post stocking and the average mark quality was 2.6. Since OTC mark retention was 100%, no adjustment was made for tag loss.

A total of 53 age-1 walleye were captured during 12 gill net nights from 6-9 November 2001. Overall, age-1 walleye were captured at a rate of 4.4 fish/net night. Naturally reproduced age-1 walleye were captured at a significantly higher rate (4.3 fish/net night) than OTC marked age-1 walleye (0.2 fish/net night) over the pooled gill net sample ($P = 0.001$). Age-1 walleye CPUE was not significantly higher in the Catawba arm of Lake James (6.3 fish/net night) compared to the Linville arm (2.5 fish/net night) of the reservoir ($P = 0.369$).

Age-1 walleye ranged in size from 265-406 mm TL (Figure 2). Between-lake region differences in the sizes of age-1 walleye were found. Overall, the mean size of an age-1 walleye captured from the Catawba arm of the reservoir was 21 mm larger than one collected from the Linville arm (Table 1). The age-1 walleye size differential observed among regions in Lake James has been documented for both age-0 (Besler 2002a) as well as adult walleye (Besler 2000, Besler 2001, Besler 2002b). Although walleye sizes vary among lake regions, the length frequency distribution suggests that the age-1 year class is vulnerable to the gill nets used in this study and that the age-1 walleye obtained are a representative sample.

The proportionate contribution of OTC marked age-1 walleye was 3.7% (N = 53). The proportionate contribution reported was below the 25% management criteria used to determine stocking success.

## Conclusions

Stocked walleye are contributing to the age-1 population in Lake James at a low rate. The proportionate contribution reported after year one of this study was below the 25% management criteria used to determine stocking success. This study will be repeated in 2002.

## Recommendations

1) Continue the study as planned in 2002.

## References

Brown, R. J. and L. L. Kearson. 1986. An evaluation of the fishery resources of Lake James with special emphasis on the management of the walleye. Progress Report. North Carolina Wildlife Resources Commission, Raleigh.

Brown, R. J., and J. H. Mickey, Jr. 1976. Lake James fishery management, 1957–1976. Special Report. North Carolina Wildlife Resources Commission, Raleigh.

Fielder, D. G. 1992. Evaluation of stocking walleye fry and fingerlings and factors affecting their success in lower Lake Oahe, South Dakota. North American Journal of Fisheries Management 12:336-345.

Forney, J. L. 1976. Year-class formation in the walleye (*Stizostedion vitreum vitreum*) population of Oneida Lake, New York, 1966-73. Journal of the Fisheries Research Board of Canada 33:783-792.

Hammers, B. E., and L. E. Miranda. 1991. Comparison of methods for estimating age, growth, and related population characteristics of white crappies. North American Journal of Fisheries Management 11:492-498.

Hansen, M. J., M. A. Bozek, J. R. Newby, S. P. Newman, and M. D. Staggs. 1998. Factors affecting recruitment of walleyes in Escanaba Lake, Wisconsin, 1958-1996. North American Journal of Fisheries Managemet 18:764-774

Hauber, A. B. 1983. Two methods for evaluating fingerling walleye stocking success and natural year class densities in Seven Island Lake, Wisconsin, 1977-1981. North American Journal of Fisheries Management 3:152-155.

Kayle, K. A. 1992. Use of oxytetracycline to determine the contribution of stocked fingerling walleyes. North American Journal of Fisheries Management 12:353-355.

Laarman, P. W. 1978. Case histories of stocking walleyes in inland lakes, impoundments, and the Great Lakes – 100 years with walleyes. American Fisheries Society Special Publication 11:254-260.

Lorson, R. D., and V. A. Mudrak. 1987. Use of tetracycline to mark otoliths of American shad fry. North American Journal of Fisheries Management 7:453-455.

Li, J., Y. Cohen, D. H. Schupp, and I. R. Adelman. 1996a. Effects of walleye stocking on population abundance and fish size. North American Journal of Fisheries Management 16:830-839.

Li, J., Y. Cohen, D. H. Schupp, and I. R. Adelman. 1996b. Effects of walleye stocking on year class strength. North American Journal of Fisheries Management 16:840-850.

Madenjian, C. P., J. T. Tyson, R. L. Knight, M. W. Kershner, and M. J. Hansen. 1996. First year growth, recruitment, and maturity of walleyes in western Lake Erie. Transactions of the American Fisheries Society 125:821-830.

McWilliams, R. H., and J. G. Larscheid. 1992. Assessment of walleye fry and fingerling stocking in the Okoboji lakes, Iowa. North American Journal of Fisheries Management 12:329-335.

Murphy, B.R., L.A. Nielson, and B. J. Turner. 1983. Use of genetic tags to evaluate stocking success for reservoir walleyes. Transactions of the American Fishery Society 112:457-463.

Nate, N. A., M. A. Bozek, M. J. Hansen, and S. W. Hewett. 2000. Variation in walleye abundance with lake size and recruitment source. North American Journal of Fisheries Management 20:119-126.

Regier, H.A., V.C. Applegate and R.A. Ryder. 1969. The ecology and management of walleye in western Lake Erie. Technical Report. Great Lakes Fisheries Commission 15:101 pages.

SYSTAT. 2000. SYSTAT 10 Statistics. SPSS, Inc., Chicago, Illinois.

TABLE 1.—Summary statistics of age-1 walleye captured by gill nets from Lake James in November 2001. Summary statistics also broken down within the Catawba and Linvile reservoir regions.

| Summary Statistic | Overall | Catawba | Linville |
|---|---|---|---|
| Sample Size | 53 | 38 | 15 |
| Mean | 363.7 | 369.8 | 348.2 |
| SE | 4.4 | 5.5 | 4.9 |
| SD | 31.8 | 33.8 | 19.1 |
| 95% Upper CI | 372.2 | 380.5 | 357.9 |
| 95% Lower CI | 355.1 | 359.0 | 338.5 |
| C.V. (%) | 8.7 | 9.3 | 5.5 |

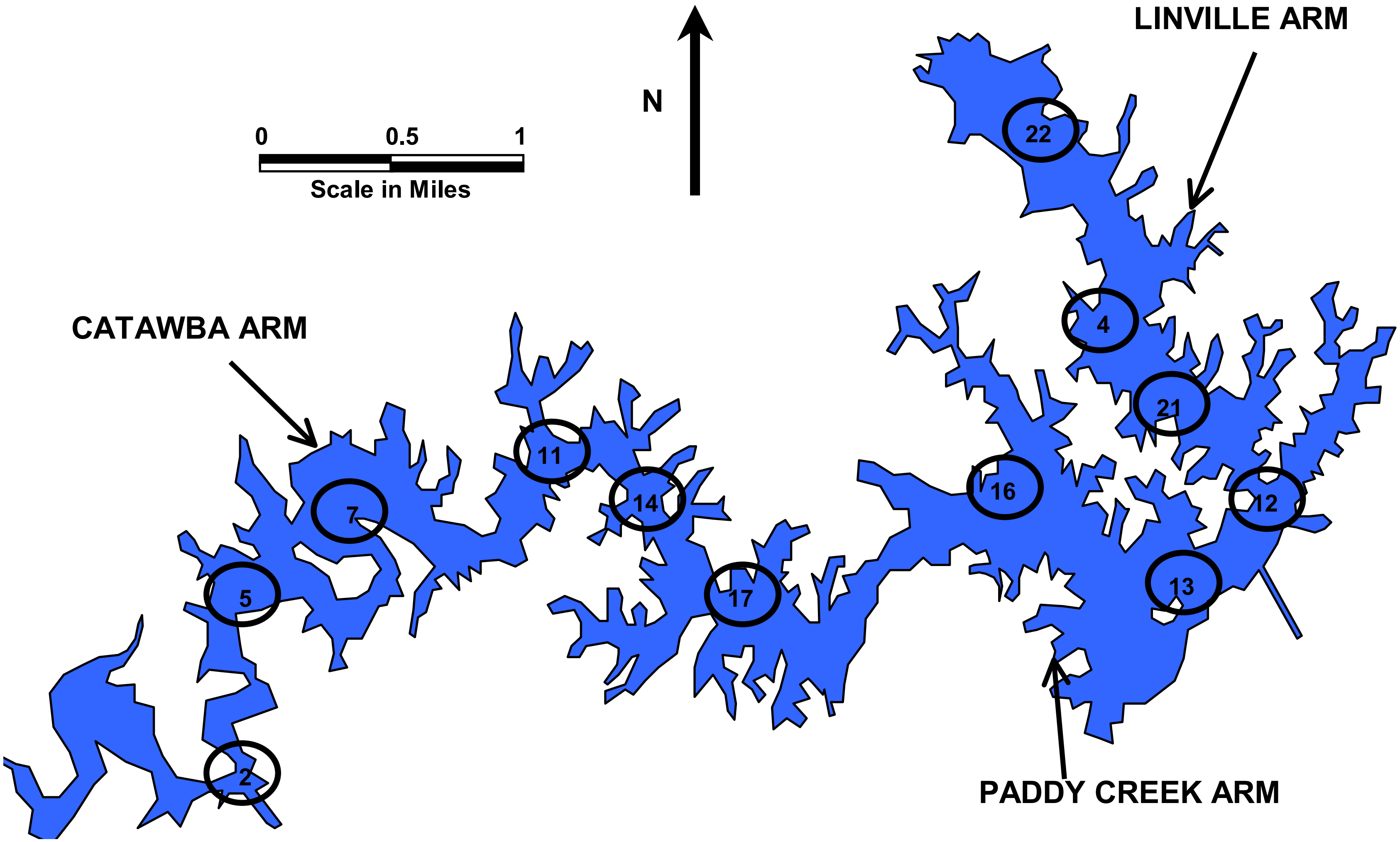


FIGURE 1.—Schematic map of Lake James, Burke and McDowell counties, North Carolina. Identified areas are the major arms of the reservoir and the numbered 2001 gill net sampling locations.

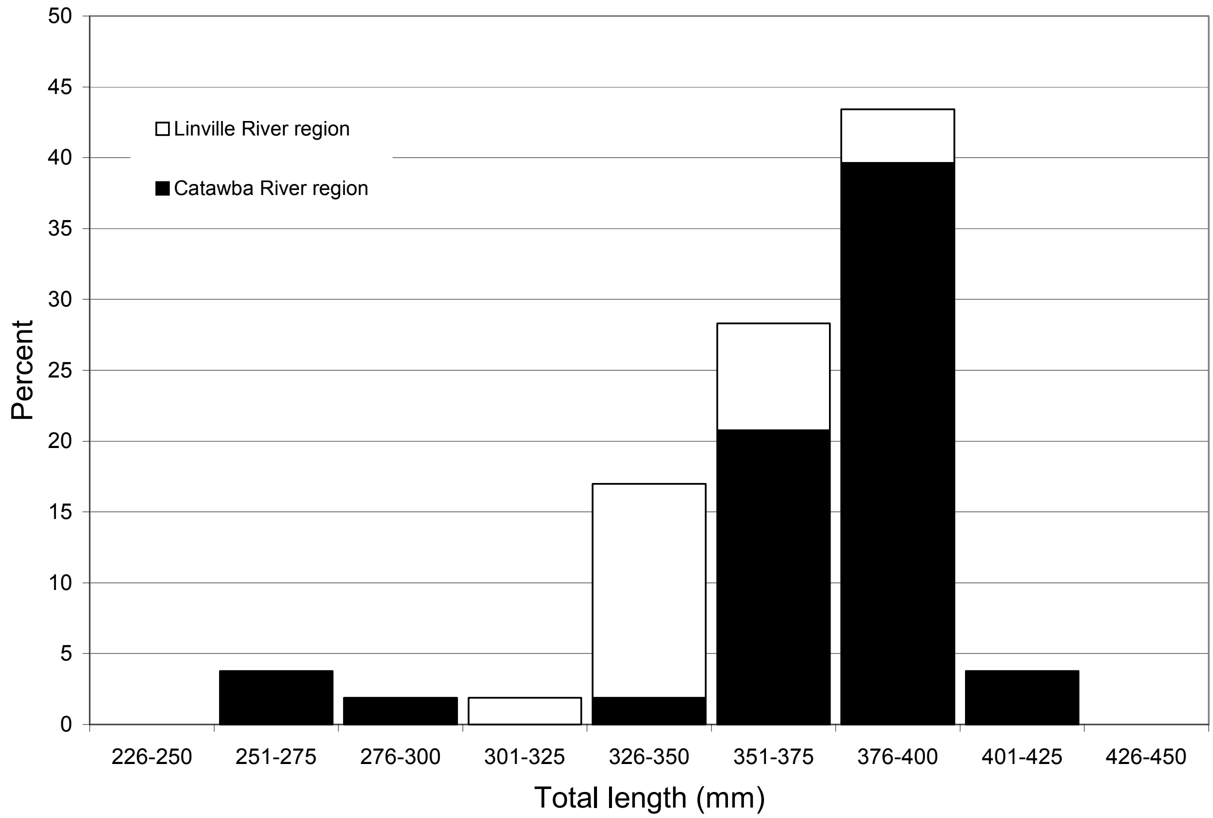


FIGURE 2.–Length frequency distribution of age-1 walleye captured in gill nets from Lake James, November 2001.