NORTH CAROLINA WILDLIFE RESOURCES COMMISSION
DIVISION OF BOATING AND INLAND FISHERIES

FINAL REPORT

Project Title:	Mountain Fisheries Investigations
Project Number:	F-24-13
Study Title:	**EVALUATION OF THE FISHERY RESOURCES OF LAKE JAMES EMPHASIZING WALLEYE MANAGEMENT**
Study Type:	Survey
Period:	1 April 1983 - 31 October 1987

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Abstract: In 1983, the North Carolina Wildlife Resources Commission (NCWRC) and Duke Power Company initiated a 5-year study on Lake James to develop indices of abundance for walleye (*Stizostedion vitreum*) and other species which may have utility in relating water level management to fish populations. The objectives were: 1) to determine the extent of summer hypolimnetic oxygen depletion, 2) to determine the annual variation in fish standing crops, 3) to determine if sufficient numbers of fish could be captured in cove rotenone samples to calculate Young-Adult Ratios (YAR) and Proportional Stock Densities (PSD) for selected species, 4) to determine if young-of-year (YOY) walleye could be captured in sufficient numbers by night shoreline electrofishing to calculate an index of year class abundance, and 5) to determine if sufficient numbers of age I and II walleye could be captured in experimental gill nets to calculate an index of year class abundance. An additional objective, added in 1986, was to quantify the relative annual abundance and location of walleye spawners in the Linville River. Low oxygen levels were present in the aphotic zone throughout the lake during summer. Oxygen depletion was most extensive during September. The average standing crop was 141.2 kg/ha. Small numbers of adult fish and large variations in fish abundance data from cove rotenone data made YARs and PSDs unreliable indices. Electrofishing catch-per-unit-effort (CPUE) for YOY walleye, while variable, appears to provide a relative indicator of year class strength, although correlations with population size were not made in this study. Age I walleye were not captured efficiently in gill nets, but age II and III were captured in sufficient numbers to calculate an index of abundance. Fewer walleye spawners were present in the Linville River during 1986 than 1987, but fish were observed throughout the sampling area in both years.

Lake James was initially stocked by the NCWRC with walleye fry from unknown sources in 1949, 1950, and 1952. These stockings established a self-sustaining population which was followed by the development of an important sport fishery (Richardson and Ratledge 1961). Additional stockings were periodically made by the NCWRC because of public pressure to improve the walleye fishery. Changes in anglers' catches that prompted the public pressure for the stockings most likely reflected natural fluctuations in walleye abundance. This characteristic has been seen in other walleye populations (Hile 1954, Regier et al. 1969, Forney 1980) and is probably a normal phenomenon of self-sustaining walleye populations. Factors suspected of causing these fluctuations include rapid changes in water temperatures during spawning and egg incubation (Bush et al. 1975, Serns 1982), fluctuating prey abundance (Forney 1980), fluctuating water levels (Groen and Schroeder 1978, Kallemeyn 1987), and cannibalism (Forney 1980).

Surveys of Lake James have shown similar fluctuations in standing crops of all game and nongame fish species (Brown and Mickey 1976). Brown (1979) speculated that low lake levels and lake level fluctuations during spawning and egg incubation were a cause of reduced recruitment. During the last 10 years, spring lake levels have fluctuated an average of 2 m with the maximum change exceeding 4 m (Duke Power Co. unpubl. data).

In 1982, the NCWRC requested several modifications to the Duke Power Company water level management plan (rule curve) to minimize water level fluctuations during March and April. The NCWRC specifically requested the minimum lake level, normally reached by the end of February, be increased by 0.6 m. This assumed the higher lake level was necessary for adult walleye to reach spawning areas in the Linville River. It also was requested that lake level be stabilized for a 25-day period following peak walleye lake spawning. Duke Power Company altered the rule curve for Lake James in 1983, but did not implement the lake level stabilization plan.

In 1983, following the change in the rule curve, Duke Power Company and the NCWRC initiated this 5-year cooperative study. The purpose of this study was to develop indices of abundance for walleye and other species which may have utility in relating water level management to fish population fluctuations. Such indices could be used to determine if changes in management, particularly regulations, may be necessary for particular species. The objectives were: 1) to determine the extent of summer hypolimnetic oxygen depletion, 2) to determine the annual variation in fish standing crops, 3) to determine if sufficient numbers of fish could be captured from cove rotenone samples to calculate Young-Adult Ratios (YAR) and Proportional Stock Densities (PSD) for selected species, 4) to determine if young-of-year (YOY) walleye could be captured in sufficient numbers from night shoreline electrofishing to calculate an index of year class abundance, and 5) to determine if sufficient numbers of age I and II walleye could be captured in experimental gill nets to calculate an index of year class abundance. An additional objective, added in 1986, was to determine the relative annual abundance and location of walleye spawners in the Linville River.

We acknowledge Duke Power Company's cooperation in providing equipment and the assistance of Steve Johnson, Don Degan, Sandra Sherer, and Don Cloutman to complete these studies. Gratitude is extended to the owners and operators of Mountain Harbor Marina and Mimosa Boat Landing for the use of their facilities. A special thanks is given to Ben and J.C. Dellinger for granting unlimited access to their property for observations of the Linville River spawning area.

METHODS

Lake Description

Lake James was formed in 1923 when 3 earthen dams were completed on the Catawba and Linville rivers and Paddy Creek. The resulting 2,700-ha mesotrophic reservoir was actually formed by connecting 2 basins, the Linville Arm (LA) and the Catawba Arm (CA), by a 10-m deep canal (Fig. 1). Located in western North Carolina at the base of the Blue Ridge Mountains, Lake James is unique in the Catawba River chain of reservoirs because it supports reproducing populations of smallmouth bass (*Micropterus dolomieui*) and walleye along with such warmwater species as largemouth bass (*M. salmoides*) and black crappie (*Pomoxis nigromaculatus*).

Water Chemistry

Monthly oxygen and temperature measurements were taken from July through December in 1984 and 1985 using a Yellow Springs Instruments Model 54 temperature/dissolved oxygen meter. Four stations were located on the LA, including 1 in the Paddy Creek section, and 3 stations were located on the CA. A station in the connecting canal was added in 1985 (Fig. 1). Isopleths and isotherms were drawn to provide graphic depictions of the oxygen and temperature regimes occurring in the lake and to determine the extent of summer hypolimnetic oxygen depletion.

Cove Rotenone

One cove in each arm of the lake (Fig. 1) was rotenoned using a 5% solution applied at a rate of 1 mg/l. Block nets were set at both ends of each cove. All fish collected on the first day were identified to species, sorted into 25-mm size groups, counted, and weighed to the nearest gram or kilogram. Average individual weights of each species in each size group from the first day were used to estimate the weight of fish in those size groups collected on the second day. Subsampling was necessary to estimate numbers of abundant species or size groups. Species of the genera *Pomoxis*, *Notropis*, and *Etheostoma* were not sorted. Standing crops were calculated for all species groups. Comparisons of mean standing crops of each arm of the lake were made using a Wilcoxon Rank Sum Test (Ott 1984) with small sample-size critical values (Hollander and Wolf 1973). Significance was determined at $\alpha = 0.05$.

Proportional Stock Densities ($PSD_{x,y}$), where x is the number of fish greater than or equal to stock size in centimeters and y is the number of fish greater than or equal to quality size in centimeters, were calculated according to Anderson and Gutreuter (1983). Species for which PSD calculations were made included: redbreast sunfish (*Lepomis auritus*) and bluegill (*L. macrochirus*) ($PSD_{10,15}$), crappie ($PSD_{15,20}$), largemouth and smallmouth bass ($PSD_{20,30}$), and walleye ($PSD_{30,40}$).

Young-Adult Ratios ($YAR_{x,y}$), where x equals the maximum total length of young-of-year in centimeters and y equals the minimum total length of adults in centimeters, were calculated as an index of reproductive success (Reynolds and Baab 1978). YARs were calculated for redbreast sunfish and bluegill ($YAR_{7.5,10.0}$), largemouth and smallmouth bass ($YAR_{12.5,30.0}$), crappie ($YAR_{7.5,15.0}$), yellow perch ($YAR_{10.0,15.0}$), and walleye ($YAR_{20.0,40.0}$).

Electrofishing

A boat mounted Smith Root Mark VI electrofishing unit was used to capture walleye at night on sandy bottom shorelines. Output was 600 volts DC at 4 amps. Eight shoreline stations were chosen on the LA and Paddy Creek section (Fig. 1). Sampling was conducted between April and October 1985-1987. CPUE was expressed as number of walleye captured per 100 m of shoreline electrofished.

Gillnetting

Three experimental monofilament gill nets, each 45.6 x 2.4 m and consisting of three 15.2-m panels of 50-, 64-, and 76-mm stretch mesh, were fished overnight on the bottom during September at each of 4 stations. Effort was equally divided between the CA and LA (Fig. 1). Each walleye captured was weighed to the nearest gram, measured to the nearest millimeter in total length, and had a scale sample removed from the left side below the lateral line at the tip of the pectoral fin. Walleye ages were determined from scale impressions made on cellulose acetate slides (Lagler 1956). Age class distributions and CPUEs were determined for each year of gillnetting. All CPUEs were expressed as number of walleye captured per 100 m of gill net.

Walleye Spawning Counts

Walleye spawning counts were made between the first week of March and the first week of April during 1986 and 1987 on the Linville River. Four observation stations, located at the lower ends of pools, were established on the river between the lake and the NC 126 bridge (Fig. 1). Spawning walleye were counted by sweeping a 12-volt spotlight beam across the river and counting the reflections from the tapeta lucida of walleye. Counts were started at 2130 hours at the lower station.

RESULTS

Water Chemistry

Figure 2 demonstrates a generalized cross section of Lake James showing the typical late summer thermal stratification with associated dissolved oxygen (DO) regimes and locations of the canal and penstock. By July the CA was stratified, its thermocline located between 8 and 10 m. Generally, temperatures in the thermocline ranged between 11 and 19 C (Brown and Kearson 1986, 1987). The thermocline location increased in depth throughout the summer and fall, and by November it was located at 15 m. It contained temperatures ranging between 8-16 C. The LA never developed a well-defined thermocline during 1984 and 1985, and the isotherms were generally widely separated.

On the CA, dissolved oxygen levels were <5 mg/l at depths >7 m from July through October. Lowest oxygen levels were found in October 1985 when most of the hypolimnetic waters had DO levels <1 mg/l (Brown and Kearson 1986). However, an area of increased DO was present in the hypolimnion behind the Catawba Dam from July through September in 1984, and from July through August in 1985 (Fig. 2). This pocket of water also appeared to vary in volume and dissolved oxygen level during the 2 summers of observations. After October, the amount of low DO water in the hypolimnion declined.

Oxygen depletion occurred throughout the LA at depths below 9-14 m from July through September eventhough a thermocline was absent. Because of the deepwater draw-off on the LA, the volume of low DO water decreased by autumn. By October, low DO water was found only below depths ranging from 19-25 m.

Cove Rotenone

Twenty-seven species of fish were found in cove rotenone samples during the study (Table 1). The mean standing crops for the LA (129.3 ± 62.0 kg/ha) and the CA (153.1 ± 16.1 kg/ha) were not significantly different ($P > 0.05$). The average standing crop for Lake James was 141.2 kg/ha. Species abundance and standing crops were highly variable during the study (Table 2).

Young-Adult Ratios calculated from the rotenone data also were highly variable, ranging in value from 0 to 376 (Table 3). In some years YARs could not be calculated because no adult fish were collected. This was true for all species of interest, except redbreast sunfish and bluegill.

PSDs exhibited maximum variability, ranging in value from 0% to 100% (Table 4). This occurred because the numbers of stock size fish were generally <50 for all species in all years. For largemouth bass, smallmouth bass, and walleye the numbers of stock size fish were generally <10. Most PSDs for walleye were equal to 0 (Table 4).

Electrofishing

The number of YOY walleye captured by electrofishing was 38 in 1985, 27 in 1986, and 71 in 1987. Few, or no, YOY walleye were captured in April, May, or June of any year. The majority of the YOY walleye were captured from July through September. Catches always declined during October. Monthly CPUEs ranged from 0.00 to 1.37 walleye/100 m of shoreline (Table 5).

Gillnetting

The lakewide walleye index of abundance was 18.0, 10.6, 7.3, 21.5, and 22.3 walleye captured/100 m of gill net from 1983 through 1987. Although gill nets captured walleye from age 0 through V, most of the catch was of age II (43%) and III (33%) fish (Table 6). Few age 0 or I walleye were captured in gill nets.

Age II and III CPUEs showed similar trends (an increase in all cases) between the 1982, 1983, and 1984 year classes. Comparisons of CPUEs for these same age groups of the 1981 and 1982 year classes were inconsistent, i.e. one showed a decline, while the other showed no change.

Comparisons between age II and III walleye within each year class showed no consistent relationship. The 1981 and 1984 year classes were better represented by age II fish, while the 1982 and 1983 year classes were better represented by age III fish.

Walleye Spawning Counts

A total of 378 walleye were observed in 1986 (Brown et al. 1987) and 701 were observed in 1987. The greater number observed in 1987 was in spite of 9 nights when weather or water conditions substantially affected the ability to count walleye. Walleye were observed at all 4 stations in both years.

DISCUSSION

Water Chemistry

The extent and duration of summer and fall DO depletion in aphotic waters was influenced by the physical features of Lake James. The relatively shallow canal between the 2 arms of the lake allowed only surface waters to flow from the CA to the LA. As a result, a pocket of cold, well-oxygenated water was formed in the hypolimnion near the Catawba Dam (Fig. 2) after the lake became thermally stratified. The remainder of the CA hypolimnion had low oxygen levels. This high DO area may have a role in the distribution of coolwater fish species of Lake James. It may be a refuge area for these species, especially during the critical October period when most of the CA hypolimnetic waters contain insufficient DO to support coolwater fish species.

The canal and withdrawal of water through the penstock were the main physical features influencing the water chemistry of the LA (Fig. 2). The canal allowed only warmer, epilimnetic CA waters to replace LA waters lost through power generation. These warmer waters flowed through the canal and mixed with LA waters near Paddy Creek Dam. The combined influences of water withdrawal and location of the canal apparently resulted in increased mixing that prevented thermal stratification.

Water withdrawal through the penstock also influenced the DO regimes of the LA. From July through early August coolwater fishery habitat was reduced in volume by the loss of cold, well-oxygenated waters from the aphotic zone. Fishery habitat was further restricted as warmer replacement waters became deoxygenated. Coolwater fishery habitat was restored to a large portion of the LA in September as a result of the withdrawal of low DO water during power generation and the cooling of surface waters.

Using the 1984-85 water chemistry data, a generalized view of available walleye habitat in Lake James during late summer was constructed (Fig. 2). Using walleye's physiological optima for temperature of 21-23 C (Hokanson 1977) and DO of ≥5 mg/l, the amount of walleye habitat on each arm of the lake was defined. The extent of walleye habitat was greater on the LA and Paddy Creek section than on the CA during September. The capture of greater numbers of walleye in gill nets on the LA also may indicate the LA had a greater amount of coolwater habitat during this time.

Cove Rotenone

Mean total fish standing crop of 141.2 kg/ha found in this study is similar to values previously reported for Lake James and below standing crops reported for most reservoirs located further downstream on the Catawba River (Brown and Kearson 1984). Buynak (1986) found Kentucky lakes with highly forested watersheds to be less productive. The tributaries of Lake James drain a watershed which is largely forested, infertile, and sparsely populated. Downstream reservoirs receive runoff from agricultural land, in addition to wastewater effluents from more populated municipalities.

Although standing crops of the LA and CA were not significantly different, the CA generally had higher total standing crops. Differences in standing crops were primarily due to fluctuations in the standing crops of nongame fish, principally gizzard shad. This may be indicative of differences in productivity of the 2 arms.

The YAR and PSD indices were not reliable measures of reproductive success or size distributions of gamefish species because adult fish were either poorly represented or their numbers varied drastically. Even bluegill, redbreast sunfish, and crappie, which were well represented by adult fish in samples, did not provide reliable indices since YOY could not be captured in cove rotenone samples in relation to their true abundance. Frequently, YOY from late spawning sunfish species were found to pass through dip nets having 0.5-cm size mesh. In evaluating the usefulness of rotenone data to assess largemouth bass spawning success as related to lake stabilization, Cloutman (1987) determined that because of small sample sizes and high variances it would require 149 replicates to determine any relationship between these variables. He concluded rotenone sampling was not an adequate method to evaluate the Duke Power lake stabilization program.

Electrofishing

Electrofishing has proven to be effective for capturing YOY walleye in other areas (Serns 1982). This also is true of Lake James, although the amount of shoreline suitable for such sampling is limited. Because of monthly variations in CPUE (walleye/100 m of shoreline), an average CPUE appears to be the best indicator of YOY abundance. Since YOY walleye were not readily captured before July, the mean CPUE for July through October is a more appropriate indicator of their abundance.

Factors which may have affected the capture of YOY walleye by electrofishing include changes in lake water levels and electrofishing boat design. Low lake levels during 1986 reduced the amount of area available for electrofishing within the sample areas. Although a change in the electrofishing boat electrode array made between the 1985 and 1986 seasons was not assessed, it was assumed it would not affect the results.

Gillnetting

The objective of gillnetting was to develop indices of abundance for age I and II walleye to assess year class strength. However, few age I walleye were captured. Willis (1987) found gill nets with mesh sizes of 50 and 64 mm effectively captured walleye ranging from 230-519 mm total length. Age II and III walleye in Lake James were within this size range (Brown and Kearson 1984) and were effectively captured by the nets. Age I Lake James walleye were generally <230 mm and not subject to capture using this method. Another factor influencing the catch of age I walleye may be that fish of this size segregate themselves from the larger and older fish. Based on these results, gillnetting was found to provide data suitable to calculate an index of abundance for age II and III walleye, but not age I fish.

Evaluation of the gillnetting CPUEs is difficult without an estimate of the corresponding walleye populations. Assuming the gillnets capture age II and III walleye in relation to their abundance, it appears these CPUEs are providing us with a relative indication of year class strength. The unexpected increases in CPUEs between age II and III walleye within the 1982 and 1983 year classes must also be examined before these indicators can be relied upon.

Walleye Spawning Counts

Spring rains and power generation are the factors which determine Lake James water levels. Duke Power Company has been able to closely match the rule curve only during dry years (Duke Power Co., unpubl. data) because stable river flows have allowed them to maintain stable lake levels. Despite the low river flows and low lake levels occurring during this study, river spawning walleye were observed at all 4 stations. Thus, it does not appear that either lake level, as dictated by the rule curve, or river flow are factors which prevent successful spawning in the Linville River.

SUMMARY

Understanding Lake James' summer temperature and dissolved oxygen regimes is important in making inferences as to their affect on the fishery resources. Walleye distribution, growth, and mortality rates may be influenced by the amount of optimal habitat available in September. Increased knowledge of the effects of temperature and dissolved oxygen upon gamefish populations may be helpful in their management, but it is acknowledged that little can be done to change this relationship.

The extreme variation in rotenone catches at Lake James precluded using biomass, YAR, or PSD indices to evaluate the lake level management program. It does appear, however, that the indices developed from electrofishing for age 0 and gill nets for age II and

III walleye show potential for predicting their relative year class strengths. Once these indices are correlated to fish abundance they may become useful as a tool for managing Lake James walleye.

The spawning counts on the Linville River revealed walleye can reach spawning sites under very low river flow and lake level conditions. As a result, these are not considered factors which prevent successful river spawning.

RECOMMENDATIONS

1. Discontinue annual cove rotenone sampling to assess gamefish stocks.

2. Continue to develop year class strength databases for age 0, II, and III walleye using electrofishing and gillnetting techniques, and correlate the YOY abundance index with year class strength of age II and III walleye.

3. Determine correlations between walleye population size and abundance indices.

LITERATURE CITED

Anderson, R.O. and S.J. Gutreuter. 1983. Length, weight, and associated structural indices. Pages 283-300 in L.A. Nielsen and D.L. Johnson, eds. Fisheries techniques. Am. Fish. Soc., Bethesda, Md.

Brown, R.J. 1979. Cove rotenone samples on Lake James, 1979. Proj. F-24-5. N.C. Wildl. Resour. Comm., Raleigh. 9pp.

__________, C.J. Goudreau, and J.C. Borawa. 1987. An evaluation of the fishery resources of Lake James with special emphasis on the management of the walleye - progress report - 1986. Proj. F-24-11. N.C. Wildl. Resour. Comm., Raleigh. 11pp.

__________ and L.L. Kearson. 1984. Lake James survey report, 1981-1983. Proj. F-24-9. N.C. Wildl. Resour. Comm., Raleigh. 18pp.

__________________________. 1986. An evaluation of the fishery resources of Lake James with special emphasis on the management of the walleye - progress report - 1984. Proj. F-24-10. N.C. Wildl. Resour. Comm., Raleigh. 21pp.

__________________________. 1987. An evaluation of the fishery resources of Lake James with special emphasis on the management of the walleye - progress report - 1985. Proj. F-24-11. N.C. Wildl. Resour. Comm., Raleigh. 26pp.

Brown, R.J. and J.H. Mickey, Jr. 1976. Lake James fishery management, 1957-1976. Proj. F-24-1. N.C. Wildl. Resour. Comm., Raleigh. 34pp.

Bush, W., R.L. Scholl and W.L. Hartman. 1975. Environmental factors effecting the strength of walleye (Stizostedion vitreum) year classes in western Lake Erie, 1960-70. J. Fish. Res. Bd. Can. 32:1733-43.

Buynak, G.L. 1986. Habitat preference of black bass species in lakes in Kentucky. Bul. 81. Ky. Dep. Fish and Wildl. Resour., Frankfort. 17pp.

Cloutman, D.G. 1987. Evaluation of the Duke Power company lake stabilization program. Huntersville, N.C., Res. Rep. PES/87-02. 17pp.

Forney, J.L. 1980. Evaluation of management strategy for walleye in Oneida Lake, New York. N.Y. Fish and Game J. 27:105-141.

Groen, C.L. and T.A. Schroeder. 1978. Effects of water level management on walleye and other coolwater fisheries in Kansas reservoirs. Pages 278-283 in R.L. Kendall, ed. Selected coolwater fishes of North America. Spec. Publ. No. 11. Am. Fish. Soc., Washington, D.C.

Hile, R. 1954. Fluctuations in growth and year class of the walleye in Saginaw Bay. U.S. Fish. Wildl. Serv. Fish. Bull. 56:7-59.

Hokanson, K.E.F. 1977. Temperature requirements of some percids and adaptations to the seasonal temperature cycle. J. Fish Res. Bd. Can. 34:1524-1550.

Hollander, M. and D.A. Wolfe. 1973. Nonparametric statistical methods. John Wiley and Sons, Inc., New York. 503pp.

Kallemeyn, L.W. 1987. Correlations of regulated lake levels and climatic factors with abundance of young-of-the-year walleye and yellow perch in four lakes in Voyageurs National Park. North Am. J. Fish. Manage. 7:513-521.

Lagler, K.F. 1956. Freshwater fishery biology. Wm. C. Brown Co., Dubuque, Iowa. 255pp.

Ney, J.J. 1978. A synoptic review of yellow perch and walleye biology. Pages 1-12 in R.L. Kendall, ed. Selected coolwater fishes of North America. Spec. Publ. No. 11. Am. Fish. Soc., Washington, D.C.

Ott, L. 1984. An introduction of statistical methods and data analysis, 2nd ed. Duxbury Press, Boston. 775pp.

Regier, H.W., V.C. Applegate, and R.A. Ryder. 1969. The ecology and management of the walleye in western Lake Erie. Great Lakes Fish. Comm., Ann Arbor, Mich. Tech. Rep. 15. 101pp.

Reynolds, J.B. and L. Baab. 1978. Structure and dynamics of largemouth bass populations. N. Central Div. Am. Fish. Soc. Spec. Publ. No. 5, Washington, D.C.

Richardson, F. and H.M. Ratledge. 1961. Upper Catawba River reservoirs and Lake Lure. Final Rep. Proj. F5R and F6R Job 1. N.C. Wildl. Resour. Comm., Raleigh. 62pp.

Serns, S.L. 1982. Influence of various factors on density and growth of age-0 walleyes in Escanaba Lake Wisconsin, 1958-1980. Trans. Am. Fish. Soc. 111:299-306.

Willis, D.W. 1987. Use of gill net data to provide a recruitment index for walleye. North Am. J. Fish. Manage. 7:591-592.

Figure 1. Locations of sampling stations on Lake James, 1983-1987.

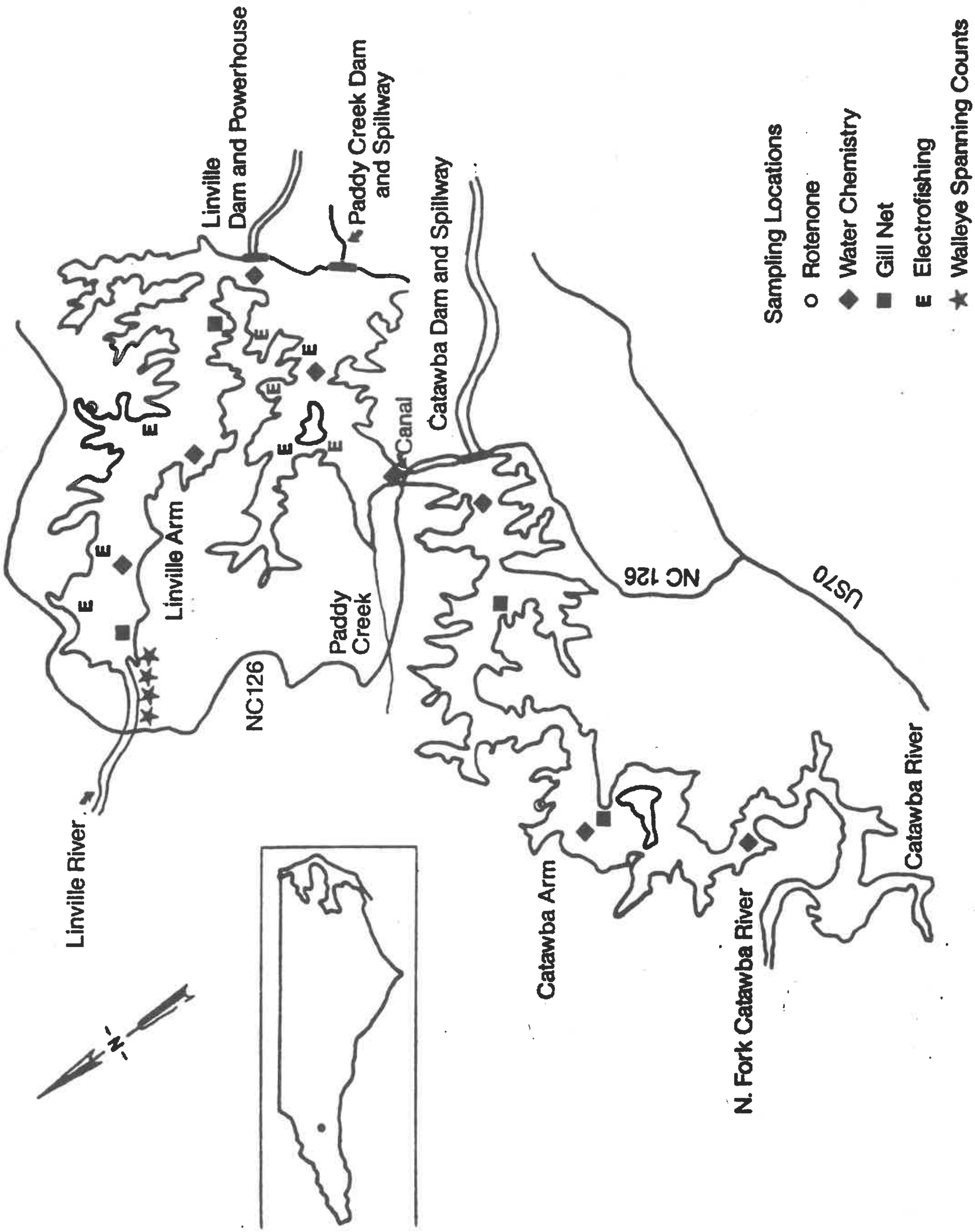

Figure 2. A generalized cross section of Lake James in September illustrating the location of the canal and penstock which influence the thermal and dissolved oxygen regimes of the lake.

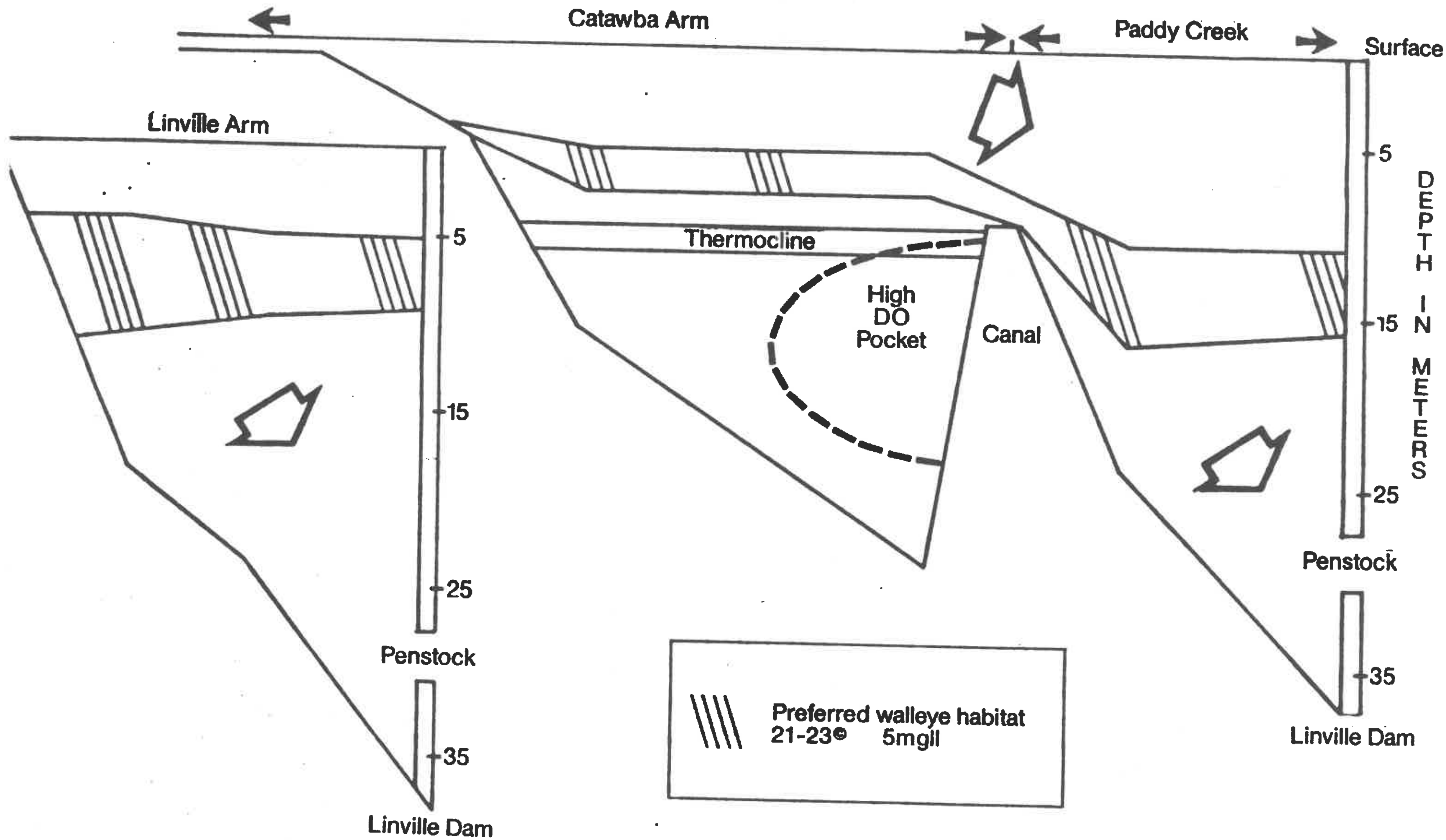

Table 1. A checklist of species collected from electrofishing, gillnetting, and cove rotenone samples from Lake James, 1983-1987.

Scientific name	Common name
Carpiodes cyprinus	Quillback
Cyprinus carpio	Carp
Dorosoma cepedianum	Gizzard shad
Dorosoma petenense	Threadfin shad
Esox masquinongy	Muskellunge
Etheostoma olmstedi	Tesselated darter
Hypentelium nigricans	Northern hogsucker
Ictalurus catus	White catfish
Ictalurus nebulosus	Brown bullhead
Ictalurus platycephalus	Flathead bullhead
Ictalurus punctatus	Channel catfish
Lepomis auritus	Redbreast sunfish
Lepomis gibbosus	Pumpkinseed
Lepomis gulosus	Warmouth
Lepomis macrochirus	Bluegill
Lepomis microlophus	Redear sunfish
Micropterus dolomieui	Smallmouth bass
Micropterus salmoides	Largemouth bass
Morone chrysops	White bass
Moxostoma anisurum	Silver redhorse
Notemigonus crysoleucas	Golden shiner
Notropis chloristius	Greenfin shiner
Notropis procne	Swallowtail shiner
Perca flavescens	Yellow perch
Pomoxis annularis	White crappie
Pomoxis nigromaculatus	Black crappie
Stizostedion vitreum	Walleye

Table 2. Average abundance, average standing crop, and standard deviations ( ) of selected species found in Lake James rotenone samples, 1983-1987.

Species	Abundance number/ha		Standing Crop kg/ha	
Gizzard shad	965	(1179)	55.29	(36.52)
Threadfin shad	813	(1680)	1.80	(3.33)
White bass	48	(56)	1.26	(1.19)
Redbreast sunfish	963	(1029)	5.33	(2.45)
Bluegill	2194	(2177)	7.24	(5.31)
Smallmouth bass	66	(34)	2.33	(0.88)
Largemouth bass	206	(206)	5.39	(3.71)
Crappie	620	(770)	4.97	(5.45)
Yellow perch	932	(717)	4.47	(2.54)
Walleye	30	(45)	2.77	(2.96)

Table 3. Young-adult ratio values for selected species by year in Lake James based on cove rotenone samples. Missing values indicate the index could not be calculated.

Species	Linville Arm					Catawba Arm				
	1983	1984	1985	1986	1987	1983	1984	1985	1986	1987
Redbreast sunfish	5	11	24	106	29	2	4	5	9	5
Bluegill	17	185	47	56	18	9	12	6	6	11
Smallmouth bass		33	24	4	19	87	74	117	13	55
Largemouth bass		32	98	64	104	376	30	25	25	171
Crappie	4	24				23	66	15	2	9
Yellow perch	42	18		47	88	218	111	30	40	10
Walleye		26	0					1	1	

Table 4. Proportional stock density values (%) for selected species by year in Lake James based on cove rotenone samples. Missing values indicate the index could not be calculated.

Species	Linville Arm 1983	1984	1985	1986	1987	Catawba Arm 1983	1984	1985	1986	1987
Redbreast sunfish	33	18	32	14	49	38	26	26	27	19
Bluegill	8	49	44	9	19	13	20	25	50	24
Smallmouth bass	0	20	8	44	40	33	33	9	31	25
Largemouth bass	0	100	50	100	14	20	33	65	50	12
Crappie	47	74				11	36	31	35	3
Walleye	0	60	50	0	0	0	0	38	56	0

Table 5. Catch per unit effort (CPUE) of young-of-year walleye (number/100 m shoreline) by night electrofishing in Lake James from 1985-1987.

Month	CPUE 1985	CPUE 1986	CPUE 1987
April	0.00	0.00	0.00
May	0.00	0.00	0.00
June	0.00	0.08	0.47
July	0.35	0.08	1.37
August	0.27	0.51	0.59
September	0.63	0.27	0.24
October	0.24	0.12	0.16
April-October CPUE	0.21	0.15	0.34
July-October CPUE	0.37	0.24	0.70

Table 6. Catch per unit effort (number/100 m) and total numbers of walleye captured ( ) by year class in experimental gill nets from Lake James, 1983-1987.

	Year Class									
Age	1979	1980	1981	1982	1983	1984	1985	1986	1987	N
O					0.0	0.0	0.0	0.2 (1)	0.9 (5)	6
I				2.6 (14)	0.2 (1)	0.2 (1)	4.6 (25)	2.0 (11)		52
II			7.5 (41)	2.6 (14)	2.9 (16)	9.5 (52)	10.8 (59)			182
III		7.3 (40)	2.9 (16)	2.9 (16)	5.5 (30)	6.6 (36)				138
IV	0.4 (2)	3.1 (17)	0.5 (3)	1.3 (7)	1.8 (10)					39
V	1.1 (6)	0.0	0.2 (1)	0.2 (1)						8