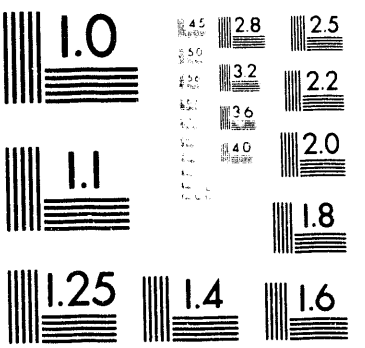
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TENNESSEE VALLEY AUTHORITY

River Basin Operations
Water Resources

CHICKAMAUGA RESERVOIR 1992 FISHERIES MONITORING

COVE ROTENONE RESULTS

Prepared by
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INTRODUCTION

Purpose and History

The Tennessee Valley Authority (TVA) is required by the National Pollutant Discharge Elimination System (NPDES) Permit for Sequoyah Nuclear Plant (SQN) to conduct and report annually a nonradiological operational monitoring program to evaluate potential effects of SQN on Chickamauga Reservoir. This monitoring program was initially designed to identify potential changes in water quality and biological communities in Chickamauga Reservoir resulting from operation of SQN. Results of monitoring conducted from 1980-87 (TVA 1982, 1983a, 1984, 1985, 1986a, 1986b, 1987) identified no significant changes in Chickamauga Reservoir considered to be related to operation of SQN. Based on absence of plant-induced effects and fulfillment of the monitoring period required by the NPDES permit, some components of the program were terminated. Cove rotenone sampling was continued because it remains the best overall method for determining reservoir-wide quantitative and qualitative changes in fish populations.

Chickamauga Reservoir cove rotenone sampling has also been conducted as part of the preoperational monitoring program for Watts Bar Nuclear Plant (WBN) to evaluate the combined effects of operating two nuclear facilities on one reservoir once WBN becomes operational. The purpose of this report is to present results of cove rotenone sampling conducted on Chickamauga Reservoir in 1992.

Watts Bar Nuclear Plant

WBN is under construction on the west bank of Chickamauga Reservoir at Tennessee River Mile (TRM) 528.0 (Figure 1), approximately two miles downstream from Watts Bar Dam. WBN will be operated in closed cycle cooling mode, with only blowdown from two cooling towers to be discharged through multiport diffusers located in the main channel at TRM 527.8. Makeup water will be pumped from an intake channel located at TRM 528.0 with a maximum flowrate of 4.5 m^3/s (160 cfs), which represents 0.6 percent of the long-term average flow of 767 m^3/s (27,100 cfs) past WBN.

Sequoyah Nuclear Plant

SQN is located on the west bank of Chickamauga Reservoir at TRM 484.5 (Figure 1). It has two pressurized water reactors with a total nameplate rating of 2,441 MWe. Condenser cooling water (CCW) is withdrawn from the cooler lower strata of Chickamauga Reservoir under a deep skimmer wall, situated near the 13 m deep river channel. Water leaving the condensers can be routed in one of three ways: (1) to the diffuser pond and out the diffuser pipes (open mode); (2) through the cooling towers, then to the diffuser pond and out the diffuser pipes (helper mode); or (3) through the cooling towers and recirculated to the intake (closed mode) with only blowdown discharged through the diffuser pipes. An underwater dam crosses the river channel 75 m upstream from the diffuser, decreasing the likelihood of any warm water wedge extending upstream from the thermal discharge to the plant intake, and "impounding" cooler water from lower strata of the reservoir near the intake.

In August 1985, both units at SQN were shut down. Unit 2 operated intermittently in May and June following restart in May 1988. Continuous operation of at least one unit occurred from early July 1988 through the end of 1990 except for October 6 through October 20 of 1990 when no units were operating. In 1991 there was continuous operation of at least one unit except for a ten day period in November. Units 1 and 2 were both shut down from March 19 through April 18, 1992 with at least one unit in operation the remainder of the year.

Reservoir Description

Chickamauga Reservoir is formed by Chickamauga Dam, situated at TRM 471.0. Water elevation normally varies from 205.7 m (675 ft) msl in winter to 208.0 m (682.5 ft.) msl in summer. At elevation 208 m msl, the reservoir is 94.8 km (58.9 mi) long on the Tennessee River and extends 51.5 km (31 mi) up the Hiwassee River. Annual mean travel time for water moving through the reservoir is approximately seven days. Monthly average travel times range between 4 days (February) and 11 days (May). According to current operating guidelines, TVA attempts to maintain a minimum daily average discharge of 170 m^3/s (6,000 cfs) from Chickamauga Dam.

MATERIALS AND METHODS

Fish sampling with rotenone was initiated in Chickamauga Reservoir in 1947 to determine standing stock (no/ha and kg/ha) of game, forage, and

commercial fish species. Samples were taken at various locations, primarily in coves, annually through 1959 (except for 1948 and 1953). In addition to standing stock information, these data provided species occurrence and composition information and characterized the general fish community of the reservoir. Sampling was discontinued after 1959, but resumed in 1970 to collect preoperational monitoring data for SQN. Characteristics of sample sites (1970-92) are shown in Table 1.

Cove rotenone sampling provides estimates of fish populations in coves. These estimates do not necessarily represent true population estimates of the entire reservoir because fish species are not distributed evenly throughout the reservoir. However, useful estimates are possible for certain species which orient more toward shoreline or structure than open water habitat during all or part of their life cycle. Considering these limitations, cove rotenone sampling can provide an estimate of abundance of many fish species in southeastern reservoirs. Cove rotenone data provide estimates of reproductive success, year-class strengths, and relative fish stock sizes in a given year; and aid in determining long-term trends in these parameters for various littoral species in a reservoir.

The fish population in a cove is first isolated from the reservoir by stretching a block net across the cove. Toxicant (rotenone) is applied throughout the water column and fish are collected as they surface. Fish not collected initially are picked up the subsequent day after they have floated to the surface. Analysis of cove rotenone data includes grouping

fish into young-of-year, intermediate, and harvestable size classes based on length (Table 2) as well as game, commercial and forage. A complete description of field procedures and data analysis techniques can be reviewed in TVA 1983b.

For discussion in this report, species designated as important were determined by the following criteria: (1) must occur in at least 50 percent of samples since 1970, and (2) must comprise one percent of either the total number or total biomass collected. In addition to species meeting these criteria, certain other species of special interest were included for analysis because of their importance as sport or commercial species.

RESULTS AND DISCUSSION

Forty-two species representing eleven families were collected in cove rotenone samples in 1992 (Table 3). This is six more species than were collected during 1991. Total standing stock of fish in Chickamauga Reservoir in 1992 was 28,354 fish/ha weighing 212.3 kg/ha (Table 5). This was the second lowest total number collected since 1979, and slightly lower than the average (29,538) for the period of record. Total biomass (212.3 kg/ha) in 1992 was the lowest since 1982, and significantly lower then the long-term average (320.8) for the reservoir (Table 5).

The most abundant species in 1992 rotenone samples was threadfin shad (55.0 percent) followed by bluegill (20.3 percent), golden shiner (6.7 percent) and gizzard shad (6.6 percent) (Table 6). Gizzard shad comprised 32.8 percent of the total biomass sampled followed by freshwater drum (15.2 percent), threadfin shad (13.2 percent) and bluegill (13.2 percent) bringing the biomass of these four species to 74.4 percent of the total sample.

In 1992 young-of-year fish represented 92.0 percent of the total number of fish and 23.8 percent of the biomass (Table 10). Percentage (by number) of intermediate size fish was 4.6 percent and harvestable size fish 3.5 percent, but harvestable size fish comprised 62.8 percent of the total biomass.

Gamefish, primarily bluegill, largemouth bass, redear sunfish and black crappie comprised 21.8 percent of the young-of-year fish by number (Table 10). These four species comprised 23.5 percent of the total (all sizes) biomass in 1992 and have been important species since 1970 (Table 9). Gamefish have shown an overall increasing trend in numbers and biomass since 1970. However, numbers have declined since 1988 but biomass has remained relatively stable (Table 7).

Forage species comprised 71.5 percent of the total number in 1992 and 51.2 percent of the biomass (Table 10). Young-of-year threadfin shad, golden shiners and gizzard shad continue to dominate both total number and biomass in this group. Numbers and biomass of forage fish have been

highly variable since 1970 with the highest estimate (31,657/ha) recorded in 1988 (Table 7). Forage fish in 1992 were slightly higher in number but lower in biomass than the 1991 sample. Game and commercial species comprised 25.9 and 22.8 percent of total biomass, respectively (Table 10). Commercial species also declined in numbers and biomass in 1992, but since 1970 have remained relatively stable (Table 7).

Important Species

Twenty-one species were classified as important or of special interest in cove rotenone samples from 1970 through 1992 (Table 9). Results of linear regression analyses for significant trends (Table 11), and abundance and biomass of all size classes of these species through time are discussed below. The trend analyses cover the entire sampling period from 1970, and may not reflect the most recent population trends.

Gizzard shad. Although numbers and biomass of young-of-year gizzard shad dropped sharply in 1991 and 1992 (Table 12), they continued to show a significant increasing trend through time (Table 11). No statistically significant trends were indicated for numbers or biomass of adult gizzard shad although there is a gradual decline since 1984. Total numbers in 1992 were the lowest during the period of record and the lowest biomass since 1980.

Threadfin Shad. Threadfin shad stock estimates have varied widely during the period of record. This species frequently experiences extensive winter kill in Tennessee Valley reservoirs. Dramatic declines

in 1978, 1982, 1984, and 1989 (Table 13) followed especially cold winters. Another important factor which influences cove populations of threadfin shad is aquatic macrophyte density. An experimental summer drawdown about a month before the 1985 sample resulted in decreased macrophytes in coves around the periphery of Chickamauga Reservoir which could have contributed to the record stock estimates that year. Houser and Bryant (1968) stated that in the absence of aquatic weeds, cove standing stocks of threadfin shad were equal to open water stocks in two Arkansas reservoirs. The strong resurgence of aquatic weeds in 1986 apparently restricted threadfin shad from cove areas. Since 1982 coves sampled on Chickamauga Reservoir were sprayed once or twice prior to the rotenone sample to remove aquatic macrophytes. With the recent decline of aquatic macrophytes, spraying was conducted only when they were present. Decreased aquatic macrophyte densities since 1988 have resulted in more open water habitat and an increase in young-of-year threadfin shad densities. For the first time since 1970 both young-of-year threadfin shad numbers and biomass show a significant increasing trend (Table 11). In 1992 threadfin shad comprised 55 percent of the total number of fish taken from all coves sampled.

Adult threadfin shad were absent in samples from 1976 through 1988 and again in 1990 and 1992 (Table 13). While adult densities may actually be low, this could also be a result of the size classification system. Threadfin shad are presently classified as young-of-year if they fall within a size range of 1 to 125 mm in total length. This grouping may include threadfin shad which are actually adults.

Carp. The lowest total number and the second lowest total biomass for the period of record was recorded for carp in 1992. For the fourth consecutive year only adult carp were collected in rotenone samples (Table 14). The trend in number and biomass of adult carp shows a statistically significant decrease (Table 11).

Golden shiner. Linear regression analysis for golden shiner shows an increasing trend in densities and biomass for young-of year (Table 11). Densities of young-of-year in 1992 were the highest during the period of record and biomass was second highest (Table 15).

Bullhead Minnow. Results of linear regression analyses show that numbers of young-of-year bullhead minnows have exhibited a statistically significant increase since 1971 (Table 11). The density in 1992 was lower than that observed in 1991 and below average for the period of record (Table 16).

Bluegill. Numbers and biomass of all size classes of bluegill show a statistically significant increase (Table 11) since 1970. Until 1991 only young-of year numbers and biomass and intermediate numbers were increasing. This trend does not reflect the recent decline in total numbers and biomass of young-of-year bluegill observed since 1987 (Table 17).

Longear Sunfish. Densities and biomass for longear sunfish were slightly higher in 1992 than in 1991 (Table 18). Trend analysis shows densities and biomass of young-of-year and intermediate longear sunfish

decreasing significantly (Table 11). Native populations of longear sunfish appear to be disappearing or declining in east Tennessee, and evidence suggests that direct competition with the ecologically similar redbreast sunfish may be involved (Etnier and Starnes, in press).

Redear sunfish. In spite of high fluctuations in numbers and biomass of young-of-year and intermediate redear and numbers of adults, total biomass for this species has been fairly stable (Table 19). The decline in aquatic macrophytes since 1988 has paralleled the decrease in young-of-year redear. Loss of cover for this size class may account for the decrease. Recruitment, however, has apparently been adequate to maintain adult stocks (Table 19).

Smallmouth Buffalo. Only young-of-year smallmouth buffalo were collected in the 1992 sample (Table 20). Both numbers and biomass of intermediate and adult size classes of this species have declined significantly (Table 11). This trend warrants concern considering the commercial value of smallmouth buffalo.

Spotted Sucker. There was a decline in total numbers and biomass for spotted sucker in 1992 (Table 21). For the first time since 1981 no intermediate spotted suckers were collected in the cove rotenone samples and the lowest number of young-of-year were collected since 1982. Statistically, young-of-year spotted sucker have declined significantly in both numbers and biomass (Table 11). Recruitment however, has apparently been adequate to maintain adult stocks (Table 21).

Channel Catfish. Numbers of young-of-year and numbers and biomass of intermediate size channel catfish continued to show a significant decline since 1970 (Table 11). Total numbers and biomass of adults, however, have remained relatively stable (Table 22).

Flathead Catfish. Cove rotenone sampling does not collect large numbers of this species, nor does it provide a representative sample of all size classes for this species (Table 23). Regression analysis indicates a significant declining trend in numbers and biomass of intermediate and adult flatheads (Table 11).

White Bass. Only young-of-year white bass were collected in 1992 samples (Table 24). Cove rotenone is not a good indicator of adult populations of white bass in a reservoir but does provide data on young-of-year to evaluate reproductive success. Regression analysis indicated no significant trends for this species. TVA's first year progress report (Buchanan 1991) from an investigation of white bass in Chickamauga Reservoir indicates a viable and perhaps expanding population. The three year white bass population study began in 1990, and should provide more detailed information on the status of this important species in the reservoir.

Yellow Bass. In 1992 young-of-year yellow bass continued to decline from the record high observed in 1990 (Table 25). Although there has been a significant increasing trend in both numbers and biomass of all size groups through 1991, the intermediate biomass in 1992 is no

longer significantly increasing (Table 11). The steady decrease in aquatic macrophyte densities since the drought (1985-1988) may be a factor in declining densities of yellow bass.

Warmouth. Total densities of warmouth in 1992 was the lowest recorded since 1976 (Table 26). Regression analysis shows that numbers and biomass for all size groups of warmouth increased significantly from 1970 through 1992 (Table 11). However, decreased aquatic macrophyte densities may also be a factor in the recent decline of this species.

Black and White Crappie. The lowest total number since 1974, and the lowest total biomass during the period of record for white crappie was recorded in 1992 (Table 27). A significant declining trend in numbers and biomass of adults and biomass of intermediate white crappie was indicated by regression analysis.

Young-of-year black crappie have shown a marked increase in total numbers since 1988 (Table 28). The highest number of young-of-year black crappie was collected during 1992. A total of 444 young-of-year black crappie and 19 young-of-year white crappie was collected from the five coves sampled.

Generally when both species of crappie occur, one will dominate (Goodson 1966). Black crappie generally predominate in clear waters and are more dependent on aquatic plants and other cover than white crappie (Goodson 1966). The increased aquatic macrophyte communities and clear

water resulting from drought conditions during 1985-88 could account for the shift in dominance to black crappie and/or decline in white crappie (Buchanan and McDonough 1990). Macrophyte coverage in Chickamauga Reservoir decreased from 7,455 acres in 1988 to 383 acres in 1992.

Sauger. No sauger were collected in cove rotenone samples in 1992. Cove rotenone is not a valid indicator of sauger populations in reservoirs and sauger have not been collected consistently in cove rotenone samples from Chickamauga Reservoir since 1979 (Table 29). Results of TVA's recent investigations of the sauger population in Chickamauga Reservoir indicate a decline in abundance during the drought (1985-88) caused by weak year classes in 1985 and 1986, mortality of older year classes and extended periods of low flow during spawning (Hickman et. al. 1989). TVA initiated an annual program in spring of 1992 to supply a minimum flow of 4,000 cfs during the April sauger spawning period to enhance spawning success. This program may help restore sauger populations to their earlier levels. Further investigations of the sauger population in Chickamauga Reservoir will commence in spring of 1993 to evaluate the minimum flow program as well as a stocking of fingerling sauger in 1990 by TWRA.

Yellow Perch. Young-of-year yellow perch first appeared in Chickamauga Reservoir cove rotenone samples in 1970. Both numbers and biomass for all size classes, except young-of-year biomass, have shown statistically significant increasing trends (Table 11). The total number for this species was higher in 1992 than in 1991, but total biomass was

lower (Table 30). This species produces a semi-buoyant egg mass which is woven around and among vegetation (Goodson 1966). Decreasing levels of aquatic macrophytes could result in lower densities of yellow perch in Chickamauga Reservoir.

Freshwater Drum. Regression analysis revealed that numbers and biomass of young-of-year, and biomass of intermediate freshwater drum have declined in samples from 1970 through 1992 (Table 11); however, there was no discernible trend for adults and intermediate numbers. A study conducted on Chickamauga Reservoir in 1986 (TVA 1987) indicated that in spite of decreasing trends in young-of-year densities and biomass of intermediate freshwater drum as indicated in cove rotenone results, the total population appears to be stable.

Largemouth Bass. Regression analysis in 1992 shows a significant increasing trend in numbers and biomass for young-of-year and adult largemouth bass (Table 11). Densities of young-of-year were the third highest observed during the period of record (Table 32).

SUMMARY

Changes and significant trends in numbers and biomass have been noted for all of the fish species designated important in Chickamauga Reservoir. Total number of fish in 1992 was slightly lower, and total biomass significantly lower, than in 1991. Both total numbers and biomass in 1992 were lower than the average for the period of record (1970-1992) (Table 5). Some species (i.e., carp, smallmouth buffalo, flathead catfish, sauger, white bass, and white crappie) that have decreased in numbers and/or biomass for one or more size classes are those for which cove rotenone sampling often does not provide a representative sample. Trends based entirely on cove rotenone data may therefore be spurious. However, cove rotenone data for young-of-year white bass and crappie are considered more valid. Conversely, species that have shown increasing trends (i.e., bluegill, redear sunfish, warmouth, yellow perch, gizzard shad, and largemouth bass) are those for which cove rotenone provides better estimates of relative abundance, and trends based on these data are more likely to be accurate. Cove rotenone data are also considered valid in evaluating population trends for channel catfish, threadfin shad, bullhead minnows, and yellow bass.

The overriding influence on standing stock estimates for many of the important fish species in Chickamauga Reservoir, with the possible exception of longear sunfish, appears to be effects of habitat alteration. The dramatic increase in aquatic macrophytes from 1980 through 1988 resulted in higher standing stock estimates for various

centrarchids, particularly warmouth, redear sunfish, bluegill and largemouth bass. A recent study (Scott, in press) on the effects of aquatic macrophytes on fish communities in Chickamauga Reservoir, suggests that the difference in leaf morphology and growth form between the dominant species of vegetation (milfoil and spinyleaf naiads) may also effect the abundance of many fish species in the reservoir. Most important gamefish species benefit more from milfoil than spinyleaf naiad. Whether aquatic vegetation has resulted in an actual decrease in biomass or numbers of some fish species (white crappie and freshwater drum) or simply displaced them to uninfested areas, is not clear. Aquatic macrophytes in Chickamauga Reservoir have decreased from 7,455 acres in 1988 to 383 acres in 1992. Most species of fish which were favored by increased vegetation are now showing declines in total numbers and biomass. This shift may create conditions much like the pre-drought years, resulting in a reversal in the high densities of fish which depend on aquatic macrophytes for spawning habitat and protection from predator species.

CONCLUSIONS AND RECOMMENDATIONS

Based on results from annual cove rotenone sampling from 1970 through 1992, total fish biomass in Chickamauga Reservoir has remained relatively stable. Although changes in abundance have been documented for some species, most variation appears related to level of aquatic macrophyte coverage, drought-induced conditions, and occasional flood conditions.

Several important species of fish (sauger, white bass, white and black crappie, channel catfish and freshwater drum) have recently been the subject of special targeted studies by TVA in Chickamauga Reservoir. These studies along with a just completed review of historical data that examines the relationship between aquatic macrophyte type and coverage and fish community dynamics have provided much valuable information on the reservoir fish community and the possible effects of SQN operation. Further, a recent review of the WBN Environmental Impact Statement in light of this new information indicates that the likelihood of significant impacts of WBN operation on the fish community, already considered low, are even less than previously thought.

In view of the continuous 22 year data base and the completion of the program of targeted studies that has so improved our understanding of the dynamics of the reservoir fish community, we think that in the future biennial cove rotenone sampling should be sufficient to document any significant changes. Therefore, it is our recommendation that in the future cove rotenone sampling on Chickamauga be conducted every two years rather than annually.

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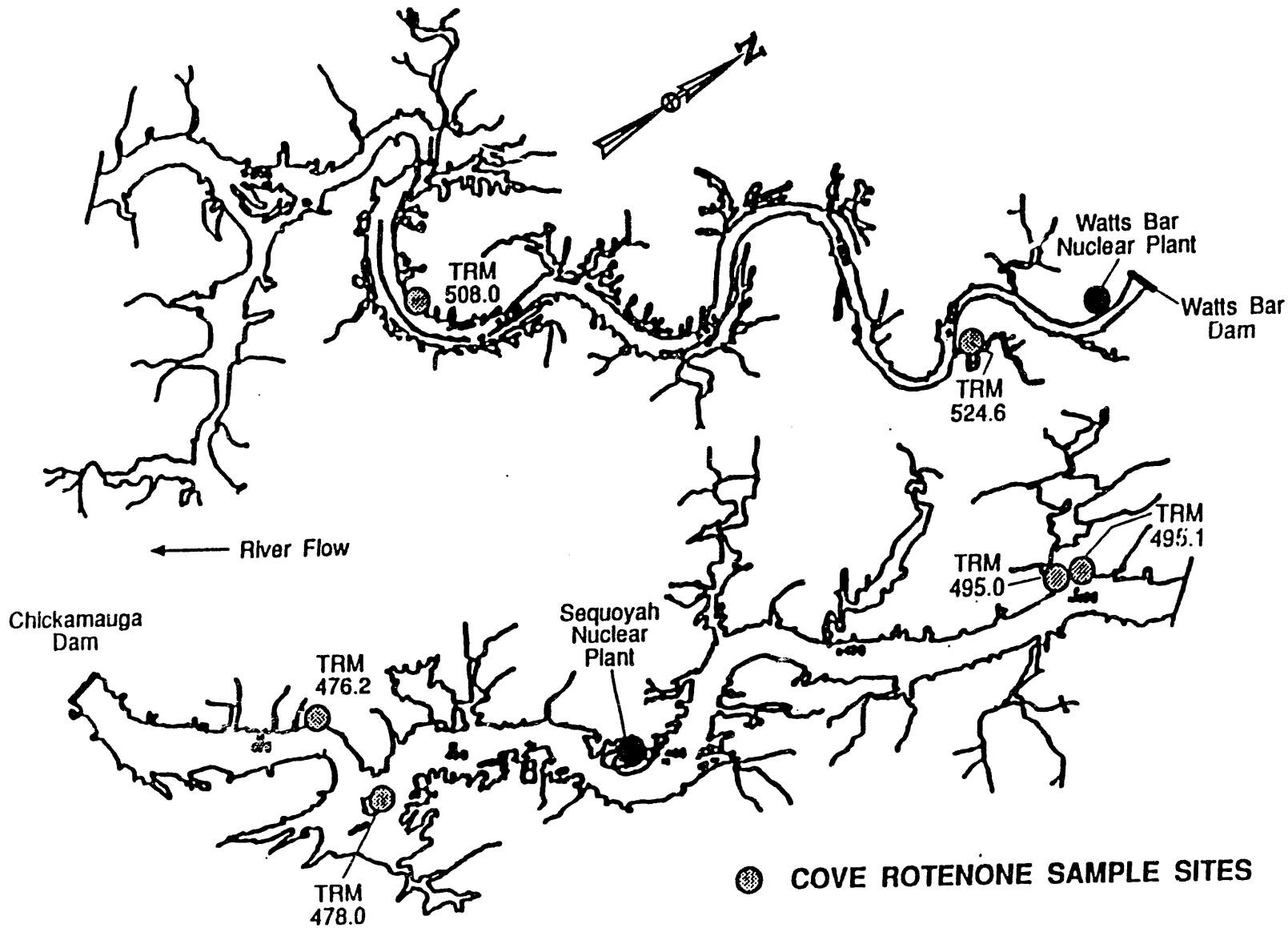

Figure 1. Location of cove rotenone samples sits in Chickamauga Reservoir, 1970 through 1992.

Table 1. Characteristics of rotenone sites sampled in Chickamauga Reservoir during 1970 through 1992 (Chickamauga Dam located at TRM 471.0, Sequoyah Nuclear Plant at TRM 484.5, and Watts Bar Nuclear Plant at TRM 528.0).

Tennessee River mile	Date	Area (hectares)	Mean depth (m)	Maximum depth (m)	Surface temperature (°C)
475.2	08/03/70	0.90	1.5	3.2	29.5
475.5	08/04/70	0.89	1.8	-	29.4
475.5	09/14/71	1.26	2.0	-	25.5
475.7	09/19/72	1.26	2.0	-	-
475.7	09/18/73	1.26	-	6.4	24.8
475.7	09/16/74	1.26	2.0	4.6	25.0
475.7	09/16/75	1.33	2.0	6.1	23.5
475.7	09/14/76	0.93	1.9	4.9	23.5
476.2	09/01/77	0.49	1.1	1.9	28.1
476.2	08/22/78	0.29	0.7	1.5	28.5
476.2	08/21/79	0.74	1.2	2.8	28.5
476.2	08/19/80	0.65	0.7	2.2	30.0
476.2	09/01/81	0.75	1.1	2.8	27.5
476.2	08/31/82	0.42	0.8	1.4	27.5
476.2	08/30/83	0.42	0.8	1.8	29.5
476.2	08/27/84	0.42	0.7	1.5	26.8
476.2	08/27/85	0.42	0.8	1.5	26.5
476.2	08/26/86	0.40	0.6	1.5	30.4
476.2	08/11/87	0.40	0.8	1.5	30.0
476.2	08/23/88	0.50	1.1	2.1	30.2
476.2	08/15/89	0.50	1.0	3.3	29.1
476.2	08/14/90	0.40	0.9	1.8	29.5
476.2	08/06/91	0.50	1.0	1.9	30.6
476.2	08/04/92	0.60	0.7	1.5	29.8
478.0	08/05/70	0.45	1.7	-	28.6
478.0	09/16/71	0.97	0.5	-	26.7
478.0	09/21/72	0.97	0.5	-	28.5
478.0	09/20/73	0.97	-	4.0	23.7
478.0	09/18/74	0.97	0.5	1.8	25.0
478.0	09/18/75	0.97	1.4	4.3	23.6
478.0	09/16/76	0.56	1.2	2.4	23.0
478.0	08/30/77	0.35	1.0	2.2	27.0
478.0	08/24/78	0.58	0.9	2.2	30.0
478.0	08/23/79	0.43	1.2	2.5	28.5
478.0	08/21/80	0.65	1.3	2.9	31.0
478.0	09/03/81	0.61	1.3	2.8	27.5
479.0	09/02/82	0.43	1.0	2.3	28.0
478.0	09/01/83	0.44	1.0	2.6	28.5
478.0	08/29/84	0.44	1.1	2.5	28.0

Table 1. (Continued)

Tennessee River mile	Date	Area (hectares)	Mean depth (m)	Maximum depth (m)	Surface temperature (°C)
478.0	08/29/85	0.45	1.0	2.4	28.5
478.0	08/28/86	0.45	0.8	1.9	28.6
478.0	08/13/87	0.40	1.2	2.2	29.8
478.0	08/25/88	0.40	1.3	2.8	29.4
478.0	08/17/89	0.50	1.2	3.9	29.3
478.0	08/16/90	0.60	1.4	3.1	29.3
478.0	08/08/91	0.50	1.2	2.8	30.7
478.0	08/11/92	0.70	1.1	2.6	31.2
484.7	07/06/70	0.49	1.6	-	26.0
495.0	07/10/70	0.61	1.3	-	-
495.0	09/23/71	0.93	1.4	-	24.4
495.0	09/28/72	0.93	1.4	-	-
495.0	09/27/73	0.93	-	4.0	24.6
495.0	09/23/74	0.93	1.4	3.7	22.0
495.0	09/23/75	0.93	1.4	3.7	22.8
495.0	09/21/76	0.47	1.2	3.7	22.2
495.0	09/13/77	0.39	1.8	5.2	23.4
495.0	08/31/78	0.46	1.3	3.4	29.7
495.0	09/05/79	0.52	1.4	3.7	27.5
495.0	08/26/80	0.58	1.6	3.7	30.0
495.0	08/20/81	0.46	1.2	3.1	24.0
495.0	08/19/82	0.46	1.4	3.4	29.0
495.0	08/18/83	0.41	1.2	3.1	28.5
495.0	08/16/84	0.41	1.4	3.2	27.0
495.0	08/22/85	0.44	1.1	3.1	29.0
495.0	09/09/86	0.44	1.1	3.0	25.7
495.1	08/27/87	0.40	0.7	1.5	28.7
495.1	08/11/88	0.40	1.0	1.9	28.3
495.1	08/10/89	0.40	0.8	2.6	27.0
495.1	08/09/90	0.50	0.9	1.8	26.5
495.1	08/03/91	0.60	0.9	1.9	27.7
495.1	08/06/92	0.60	0.6	1.5	27.8
HRM 1.2**	07/27/70	0.55	1.2	3.4	25.3
HRM 2.5**	07/28/70	0.96	1.3	-	29.8
HRM 3.5**	07/29/70	0.69	1.2	2.5	30.7
505.4	07/14/70	0.18	1.3	-	27.5
506.0	07/13/70	0.28	1.1	-	28.0
507.3	07/14/70	0.27	1.0	2.1	27.3
508.0	09/20/71	0.43	0.9	-	23.9
508.0	09/27/72	0.43	-	-	-
508.0	09/25/73	0.43	-	2.0	24.9
508.0	09/25/74	0.43	0.9	3.1	21.0

Table 1. (Continued).

Tennessee River mile	Date	Area (hectares)	Mean depth (m)	Maximum depth (m)	Surface temperature (°C)
508.0	09/25/75	0.42	0.9	3.1	22.3
508.0	09/23/76	0.43	0.9	2.0	22.2
508.0	09/15/77	0.43	0.9	2.2	23.3
508.0	08/29/78	0.57	1.0	1.8	30.5
508.0	08/23/79	0.43	0.9	1.9	27.3
508.0	08/28/80	0.51	0.9	1.7	30.0
508.0	08/18/81	0.48	1.0	1.9	27.0
508.0	08/17/82	0.46	0.9	1.8	27.0
508.0	08/16/83	0.40	0.8	1.2	29.0
508.0	08/13/84	0.42	1.0	1.8	28.5
508.0	08/20/85	0.44	0.8	1.7	30.0
508.0	08/12/86	0.44	0.7	1.4	27.4
508.0	08/25/87	0.40	0.8	1.7	27.4
508.0	08/09/88	0.40	1.2	2.1	29.4
508.0	08/08/89	0.50	1.0	3.3	25.9
508.0	08/07/90	0.50	1.1	1.9	27.7
508.0	08/15/91	0.40	1.0	1.9	26.5
508.0	08/13/92	0.40	0.9	1.7	27.5
524.6	09/08/76	0.33	0.3	1.0	25.2
514.6	09/07/77	0.33	0.5	1.2	26.6
524.6	09/29/78	0.29	0.4	0.6	31.0
524.6	08/21/79	0.38	0.6	1.2	30.0
524.6	09/03/80	0.48	0.4	0.8	27.0
524.6	09/09/81	0.32	0.2	0.5	-
524.6	09/08/82	0.14	0.4	0.9	26.5
524.6	09/08/83	0.43	0.4	0.8	26.5
524.6	09/04/84	0.45	0.5	1.0	23.0
524.6	09/05/85	0.47	0.4	0.8	30.0
524.6	09/11/86	0.45	0.4	0.8	26.5
524.6	09/03/87	0.40	0.4	0.8	27.0
524.6	09/01/88	0.50	0.7	1.2	27.5
524.6	08/22/89	0.50	0.9	3.0	29.2
524.6	08/21/90	0.50	0.6	1.2	28.3
524.6	08/20/91	0.60	0.6	1.2	27.1
524.6	08/18/92	0.50	0.5	0.9	27.2

**Hiwassee River Mile (confluence at TRM 500.0)

Table 2. Size classes (millimeters) used in fish inventories.

	Young-of-Year	Intermediate	Harvestable
GAME			
White bass	1-150	151-200	201 and over
Yellow bass	1-150	151-200	201 and over
Striped bass	1-175	176-375	376 and over
Rock bass	1-75	76-125	126 and over
Bluegill	1-75	76-125	126 and over
Other sunfish	1-75	76-125	126 and over
Smallmouth bass	1-100	101-200	201 and over
Spotted bass	1-100	101-200	201 and over
Largemouth bass	1-100	101-225	226 and over
Crappie	1-75	76-175	176 and over
Sauger	1-200	201-275	276 and over
Walleye	1-200	201-275	276 and over
ROUGH			
Lamprey	1-50	51-125	126 and over
Paddlefish	1-300	301-450	451 and over
Gar	1-300	301-475	476 and over
Bowfin	1-200	201-300	301 and over
Skipjack herring	1-150	151-275	276 and over
Mooneye	1-150	151-300	301 and over
Carp	1-200	201-300	301 and over
Goldfish	1-150	151-250	251 and over
Buffalo	1-200	201-300	301 and over
Carpsuckers	1-175	176-250	251 and over
Redhorses	1-175	176-250	251 and over
Other suckers	1-175	176-250	251 and over
Blue catfish	1-125	126-225	226 and over
Channel catfish	1-125	126-225	226 and over
Bullheads	1-100	101-175	176 and over
Flathead catfish	1-125	126-275	276 and over
Freshwater drum	1-125	126-200	201 and over
FORAGE			
Gizzard shad	1-125	-	126 and over
Threadfin shad	1-125	-	126 and over
Miscellaneous forage fish	all sizes	-	-

Table 3. Common and scientific names of fish in rotenone samples Chickamauga Reservoir, 1992.

Common Name	Scientific Name
GAME	
White bass	Morone chrysops
Yellow bass	Morone mississippiensis
Warmouth	Lepomis gulosus
Redbreast sunfish	Lepomis auritus
Green sunfish	Lepomis cyanellus
Bluegill	Lepomis macrochirus
Longear sunfish	Lepomis megalotis
Redear sunfish	Lepomis microlophus
Smallmouth bass	Micropterus dolomieui
Spotted bass	Micropterus punctulatus
Largemouth bass	Micropterus salmoides
White crappie	Pomoxis annularis
Black crappie	Pomoxis nigromaculatus
Yellow perch	Perca flavescens
ROUGH	
Spotted gar	Lepisosteus oculatus
Longnose gar	Lepisosteus osseus
Skipjack herring	Alosa chrysochloris
Carp	Cyprinus carpio
Smallmouth buffalo	Ictiobus bubalus
Spotted sucker	Minytrema melanops
Golden redhorse	Moxostoma erythrurum
Blue catfish	Ictalurus furcatus
Yellow bullhead	Ictalurus natalis
Brown bullhead	Ictalurus nebulosus
Channel catfish	Ictalurus punctatus
Flathead catfish	Pylodictis olivaris
Freshwater drum	Aplodinotus grunniens
FORAGE	
Unidentified shad	Dorosoma sp.
Gizzard shad	Dorosoma cepedianum
Threadfin shad	Dorosoma petenense
Central stoneroller	Campostoma anomalum
Golden shiner	Notemigonus crysoleucas
Emerald shiner	Notropis atherinoides
Ghost shiner	Notropis buchanani

Table 3. (Continued).

Common Name	Scientific Name
Spotfin shiner	Notropis spilopterus
Steelcolor shiner	Notropis whipplei
Striped shiner	Notropis Chrysocephalus
Bluntnose minnow	Pimephales notatus
Bullhead minnow	Pimephales vigilax
Mosquitofish	Gambusia affinis
Rainbow darter	Etheostoma caeruleum
Logperch	Percina caprodes
Brook silverside	Labidesthes sicculus

Table 4. List of fish species collected in cove rotenone samples from Chickamauga Reservoir, 1970-92.

Species	Common Name	Fish Group
Icthyomyzon castaneus	Chestnut lamprey	Commercial
Polyodon spathula	Paddlefish	Commercial
Lepisosteus oculatus	Spotted gar	Commercial
Lepisosteus osseus	Longnose gar	Commercial
Lepisosteus platostomus	Shortnose gar	Commercial
Alosa chrysochloris	Skipjack herring	Commercial
Dorosoma cepedianum	Gizzard shad	Forage
Dorosoma petenense	Threadfin shad	Forage
Dorosoma sp.	Unidentified shad	Forage
Mixed dorosoma sp.	Mixed shad	Forage
Hiodon tergisus	Mooneye	Commercial
Campostoma anomalum	Central stoneroller	Forage
Carassius auritus	Goldfish	Forage
Cyprinus carpio	Carp	Commercial
Hybopsis storeriana	Silver chub	Forage
Notemigonus crysoleucas	Golden shiner	Forage
Notropis atherinoides	Emerald shiner	Forage
Notropis buchanani	Ghost shiner	Forage
Notropis chrysocephalus	Striped shiner	Forage
Notropis cornutus	Common shiner	Forage
Notropis emiliae	Pugnose minnow	Forage
Notropis galacturus	Whitetail shiner	Forage
Notropis spilopterus	Spotfin shiner	Forage
Notropis volucellus	Mimic shiner	Forage
Notropis whipplei	Steelcolor shiner	Forage
Notropis sp.	Unidentified shiner	Forage
Pimephales notatus	Bluntnose minnow	Forage
Pimephales vigilax	Bullhead minnow	Forage
Pimephales promelas	Flathead minnow	Forage
Pimephales sp.	Unidentified minnow	Forage
Cyprinidae	Mixed & unidentified minnows	Forage
Cyprinidae	Minnow, carp	Forage
Carpiodes carpio	River carpsucker	Commercial
Carpiodes cyprinus	Quillback carpsucker	Commercial
Carpiodes sp.	Unidentified carpsucker	Commercial
Catostomus commersoni	White sucker	Commercial
Hypentelium nigricans	Northern hogsucker	Commercial
Ictiobus bubalus	Smallmouth buffalo	Commercial
Ictiobus cyprinellus	Bigmouth buffalo	Commercial
Ictiobus niger	Black buffalo	Commercial
Ictiobus sp.	Unidentified buffalo	Commercial

Table 4. (Continued)

Species	Common Name	Fish Group
Minytrema melanops	Spotted sucker	Commercial
Moxostoma carinatum	River redhorse	Commercial
Moxostoma duquesnei	Black redhorse	Commercial
Moxostoma erythrurum	Golden redhorse	Commercial
Moxostoma macrolepidotum	Shorthead redhorse	Commercial
Moxostoma sp.	Unidentified redhorse	Commercial
Ictalurus furcatus	Blue catfish	Commercial
Ictalurus melas	Black bullhead	Commercial
Ictalurus natalis	Yellow bullhead	Commercial
Ictalurus nebulosus	Brown bullhead	Commercial
Ictalurus punctatus	Channel catfish	Commercial
Pylodictis olivaris	Flathead catfish	Commercial
Fundulus notatus	Blackstripe topminnow	Forage
Fundulus olivaceus	Blackspotted topminnow	Forage
Cyprinodontidae	Killifish	Forage
Gambusia affinis	Mosquitofish	Forage
Labidesthes sicculus	Brook silverside	Forage
Morone chrysops	White bass	Game
Morone mississippiensis	Yellow bass	Game
Morone saxatilis	Striped bass	Game
Hybrid Morone	Hybrid White and Stripe bass	Game
Morone sp.	Unidentified temperature bass	Game
Ambloplites rupestris	Rock bass	Game
Lepomis auritus	Redbreast sunfish	Game
Lepomis cyanellus	Green sunfish	Game
Lepomis gulosus	Warmouth	Game
Lepomis macrochirus	Bluegill	Game
Lepomis megalotis	Longear sunfish	Game
Lepomis microlophus	Redear sunfish	Game
Lepomis sp.	Hybrid sunfish	Game
Lepomis sp.	Unidentified sunfish	Game
Micropterus dolomieui	Smallmouth bass	Game
Micropterus punctulatus	Spotted bass	Game
Micropterus salmoides	Largemouth bass	Game
Pomoxis annularis	White crappie	Game
Pomoxis nigromaculatus	Black crappie	Game
Etheostoma asprigene	Mud darter	Forage
Etheostoma caeruleum	Rainbow darter	Forage
Etheostoma kennicotti	Stripetail darter	Forage
Etheostoma spectabile	Orangethroat darter	Forage
Etheostoma sp.	Unidentified darter	Forage
Percidae	Unidentified darter	Forage
Perca flavescens	Yellow perch	Game

Table 4. (Continued)

Species	Common Name	Fish Group
Percina caprodes	Logperch	Forage
Stizostedion canadense	Sauger	Game
Aplodinotus grunniens	Freshwater drum	Commercial

Table 5. Number of coves sampled and mean annual standing stock (no/ha, kg/ha) of all young, intermediate, and harvestable size fish collected in cove rotenone samples from Chickamauga Reservoir, 1970-92.

Year	Number Samples	Young of Year		Intermediate		Harvestable		Total	
		no/ha	kg/ha	no/ha	kg/ha	no/ha	kg/ha	no/ha	kg/ha
1970	12	7,353	12.61	534	24.80	931	182.49	8,819	219.91
1971	4	7,018	17.27	724	97.95	863	168.04	8,604	283.26
1972	4	12,872	63.06	932	30.96	1,394	271.21	15,199	365.23
1973	4	13,092	72.52	955	36.44	1,572	290.20	15,619	399.16
1974	4	9,737	34.23	673	21.98	1,263	194.91	11,673	251.13
1975	4	12,684	37.18	443	14.94	1,364	187.09	14,491	239.21
1976	5	14,662	37.20	1,179	26.39	1,400	272.84	17,241	336.43
1977	5	33,121	96.18	1,164	26.41	1,441	223.97	35,981	346.56
1978	5	19,883	31.70	960	19.98	2,584	184.51	23,427	236.19
1979	5	17,973	22.91	1,375	27.41	2,872	209.04	22,220	259.36
1980	5	34,424	44.71	537	10.08	1,020	132.58	35,981	187.37
1981	5	53,515	66.21	1,590	34.14	2,278	327.68	57,383	428.03
1982	5	33,655	56.23	977	24.37	1,919	209.92	36,551	209.52
1983	5	46,500	70.74	1,209	26.60	2,513	344.07	50,223	441.41
1984	5	24,814	43.58	937	22.47	3,545	383.25	29,296	449.30
1985	5	43,064	143.49	986	26.88	2,361	357.54	46,411	527.91
1986	5	33,393	63.82	962	30.37	1,832	251.51	36,188	345.70
1987	5	43,547	89.91	1,420	26.96	1,677	233.85	46,644	350.72
1988	5	55,086	109.33	1,214	23.59	1,350	204.04	57,650	336.96
1989	5	17,587	70.84	2,164	39.49	1,758	242.16	21,509	352.49
1990	5	40,708	79.78	1,466	32.00	1,836	241.14	44,010	352.92
1991	5	25,579	51.66	1,504	31.56	1,667	211.69	28,750	294.91
1992	5	26,071	50.50	1,292	28.45	991	133.37	28,354	212.33
All Years*	117	26,734	57.19	1,077	29.00	1,728	234.64	29,538	320.83

* Mean for all years.

Table 6. Percent species composition of cove rotenone populations Chickamauga Reservoir, 1992.

Species	Percent of Total Numbers	Percent of Total Biomass
Threadfin Shad	54.96	13.18
Bluegill	20.32	13.17
Golden Shiner	6.71	4.71
Gizzard Shad	6.59	32.83
Largemouth Bass	2.64	4.17
Redear Sunfish	1.35	5.82
Freshwater Drum	1.32	15.16
Bullhead Minnow	1.17	0.08
Brook Silverside	0.83	0.09
Black Crappie	0.75	0.32
Yellow Perch	0.62	0.85
Warmouth	0.46	0.55
Yellow Bass	0.37	0.28
Emerald Shiner	0.32	0.06
Bluntnose Minnow	0.31	0.05
Redbreast Sunfish	0.30	0.50
Logperch	0.28	0.18
Unidentified shad	0.15	T
Spotfin Shiner	0.12	0.04
Spotted Bass	0.06	0.04
Mosquitofish	0.06	T
Longear Sunfish	0.05	0.12
Channel Catfish	0.04	2.18
Spotted Sucker	0.04	2.06
White Crappie	0.04	0.01
Green Sunfish	0.03	0.01
Yellow Bullhead	0.02	0.01
Smallmouth Bass	0.02	0.09
Flathead Catfish	0.01	0.27
Smallmouth buffalo	0.01	T
Steelcolor shiner	0.01	T
Spotted Gar	0.01	0.79
Skipjack Herring	T	T
Carp	T	2.29
Golden Redhorse	T	T
Longnose gar	T	T
Brown Bullhead	T	T
Central stoneroller	T	T
Striped shiner	T	T
White Bass	T	T
Rainbow darter	T	T

Table 6. (Continued)

Species	Percent of Total Numbers	Percent of Total Biomass
Blue catfish	T	0.06
Ghost shiner	T	T
	100.00	100.00

Note: T = less than 0.01 percent.

Table 7. Mean annual standing stock (no/ha and kg/ha) of game, commercial, and forage fish collected in cove rotenone samples from Chickamauga Reservoir, 1970-92.

	Game Fish		Commercial Fish		Forage Fish	
Year	no/ha	kg/ha	no/ha	kg/ha	no/ha	kg/ha
1970	2,288.22	27.42	548.18	109.55	5,982.24	82.93
1971	2,778.21	41.27	421.52	165.43	5,404.62	76.57
1972	3,764.61	58.53	769.14	140.99	10,665.19	165.72
1973	4,427.42	59.13	979.55	158.12	10,212.52	181.92
1974	2,637.81	33.32	396.25	79.74	8,638.84	138.07
1975	5,489.16	37.06	269.92	78.42	8,731.57	123.73
1976	8,624.39	57.53	474.81	147.02	8,141.71	131.88
1977	22,477.22	72.79	443.34	94.65	12,805.99	179.13
1978	18,340.44	57.57	228.17	52.31	4,859.30	126.30
1979	18,590.09	69.87	281.76	92.03	3,347.66	97.46
1980	33,026.90	80.19	225.13	66.67	2,728.00	40.51
1981	51,074.50	116.51	504.41	131.19	5,804.83	180.33
1982	24,734.58	67.64	451.39	57.10	11,365.07	165.79
1983	33,984.29	75.73	486.75	93.60	15,751.63	272.05
1984	18,575.99	60.79	359.68	42.90	10,360.50	345.60
1985	14,844.74	62.58	473.53	100.18	31,092.40	365.15
1986	21,753.26	71.53	203.90	42.07	14,230.35	232.10
1987	23,034.26	75.00	405.80	48.20	23,203.70	227.50
1988	25,666.93	81.21	325.70	38.81	31,657.37	216.94
1989	7,658.18	74.71	352.17	54.55	13,498.53	223.23
1990	12,174.93	87.39	717.88	73.43	31,117.26	192.10
1991	8,359.70	69.90	472.38	61.36	19,918.10	163.65
1992	7,653.81	55.05	420.41	48.47	20,279.52	108.80

Table 8. Mean Number and Weight (kg) of Fish per Hectare in Five Cove Rotenone Samples from Chickamauga Reservoir, 1992

Species	Young-of-Year		Intermediate		Harvestable		Total	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight
GAME								
White bass	0.34	T	-	-	-	-	0.34	T
Yellow bass	103.99	0.51	1.30	0.10	-	-	105.29	0.60
Warmouth	97.02	0.12	24.92	0.42	8.79	0.63	130.73	1.16
Redbreast sunfish	49.01	0.07	26.64	0.42	9.24	0.57	84.89	1.06
Green sunfish	6.83	0.02	0.82	0.01	-	-	7.66	0.03
Bluegill	4,766.84	5.49	840.96	12.90	153.49	9.57	5,761.30	27.96
Longear sunfish	3.63	0.01	10.15	0.18	1.03	0.05	14.81	0.24
Redear sunfish	140.21	0.28	96.00	2.12	145.74	9.96	381.95	12.36
Smallmouth Bass	3.45	0.02	0.30	T	0.70	0.16	4.45	0.19
Spotted bass	17.33	0.08	0.30	T	-	-	17.63	0.08
Largemouth bass	717.62	1.90	13.82	1.03	15.99	5.92	747.42	8.85
White crappie	8.11	0.02	2.17	0.01	-	-	10.28	0.03
Black crappie	208.44	0.41	2.27	0.04	0.96	0.24	211.67	0.69
Yellow perch	65.83	0.18	86.71	0.53	22.85	1.10	175.38	1.80
Group total	6,188.65	9.10	1,106.36	17.76	358.80	28.19	7,653.81	55.05
COMMERCIAL								
Spotted gar	-	-	1.05	0.34	1.83	1.33	2.88	1.67
Longnose gar	1.41	0.01	-	-	-	-	1.41	0.01
Skipjack herring	1.94	0.01	-	-	-	-	1.94	0.01
Carp	-	-	-	-	1.60	4.87	1.60	4.87
Smallmouth buffalo	3.48	T	-	-	-	-	3.48	T
Spotted sucker	0.43	T	-	-	10.67	4.36	11 11	4.36
Golden redhorse	1.58	T	-	-	-	-	1.58	T
Blue catfish	-	-	-	-	0.30	0.13	0.30	0.13
Yellow bullhead	6.50	0.02	0.34	0.01	-	-	6.85	0.02
Brown bullhead	0.87	T	-	-	-	-	0.87	T
Channel catfish	-	-	3.88	0.25	7.41	4.38	11.28	4.63
Flathead catfish	2.49	T	0.87	0.11	0.53	0.46	3.89	0.57
Freshwater drum	40.50	0.18	179.45	9.98	153.29	22.03	373.24	32.19
Group total	59.20	0.22	185.59	10.69	175.62	37.55	420.41	48.47
FORAGE								
Unidentified shad	42.17	0.01	-	-	-	-	42.17	0.01
Gizzard shad	1,412.45	2.07	-	-	456.07	67.63	1,868.52	69.70
Threadfin shad	15,583.03	27.99	-	-	-	-	15,583.03	27.99
Central stoneroller	0.71	T	-	-	-	-	0.71	T
Golden shiner	1,901.18	10.01	-	-	-	-	1,901.18	10.01
Emerald shiner	91.44	0.13	-	-	-	-	91.44	0.13
Ghost shiner	0.30	T	-	-	-	-	0.30	T
Spotfin shiner	35.31	0.09	-	-	-	-	35.31	0.09
Steelcolor shiner	3.45	0.01	-	-	-	-	3.45	0.01
Striped shiner	0.36	T	-	-	-	-	0.36	T
Bluntnose minnow	87.37	0.10	-	-	-	-	87.37	0.10
Bullhead minnow	332.30	0.17	-	-	-	-	332.30	0.17
Mosquitofish	17.40	0.02	-	-	-	-	17.40	0.02
Rainbow darter	0.34	T	-	-	-	-	0.34	T
Logperch	79.24	0.39	-	-	-	-	79.24	0.39
Brook silverside	236.39	0.19	-	-	-	-	236.39	0.19
Group total	19,823.45	41.18	0.00	0.00	456.07	67.63	20,279.52	108.80

Table 9. Listing of important species collected in rotenone samples from Chickamauga Reservoir, 1970-92.*

Common Name	Scientific Name	Percent Occurrence	Percent Number	Percent Biomass
GAME				
White bass**	Morone chrysops	43.59	0.08	0.26
Yellow bass**	Morone mississippiensis	82.91	0.43	0.62
Warmouth	Lepomis gulosus	96.58	2.79	0.81
Bluegill	Lepomis macrochirus	100.00	34.54	9.55
Longear sunfish	Lepomis megalotis	72.65	1.07	0.49
Redear sunfish	Lepomis microlophus	98.29	11.40	3.43
Largemouth bass	Micropterus salmoides	99.15	1.28	3.13
White crappie**	Pomoxis annularis	88.89	0.29	0.51
Black crappie**	Pomoxis nigromaculatus	41.03	0.10	0.07
Yellow perch**	Perca flavescens	77.78	0.37	0.45
Sauger**	Stizostedion canadense	23.07	0.00	0.05
COMMERCIAL				
Carp	Cyprinus carpio	72.21	0.04	6.44
Smallmouth buffalo	Ictiobus bubalus	56.41	0.04	4.35
Spotted sucker	Minytrema melanops	80.34	0.11	2.15
Channel catfish	Ictalurus punctatus	88.03	0.07	2.92
Flathead catfish**	Pylodictis olivaris	60.68	0.01	0.18
Freshwater drum	Aplodinotus grunniens	100.00	1.04	7.78
FORAGE				
Gizzard shad	Dorosoma cepedianum	100.00	14.98	45.78
Threadfin shad	Dorosoma petenense	94.87	23.89	6.14
Golden shiner	Notemigonus crysoleucas	80.34	1.27	1.00
Bullhead minnow	Pimephales vigilax	77.79	1.71	0.14

*Based on 117 samples.
**Species of special interest that did not meet important criteria.

Table 10. Percent size distribution of major fish groups, Chickamauga Reservoir, 1992

	Young-of-Year	Inter-mediate	Harvest-able	Total	Young-of-Year	Inter-mediate	Harvest-able	Total
	Percent by Number				Percent by Weight			
Game	21.8	3.9	1.3	27.0	4.3	8.4	13.3	25.9
Commercial	0.2	0.7	0.6	1.5	0.1	5.0	17.7	22.8
Forage	69.9	0.0	1.6	71.5	19.4	0.0	31.9	51.2
Total	92.0	4.6	3.5	100.0	23.8	13.4	62.8	100.0

Table 11. Results of linear regression analyses indicating significant trends in numbers and/or biomass by size group of important fish species collected in cove rotenone samples from Chickamauga Reservoir, 1970-92.

Species	Group*	Slope	F-Value	PR F**
Gizzard shad	YNG-NO.	0.06	9.48	0.0026
Gizzard shad	YNG-WT.	0.03	11.76	0.0008
Threadfin shad	YNG-NO.	0.04	4.88	0.0292
Threadfin shad	YNG-WT.	0.02	3.94	0.0494
Carp	ADT-NO.	-0.02	9.55	0.0025
Carp	ADT-WT.	-0.03	7.12	0.0087
Golden shiner	YNG-NO.	0.12	134.43	0.0001
Golden shiner	YNG-WT.	0.03	40.56	0.0001
Bullhead minnow	YNG-NO.	0.07	19.20	0.0001
Smallmouth buffalo	INT-NO.	-0.02	23.22	0.0001
Smallmouth buffalo	INT-WT.	-0.02	16.77	0.0001
Smallmouth buffalo	ADT-NO.	-0.04	37.06	0.0001
Smallmouth buffalo	ADT-WT.	-0.05	35.16	0.0001
Spotted sucker	YNG-NO.	-0.03	14.46	0.0002
Spotted sucker	YNG-WT.	-0.007	13.45	0.0004
Channel catfish	YNG-NO.	-0.01	7.85	0.0060
Channel catfish	INT-NO.	-0.03	15.27	0.0002
Channel catfish	INT-WT.	-0.006	11.79	0.0008
Flathead catfish	INT-NO.	-0.007	5.32	0.0229
Flathead catfish	INT-WT.	-0.002	7.39	0.0076
Flathead catfish	ADT-NO.	-0.01	8.34	0.0046
Flathead catfish	ADT-WT.	-0.005	3.94	0.0495
Yellow bass	YNG-NO.	0.07	40.18	0.0001
Yellow bass	YNG-WT.	0.03	19.59	0.0001
Yellow bass	INT-NO.	0.02	6.77	0.0105
Yellow bass	INT-WT.	0.006	3.05	0.0834
Yellow bass	ADT-NO.	0.01	4.34	0.0395
Yellow bass	ADT-WT.	0.004	4.48	0.0365
Warmouth	YNG-NO.	0.09	56.94	0.0001
Warmouth	YNG-WT.	0.01	14.53	0.0002
Warmouth	INT-NO.	0.04	25.21	0.0001
Warmouth	INT-WT.	0.01	27.64	0.0001
Warmouth	ADT-NO.	0.04	26.41	0.0001
Warmouth	ADT-WT.	0.02	27.31	0.0001
Bluegill	YNG-NO.	0.03	12.97	0.0005
Bluegill	YNG-WT.	0.02	7.79	0.0062
Bluegill	INT-NO.	0.02	10.05	0.0020
Bluegill	INT-WT.	0.01	6.71	0.0108
Bluegill	ADT-NO.	0.01	5.49	0.0208
Bluegill	ADT-WT.	0.01	6.99	0.0093
Longear sunfish	YNG-NO.	-0.05	8.80	0.0037
Longear sunfish	YNG-WT.	-0.007	8.24	0.0049
Longear sunfish	INT-NO.	-0.03	5.77	0.0179

Table 11. (Continued).

Species	Group*	Slope	F-Value	PR F**
Longear sunfish	INT-WT.	-0.01	11.83	0.0008
Redear sunfish	YNG-NO.	0.08	24.50	0.0001
Redear sunfish	YNG-WT.	0.02	8.10	0.0052
Redear sunfish	INT-NO.	0.04	15.17	0.0002
Redear sunfish	INT-WT.	0.02	24.14	0.0001
Redear sunfish	ADT-NO.	0.02	7.71	0.0064
Largemouth bass	YNG-NO.	0.02	5.84	0.0173
Largemouth bass	YNG-WT.	0.007	6.62	0.0113
Largemouth bass	INT-NO.	0.02	3.88	0.0513
Largemouth bass	ADT-NO.	0.02	6.11	0.0149
Largemouth bass	ADT-WT.	0.01	6.25	0.0138
White crappie	INT-WT.	-0.008	16.13	0.0001
White crappie	ADT-NO.	-0.05	49.25	0.0001
White crappie	ADT-WT.	-0.02	40.78	0.0001
Black crappie	YNG-NO.	0.08	101.81	0.0001
Black crappie	YNG-WT.	0.004	35.81	0.0001
Black crappie	INT-NO.	0.03	33.55	0.0001
Black Crappie	INT-WT.	0.002	15.75	0.0001
Black crappie	ADT-NO.	0.008	4.72	0.0319
Yellow perch	YNG-NO.	0.03	8.55	0.0042
Yellow perch	INT-NO.	0.03	9.49	0.0026
Yellow perch	INT-WT.	0.005	10.31	0.0017
Yellow perch	ADT-NO.	0.04	17.88	0.0001
Yellow perch	ADT-WT.	0.003	15.65	0.0001
Sauger	INT-NO.	0.004	4.32	0.0398
Sauger	ADT-NO.	-0.007	5.16	0.0250
Sauger	ADT-WT.	0.003	4.23	0.0419
Freshwater drum	YNG-NO.	-0.04	13.69	0.0003
Freshwater drum	YNG-WT.	-0.008	11.80	0.0008
Freshwater drum	INT-WT.	-0.009	3.93	0.0499

*YNG-NO. = Young (numbers/ha)
INT-NO. = Intermediate (numbers/ha)
ADT-NO. = Adult (numbers/ha)
YNG-WT. = Young (kg/ha)
INT-WT. = Intermediate (kg/ha)
ADT-WT. = Adult (kg/ha)

**Probability of obtaining a value $\leq F$. Only those values with a probability level of 0.05 or less are listed.

Table 12. Numbers and biomass (kg) per hectare for Young-of-year and adult gizzard shad in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	1,129.74	2.24	645.34	75.49	1,775.08	77.73
1971	329.03	2.27	561.91	65.51	890.94	67.78
1972	0.52	0.01	836.35	119.52	836.87	119.53
1973	0.65	0.01	1,034.97	127.41	1,035.63	127.42
1974	5.23	0.07	912.33	107.61	917.56	107.69
1975	109.44	1.44	946.20	90.71	1,055.64	92.15
1976	1,140.28	9.83	844.93	105.62	1,985.21	115.45
1977	8,624.47	44.57	928.02	112.60	9,552.49	157.17
1978	1,894.39	7.74	2,177.57	115.17	4,071.96	122.92
1979	54.15	0.68	2,315.58	92.12	2,369.73	92.80
1980	953.30	2.63	503.02	34.73	1,456.32	37.36
1981	507.50	1.73	1,484.11	164.41	1,991.61	166.14
1982	7,913.77	20.23	1,530.03	140.19	9,443.80	161.89
1983	1,994.09	9.93	1,981.22	232.46	3,975.31	242.39
1984	3,606.31	8.79	3,192.03	329.83	6,798.33	338.63
1985	3,873.29	29.29	1,898.52	239.89	5,771.81	269.18
1986	5,204.10	22.00	1,528.00	195.64	6,732.10	217.64
1987	7,808.70	32.96	1,313.05	168.40	9,121.76	201.35
1988	7,564.02	26.24	850.02	137.41	8,414.04	163.65
1989	7,371.05	44.18	1,157.27	161.11	8,528.32	205.29
1990	9,751.56	13.40	922.59	130.63	10,674.06	144.04
1991	1,676.55	7.52	1,051.41	125.07	2,727.96	132.58
1992	1,412.45	2.07	456.07	67.63	1,868.52	69.70

*No intermediate size class considered.

Table 13. Numbers and biomass (kg) per hectare for young-of-year and adult threadfin shad in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	2,732.68	2.94	0.31	0.01	2,732.99	2.95
1971	3,351.72	7.19	0.00	0.00	3,351.72	7.19
1972	8,094.18	41.72	52.33	1.46	8,146.51	43.18
1973	7,248.00	50.51	6.21	0.20	7,254.21	50.72
1974	6,916.67	28.02	3.10	0.13	6,919.78	28.16
1975	3,906.97	23.05	122.96	4.07	4,029.94	27.12
1976	3,401.95	11.75	0.00	0.00	3,401.95	11.75
1977	1,566.42	17.31	0.00	0.00	1,566.42	17.31
1978	53.10	0.34	0.00	0.00	53.10	0.34
1979	363.60	0.80	0.47	0.01	364.06	0.81
1980	448.09	0.79	0.00	0.00	448.09	0.79
1981	3,294.25	8.29	0.00	0.00	3,294.25	8.29
1982	368.97	1.00	1.43	0.03	370.40	1.03
1983	8,838.26	23.67	0.00	0.00	8,838.26	23.67
1984	866.60	2.13	0.00	0.00	866.60	2.13
1985	22,913.04	92.19	0.48	0.02	22,913.52	92.21
1986	4,912.88	8.64	0.00	0.00	4,912.88	8.64
1987	12,454.17	18.07	0.00	0.00	12,454.17	18.07
1988	21,816.41	43.31	0.00	0.00	21,816.41	43.31
1989	4,567.64	11.87	27.83	0.64	4,595.47	12.50
1990	17,713.68	32.76	0.00	0.00	17,713.68	32.76
1991	15,574.39	27.10	0.32	0.01	15,574.72	27.11
1992	15,583.03	27.99	0.00	0.00	15,583.03	27.99

*No intermediate size class considered.

Table 14. Numbers and biomass (kg) per hectare for each size group of carp in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	0.84	0.00	0.15	0.06	4.77	7.04	5.77	7.09
1971	0.00	0.00	0.20	0.05	27.46	53.85	27.66	53.89
1972	0.00	0.00	0.00	0.00	14.66	31.59	14.66	31.59
1973	0.00	0.00	0.00	0.00	21.49	48.42	21.49	48.42
1974	0.00	0.00	0.52	0.09	8.28	20.18	8.79	20.27
1975	0.00	0.00	0.00	0.00	12.65	28.93	12.65	28.93
1976	0.00	0.00	0.22	0.05	22.16	46.72	22.37	46.77
1977	0.00	0.00	0.00	0.00	14.26	31.39	14.26	31.39
1978	2.09	0.11	2.16	0.31	5.21	14.43	9.46	14.86
1979	0.54	0.01	0.00	0.00	16.93	38.02	17.47	38.04
1980	4.21	0.13	0.31	0.04	7.98	24.01	12.49	24.18
1981	34.52	2.02	3.79	0.61	4.04	11.94	42.35	14.57
1982	7.02	0.14	0.48	0.12	4.92	8.91	12.41	9.16
1983	0.98	0.01	0.00	0.00	12.81	29.61	13.78	29.62
1984	1.45	0.11	0.00	0.00	1.46	3.45	2.92	3.56
1985	1.39	0.11	2.72	0.56	15.04	37.42	19.14	38.09
1986	1.34	0.07	0.44	0.06	4.91	13.54	6.70	13.67
1987	4.07	0.19	0.88	0.11	5.13	12.85	10.09	13.15
1988	1.86	0.04	0.00	0.00	2.17	5.82	4.03	5.86
1989	0.00	0.00	0.00	0.00	4.73	7.91	4.73	7.91
1990	0.00	0.00	0.00	0.00	4.69	12.08	4.69	12.08
1991	0.00	0.00	0.00	0.00	4.26	12.16	4.26	12.16
1992	0.00	0.00	0.00	0.00	1.60	4.87	1.60	4.87

Table 15. Numbers and biomass (kg) per hectare for each size group of golden shiner in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year*	
	Numbers	Biomass
1970	4.36	0.18
1971	0.58	T
1972	6.98	0.16
1973	13.26	0.73
1974	5.81	0.27
1975	12.25	0.15
1976	87.29	1.46
1977	363.21	2.05
1978	229.84	1.70
1979	352.64	3.43
1980	661.97	2.11
1981	337.37	5.47
1982	187.65	1.20
1983	518.18	3.65
1984	335.79	2.15
1985	280.62	1.54
1986	374.08	3.16
1987	658.99	6.59
1988	714.26	8.72
1989	152.38	5.01
1990	1,133.17	13.69
1991	422.43	1.91
1992	1,901.18	10.01

*All minnows grouped in young-of-year size class.

Table 16. Numbers and biomass (kg) per hectare of each size group for bullhead minnow in cove rotenone samples, Chickamauga Reservoir, 1971-92.

	Young-of-Year*	
	Numbers	Biomass
1971	1.05	0.00
1972	72.67	0.15
1973	0.65	0.00
1974	734.76	0.81
1975	3,397.45	3.72
1976	1,974.17	1.75
1977	418.03	0.67
1978	148.19	0.14
1979	118.98	0.09
1980	65.01	0.09
1981	20.46	0.01
1982	554.76	0.41
1983	684.88	0.34
1984	527.09	0.44
1985	1,133.06	0.72
1986	257.62	0.22
1987	45.22	0.03
1988	98.39	0.07
1989	92.43	0.04
1990	1,189.05	0.89
1991	773.71	0.66
1992	332.30	0.17

*All minnows grouped in young-of-year size class.

Table 17. Numbers and Biomass (kg) per hectare for each size group of bluegill in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	1,243.26	2.46	193.31	5.27	70.03	5.28	1,506.60	13.01
1971	1,669.92	3.18	345.20	8.84	94.88	6.68	2,110.00	18.70
1972	2,296.39	10.96	495.25	9.53	171.22	11.80	2,962.87	32.30
1973	2,214.82	5.97	374.95	7.81	186.17	12.13	2,775.94	25.91
1974	1,447.34	1.77	296.85	4.90	105.55	5.68	1,849.74	12.36
1975	4,073.41	4.83	237.89	4.18	108.32	5.96	4,419.62	14.97
1976	5,812.86	6.67	674.71	10.08	186.81	11.33	6,674.38	28.09
1977	18,963.39	20.64	519.75	7.96	185.11	11.21	19,668.26	39.81
1978	15,302.81	15.89	552.57	7.87	119.50	7.06	15,974.88	30.82
1979	13,121.79	11.47	953.28	13.59	213.18	12.11	14,288.25	37.16
1980	26,776.07	27.42	257.12	4.01	231.35	16.66	27,264.54	48.08
1981	23,622.21	16.68	979.89	15.16	277.70	19.30	24,879.80	51.13
1982	13,088.58	14.52	497.85	6.96	94.39	5.91	13,680.82	27.39
1983	16,134.86	16.37	663.92	9.47	118.91	7.97	16,917.69	33.81
1984	11,698.16	18.59	412.78	6.20	136.40	9.24	12,247.35	34.03
1985	10,131.34	10.35	520.46	5.81	109.76	8.28	10,661.56	24.44
1986	12,644.32	13.74	329.86	4.88	120.50	10.66	13,094.68	29.28
1987	13,373.54	17.52	830.75	11.03	126.37	11.18	14,330.66	39.73
1988	7,156.58	8.74	594.94	8.57	176.41	15.07	7,927.94	32.37
1989	4,142.82	6.07	1,126.66	15.64	184.81	12.84	5,454.29	34.55
1990	7,515.03	9.69	777.29	13.92	389.17	24.66	8,681.49	48.27
1991	5,249.34	8.10	825.90	11.68	234.05	15.43	6,309.28	35.21
1992	4,766.84	5.49	840.96	12.90	153.49	9.57	5,761.30	27.96

Table 18. Numbers and biomass (kg) per hectare for each size group of longear sunfish in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	47.16	0.32	24.34	0.58	2.71	0.17	74.21	1.07
1971	126.30	0.51	57.59	1.45	2.48	0.08	186.37	2.03
1972	171.57	0.63	76.93	1.46	5.84	0.51	254.34	2.60
1973	312.19	0.79	59.20	1.20	3.29	0.20	374.69	2.19
1974	321.73	0.47	73.49	1.19	3.70	0.17	398.92	1.84
1975	488.19	0.75	48.23	0.86	0.64	0.04	537.07	1.65
1976	867.52	1.46	188.92	2.84	4.73	0.23	1,061.16	4.53
1977	393.78	0.94	194.22	2.92	1.96	0.09	589.96	3.95
1978	191.00	0.28	75.90	1.18	7.42	0.33	274.31	1.79
1979	1,013.24	1.06	112.07	1.72	5.14	0.25	1,130.45	3.03
1980	324.67	0.53	35.93	0.67	8.80	0.42	369.40	1.62
1981	43.10	0.30	64.02	1.06	9.15	0.51	116.27	1.88
1982	51.26	0.20	44.42	0.75	3.59	0.20	99.27	1.15
1983	115.44	0.13	8.29	0.12	2.30	0.11	126.03	0.36
1984	737.09	1.26	42.20	0.60	2.42	0.19	781.71	2.05
1985	193.17	0.40	50.83	0.75	2.72	0.14	246.72	1.29
1986	224.35	0.37	13.64	0.18	0.00	0.00	238.00	0.55
1987	579.23	0.95	22.65	0.41	1.43	0.00	603.31	1.43
1988	0.00	0.00	5.22	0.08	0.00	0.00	5.22	0.08
1989	52.57	0.10	80.26	1.36	8.34	0.58	141.17	2.04
1990	20.70	0.03	1.87	0.03	0.37	0.02	22.94	0.07
1991	1.43	0.01	6.61	0.13	0.00	0.00	8.04	0.14
1992	3.63	0.01	10.15	0.18	1.03	0.05	14.81	0.24

Table 19. Numbers and biomass (kg) per hectare for each size group of redear sunfish in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	9.09	0.02	15.23	0.40	16.65	1.69	40.97	2.11
1971	80.79	0.25	25.28	0.65	33.08	4.52	139.14	5.42
1972	46.02	0.26	40.65	1.14	62.42	6.90	149.09	8.30
1973	614.75	3.64	36.64	0.89	43.59	5.35	694.98	9.88
1974	66.12	0.19	62.88	1.39	61.86	6.80	190.86	8.37
1975	160.80	0.53	17.09	0.40	62.77	6.86	240.66	7.79
1976	187.48	0.53	62.79	1.46	93.81	9.28	344.09	11.28
1977	851.95	3.03	49.23	1.10	77.90	8.60	979.08	12.73
1978	361.20	0.53	31.23	0.60	72.46	6.41	464.89	7.54
1979	1,017.73	1.26	92.27	2.13	50.44	4.57	1,160.45	7.95
1980	2,650.56	4.17	9.33	0.21	52.48	5.90	2,712.38	10.29
1981	21,860.89	17.35	40.38	0.87	62.62	5.51	21,963.89	23.73
1982	4,866.27	6.29	118.54	1.59	35.41	2.63	5,020.22	10.50
1983	10,137.85	5.94	210.69	3.95	109.94	8.16	10,458.48	18.05
1984	2,582.35	1.93	162.19	2.82	57.19	4.52	2,801.73	9.26
1985	2,712.33	3.55	116.17	1.89	81.81	4.80	2,910.31	10.24
1986	5,813.38	7.75	107.20	1.78	52.69	3.08	5,973.27	12.61
1987	5,188.45	6.09	204.21	3.46	43.70	2.56	5,436.35	12.10
1988	14,650.57	14.41	243.39	4.46	64.02	4.36	14,957.98	23.24
1989	52.40	00.19	575.11	8.29	70.65	4.87	698.16	13.35
1990	457.73	0.75	147.15	2.53	147.60	8.93	752.48	12.21
1991	176.69	0.45	235.58	4.01	113.61	8.46	525.89	12.91
1992	140.21	0.28	96.00	2.12	145.74	9.96	381.95	12.36

Table 20. Numbers and biomass (kg) per hectare for each size group of smallmouth buffalo in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	1.96	0.01	3.04	0.75	23.28	34.87	28.28	35.64
1971	0.58	0.02	36.05	71.13	0.00	0.00	36.63	71.15
1972	8.68	0.64	2.53	0.98	26.48	41.51	37.69	43.14
1973	1.74	0.15	1.39	0.40	21.21	40.84	24.34	41.39
1974	0.00	0.00	0.00	0.00	6.40	12.52	6.40	12.52
1975	1.79	0.15	0.78	0.16	6.39	18.86	8.96	19.17
1976	0.61	0.01	0.00	0.00	12.41	28.93	13.02	28.94
1977	2.33	0.16	1.82	0.72	7.49	9.93	11.64	10.82
1978	0.00	0.00	0.00	0.00	0.35	1.84	0.35	1.84
1979	0.00	0.00	0.00	0.00	3.31	4.57	3.31	4.57
1980	0.31	0.01	0.00	0.00	1.67	3.35	1.97	3.35
1981	0.00	0.00	0.43	0.15	1.58	2.75	2.01	2.90
1982	0.00	0.00	0.45	0.17	6.85	10.83	7.31	11.00
1983	36.77	0.81	0.00	0.00	3.30	5.59	40.07	6.41
1984	0.00	0.00	0.00	0.00	0.48	2.57	0.48	2.57
1985	3.64	0.16	1.73	0.53	4.86	4.30	10.23	4.98
1986	1.35	0.00	0.45	0.10	2.28	1.45	4.09	1.66
1987	0.00	0.00	0.00	0.00	2.86	7.40	2.86	7.40
1988	0.00	0.00	0.00	0.00	1.21	1.77	1.21	1.77
1989	0.41	T	0.00	0.00	0.41	0.96	0.82	0.96
1990	0.00	0.00	0.00	0.00	0.69	1.93	0.69	1.93
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1992	3.48	T	0.00	0.00	0.00	0.00	3.48	T

Table 21. Numbers and biomass (kg) per hectare for each size group of spotted sucker in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	18.02	0.10	0.68	0.07	0.47	0.23	19.17	0.40
1971	21.16	0.30	0.00	0.00	8.76	2.76	29.92	3.06
1972	38.06	0.81	2.00	0.32	19.79	6.68	59.85	7.82
1973	162.46	3.28	7.13	1.08	17.56	5.95	187.14	10.32
1974	23.71	0.36	26.16	3.54	39.10	13.07	88.97	16.96
1975	10.71	0.17	10.98	1.41	19.72	8.84	41.42	10.42
1976	15.29	0.28	3.15	0.51	35.12	17.17	53.55	17.96
1977	18.19	0.30	2.84	0.37	23.23	11.41	44.26	12.08
1978	6.23	0.09	5.25	0.64	14.85	7.48	26.33	8.21
1979	8.99	0.07	6.05	0.80	11.20	5.73	26.23	6.60
1980	3.09	0.02	0.31	0.05	10.61	7.24	14.01	7.31
1981	0.00	0.00	0.00	0.00	12.47	9.34	12.47	9.34
1982	0.43	0.02	0.43	0.03	5.83	3.45	6.70	3.50
1983	5.37	0.01	3.90	0.46	2.82	2.58	12.09	3.05
1984	12.20	0.06	19.02	2.48	8.63	3.87	39.85	6.41
1985	0.91	0.02	11.82	1.43	8.64	5.91	21.36	7.36
1986	1.36	0.01	2.72	0.31	4.97	2.70	9.05	3.03
1987	1.36	0.01	5.91	0.72	2.74	1.43	10.01	2.16
1988	0.48	T	0.95	0.12	5.56	2.67	6.98	2.79
1989	0.84	0.03	4.78	0.53	7.61	4.49	13.24	5.04
1990	2.71	0.01	1.97	0.26	18.15	10.62	22.83	10.89
1991	5.12	0.04	2.60	0.36	18.36	10.74	26.07	11.15
1992	0.43	T	0.00	0.00	10.67	4.36	11.11	4.36

Table 22. Numbers and biomass (kg) per hectare for each size group of channel catfish in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	3.27	0.02	10.10	0.62	5.71	2.35	19.07	2.98
1971	0.99	0.01	12.73	0.86	20.19	9.89	33.91	10.76
1972	1.05	0.01	12.32	0.79	23.20	7.33	36.57	8.12
1973	1.23	0.01	12.07	0.71	29.68	9.64	42.98	10.36
1974	0.52	0.01	3.21	0.19	8.41	3.92	12.14	4.12
1975	1.03	0.01	2.39	0.11	10.27	4.13	13.69	4.25
1976	1.63	0.00	6.26	0.32	17.67	12.11	25.56	12.43
1977	2.75	0.02	4.55	0.27	12.14	7.12	19.44	7.40
1978	1.38	0.00	0.35	0.01	13.45	4.17	15.18	4.18
1979	1.05	0.01	1.40	0.04	22.35	14.19	24.80	14.24
1980	2.90	0.01	0.42	0.02	11.34	7.70	14.65	7.73
1981	6.41	0.06	4.17	0.12	67.02	59.00	77.60	59.17
1982	0.00	0.00	0.91	0.03	6.21	5.98	7.12	6.01
1983	0.00	0.00	0.00	0.00	11.22	12.69	11.22	12.69
1984	0.00	0.00	0.45	0.02	9.80	11.62	10.25	11.64
1985	0.44	0.00	8.40	0.45	7.32	8.97	16.16	9.42
1986	2.22	0.01	4.89	0.18	0.44	0.59	7.56	0.79
1987	0.45	0.01	0.00	0.00	3.24	3.62	3.69	3.63
1988	1.85	0.01	9.62	0.39	35.04	10.10	46.51	10.50
1989	0.00	0.00	0.00	0.00	10.28	6.86	10.28	6.86
1990	0.34	T	2.79	0.15	8.87	5.23	12.01	5.37
1991	0.74	T	4.99	0.38	14.82	4.56	20.55	4.94
1992	0.00	0.00	3.88	0.25	7.41	4.38	11.28	4.63

Table 23. Numbers and biomass (kg) per hectare for each size group of flathead catfish in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	3.51	0.01	0.43	0.07	1.36	0.51	5.30	0.60
1971	2.89	0.01	1.92	0.32	0.47	0.20	5.27	0.53
1972	0.78	0.00	1.06	0.08	1.65	0.98	3.49	1.06
1973	1.03	0.01	0.77	0.13	4.10	2.12	5.91	2.26
1974	0.00	0.00	0.74	0.08	2.40	1.23	3.14	1.31
1975	0.77	0.00	1.57	0.24	0.86	0.36	3.20	0.60
1976	1.21	0.00	0.00	0.00	1.50	0.81	2.70	0.81
1977	3.51	0.01	0.98	0.12	1.21	0.70	5.70	0.83
1978	1.12	0.00	1.74	0.18	1.22	0.40	4.08	0.58
1979	0.00	0.00	0.77	0.12	1.12	0.43	1.89	0.55
1980	0.34	0.00	0.00	0.00	0.00	0.00	0.34	0.00
1981	20.00	0.14	1.23	0.12	0.00	0.00	21.23	0.26
1982	0.87	0.00	0.00	0.00	0.87	0.63	1.74	0.63
1983	0.00	0.00	0.49	0.01	0.00	0.00	0.49	0.01
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.44	0.20	0.44	0.20
1986	0.91	0.00	0.00	0.00	0.44	0.13	1.35	0.13
1987	0.00	0.00	0.00	0.00	0.44	0.24	0.44	0.24
1988	0.47	T	0.00	0.00	0.00	0.00	0.47	T
1989	0.85	T	0.41	0.05	0.87	0.48	2.13	0.53
1990	0.83	0.01	0.41	0.01	1.99	1.79	3.23	1.81
1991	1.90	0.01	0.36	0.03	0.47	0.20	2.73	0.25
1992	2.49	T	0.87	0.11	0.53	0.46	3.89	0.57

Table 24. Numbers and biomass (kg) per hectare for each size group of white bass in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	47.30	0.20	0.12	0.01	0.00	0.00	47.42	0.21
1971	4.07	0.08	0.00	0.00	0.00	0.00	4.07	0.08
1972	3.30	0.06	0.27	0.02	0.00	0.00	3.57	0.08
1973	13.96	0.15	1.33	0.07	1.12	0.22	16.42	0.44
1974	2.61	0.04	0.00	0.00	0.85	0.16	3.46	0.20
1975	0.00	0.00	0.00	0.00	0.27	0.06	0.27	0.06
1976	3.86	0.08	1.40	0.10	0.47	0.06	5.72	0.24
1977	35.48	0.38	2.79	0.16	0.00	0.00	38.27	0.54
1978	11.03	0.03	0.00	0.00	0.00	0.00	11.03	0.03
1979	3.16	0.05	0.00	0.00	0.00	0.00	3.16	0.05
1980	11.25	0.05	0.00	0.00	0.00	0.00	11.25	0.05
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	1.43	0.03	0.48	0.03	0.48	0.08	2.38	0.14
1983	0.00	0.00	0.00	0.00	1.46	0.18	1.46	0.18
1984	0.00	0.00	0.00	0.00	1.82	0.32	1.82	0.32
1985	37.27	0.79	5.91	0.33	0.44	0.09	43.63	1.20
1986	21.34	0.72	172.25	11.70	1.82	0.25	195.44	12.66
1987	16.04	0.25	1.78	0.09	0.00	0.00	17.82	0.35
1988	29.37	0.33	5.12	0.27	1.86	0.28	36.35	0.88
1989	2.09	0.04	0.00	0.00	0.00	0.00	2.09	0.04
1990	9.79	0.20	13.79	0.79	0.34	0.05	23.92	1.04
1991	13.01	0.19	0.00	0.00	0.00	0.00	13.01	0.19
1992	0.34	T	0.00	0.00	0.00	0.00	0.34	T

Table 25. Numbers and biomass (kg) per hectare for each size group of yellow bass in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1971	0.91	0.00	0.27	0.02	0.00	0.00	1.18	0.02
1972	21.90	0.15	0.26	0.02	0.54	0.06	22.70	0.23
1973	16.65	0.19	4.65	0.28	0.00	0.00	21.30	0.47
1974	6.63	0.11	1.92	0.14	0.00	0.00	8.55	0.25
1975	19.37	0.33	12.01	0.95	2.01	0.26	33.39	1.54
1976	48.09	0.19	8.76	0.59	3.82	0.47	60.67	1.26
1977	238.76	0.94	6.52	0.56	2.62	0.30	247.91	1.80
1978	106.99	0.29	5.90	0.45	2.70	0.33	115.59	1.06
1979	3.84	0.05	0.38	0.03	0.38	0.04	4.61	0.13
1980	121.22	0.48	5.46	0.50	1.18	0.15	127.85	1.13
1981	187.95	4.29	69.19	4.56	10.23	1.26	267.37	10.11
1982	232.81	1.15	37.20	2.94	6.04	0.77	276.05	4.86
1983	95.83	0.80	16.34	1.46	12.62	1.68	124.79	3.94
1984	100.14	0.56	9.70	0.70	1.82	0.25	111.65	1.50
1985	84.19	0.46	32.09	2.58	9.64	1.20	125.92	4.24
1986	103.22	1.44	56.70	3.18	6.74	0.91	166.66	5.54
1987	70.48	0.66	5.93	0.34	2.76	0.33	79.17	1.34
1988	174.59	1.21	6.70	0.46	0.94	0.21	182.23	1.87
1989	45.03	0.60	1.30	0.10	1.67	0.24	48.00	0.94
1990	721.50	2.13	7.27	0.44	1.38	0.17	730.15	2.74
1991	134.53	1.29	1.48	0.11	0.97	0.19	136.98	1.59
1992	103.99	0.51	1.30	0.10	0.00	0.00	105.29	0.60

Table 26. Numbers and biomass (kg) per hectare for each size group of warmouth in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	7.18	0.03	4.44	0.11	2.30	0.17	13.92	0.30
1971	37.62	0.09	10.65	0.23	0.00	0.00	48.27	0.32
1972	39.04	0.13	14.26	0.38	1.88	0.15	55.18	0.66
1973	195.94	1.09	9.40	0.25	8.17	0.65	213.51	2.00
1974	8.92	0.02	3.79	0.07	0.98	0.07	13.68	0.16
1975	38.28	0.06	4.67	0.08	2.82	0.27	45.77	0.41
1976	54.55	0.07	12.34	0.26	5.68	0.41	72.57	0.74
1977	233.55	0.41	9.93	0.15	6.12	0.46	249.60	1.02
1978	313.63	0.31	26.19	0.54	9.05	0.79	348.87	1.64
1979	844.05	0.95	34.19	0.65	18.29	1.55	896.53	3.15
1980	1,282.81	1.67	13.77	0.32	7.42	0.64	1,304.00	2.64
1981	2,733.15	5.32	56.63	1.12	32.43	2.21	2,822.21	8.65
1982	1,712.30	1.92	45.06	0.77	10.92	0.76	1,768.28	3.45
1983	3,463.73	2.50	53.73	0.84	9.38	0.79	3,526.84	4.13
1984	1,579.34	2.20	74.19	0.92	6.69	0.45	1,660.22	3.58
1985	311.27	0.40	24.55	0.39	0.45	0.03	336.27	0.81
1986	1,050.77	1.26	27.14	0.53	6.38	0.44	1,084.28	2.24
1987	1,588.89	1.95	80.87	1.50	22.31	2.33	1,692.08	5.77
1988	1,290.27	2.06	54.27	1.04	32.95	3.78	1,377.50	6.88
1989	406.65	0.45	90.37	1.38	33.01	2.63	530.03	4.46
1990	446.66	0.94	40.34	0.67	28.90	2.22	515.91	3.83
1991	590.54	1.01	50.87	0.84	15.25	1.14	656.66	2.99
1992	97.02	0.12	24.92	0.42	8.79	0.63	130.73	1.16

Table 27. Numbers and biomass (kg) per hectare for each size group of white crappie in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	89.00	0.11	28.51	1.19	20.68	3.09	138.18	4.39
1971	7.90	0.05	13.69	1.04	17.95	3.14	39.54	4.23
1972	29.80	0.10	13.33	0.48	12.55	2.52	55.68	3.11
1973	24.31	0.07	15.29	0.69	16.30	2.94	55.90	3.70
1974	0.60	0.00	2.14	0.07	7.15	1.15	9.88	1.22
1975	1.13	0.00	4.31	0.27	7.80	1.07	13.25	1.35
1976	26.53	0.06	14.70	0.24	7.65	1.25	48.88	1.55
1977	66.00	0.18	16.16	0.18	8.59	1.20	90.75	1.56
1978	116.93	0.27	26.24	0.98	12.34	1.46	155.50	2.71
1979	57.10	0.12	26.41	0.59	28.16	2.87	111.67	3.58
1980	9.31	0.02	8.42	0.09	12.86	1.74	30.59	1.85
1981	10.43	0.02	14.13	0.15	5.59	0.99	30.16	1.17
1982	118.97	0.21	4.57	0.05	3.25	0.60	126.79	0.86
1983	99.81	0.22	15.32	0.14	0.49	0.04	115.62	0.40
1984	80.87	0.17	5.77	0.14	0.98	0.10	87.61	0.41
1985	43.88	0.10	32.34	0.36	2.64	0.40	78.86	0.86
1986	29.04	0.05	14.70	0.21	0.44	0.04	44.18	0.29
1987	262.92	0.60	11.04	0.11	0.00	0.00	273.96	0.71
1988	86.11	0.18	13.35	0.13	0.00	0.00	99.46	0.31
1989	38.86	0.07	6.12	0.06	2.45	0.43	47.43	0.56
1990	133.97	0.22	41.46	0.45	0.00	0.00	175.43	0.66
1991	23.22	0.05	10.65	0.09	0.65	0.08	34.51	0.22
1992	8.11	0.02	2.17	0.01	0.00	0.00	10.28	0.03

Table 28. Numbers and biomass (kg) per hectare for each size group of black crappie in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	0.00	0.00	0.00	0.00	0.89	0.10	0.89	0.10
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	00.00
1972	1.79	0.01	0.00	0.00	0.40	0.10	2.18	0.10
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.75	0.13	0.75	0.13
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	3.08	0.65	3.08	0.65
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	1.47	0.07	0.65	0.08	2.13	0.15
1980	2.75	0.01	0.69	0.01	0.65	0.12	4.09	0.13
1981	0.83	0.00	1.82	0.06	0.43	0.04	3.09	0.11
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.45	0.00	0.45	0.00	0.00	0.00	0.91	0.00
1985	5.85	0.02	6.23	0.05	1.78	0.23	13.86	0.30
1986	1.33	0.00	6.69	0.15	1.35	0.18	9.37	0.33
1987	7.10	0.02	0.48	0.00	0.48	0.04	8.05	0.06
1988	131.13	0.30	13.01	0.16	0.90	0.10	145.04	0.56
1989	31.98	0.07	3.74	0.07	1.66	0.26	37.38	0.41
1990	125.59	0.26	7.85	0.12	2.41	0.35	135.85	0.72
1991	88.74	0.20	5.16	0.05	1.86	0.30	95.76	0.55
1992	208.44	0.41	2.27	0.04	0.96	0.24	211.67	0.69

Table 29. Numbers and biomass (kg) per hectare for each size group of sauger in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	0.00	0.00	0.00	0.00	0.75	0.23	0.75	0.23
1972	0.54	0.03	0.81	0.07	0.27	0.09	1.61	0.19
1973	2.23	0.13	0.58	0.09	2.59	0.60	5.40	0.82
1974	1.39	0.07	0.26	0.02	0.85	0.19	2.50	0.28
1975	0.27	0.02	1.46	0.21	0.19	0.03	1.92	0.26
1976	0.00	0.00	0.00	0.00	3.39	0.78	3.39	0.78
1977	6.52	0.25	0.41	0.03	0.00	0.00	6.93	0.28
1978	0.00	0.00	0.79	0.10	0.69	0.14	1.48	0.24
1979	0.00	0.00	1.40	0.14	0.47	0.08	1.86	0.23
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.44	0.10	0.44	0.10
1986	0.00	0.00	0.00	0.00	0.45	0.25	0.45	0.25
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.82	0.03	0.00	0.00	0.00	0.00	0.82	0.03
1991	0.00	0.00	0.00	0.00	1.40	0.28	1.40	0.28
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 30. Numbers and biomass (kg) per hectare for each size group of yellow perch in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	11.81	0.04	4.92	0.04	0.21	0.01	16.94	0.10
1971	0.00	0.00	28.77	0.29	4.26	0.28	33.03	0.57
1972	0.00	0.00	26.89	0.30	5.37	0.27	32.25	0.57
1973	0.00	0.00	7.68	0.09	15.73	0.76	23.41	0.85
1974	0.00	0.00	2.08	0.03	6.22	0.41	8.30	0.44
1975	0.27	0.00	3.18	0.03	0.91	0.06	4.36	0.09
1976	0.00	0.00	28.35	0.28	3.84	0.21	32.19	0.49
1977	42.99	0.11	89.64	0.54	15.01	0.61	147.65	1.25
1978	195.38	0.50	96.60	0.56	36.33	1.67	328.31	2.72
1979	0.38	0.00	26.80	0.19	43.06	2.11	70.25	2.31
1980	95.76	0.26	65.24	0.38	31.77	2.39	192.76	3.03
1981	39.05	0.12	56.11	0.36	25.35	1.17	120.50	1.64
1982	26.96	0.06	18.87	0.11	19.30	1.11	65.12	1.28
1983	49.27	0.13	33.27	0.20	22.59	0.97	105.14	1.30
1984	28.29	0.07	19.02	0.11	15.59	0.79	62.90	0.98
1985	59.09	0.17	26.41	0.14	3.20	0.28	88.70	0.58
1986	4.18	0.01	42.66	0.26	4.08	0.14	50.92	0.40
1987	11.23	0.03	34.22	0.20	7.41	0.38	52.86	0.61
1988	178.87	0.47	78.24	0.45	42.46	1.71	299.57	2.63
1989	30.41	0.07	89.77	0.57	82.74	3.15	202.92	3.80
1990	105.72	0.27	143.18	0.88	101.24	3.86	350.14	5.01
1991	13.46	0.03	62.46	0.38	45.08	1.59	121.01	2.00
1992	65.83	0.18	86.71	0.53	22.85	1.10	175.38	1.80

Table 31. Numbers and biomass (kg) per hectare for each size group of freshwater drum in cove rotenone samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	109.45	0.76	211.63	12.38	96.91	16.34	417.99	29.48
1971	72.45	0.93	139.24	8.21	58.07	8.40	269.77	17.54
1972	305.07	3.72	153.91	9.71	127.07	25.45	586.05	38.88
1973	228.57	1.87	307.13	15.63	125.75	21.71	661.45	39.21
1974	27.10	0.21	165.60	7.68	62.02	10.33	254.72	18.22
1975	33.86	0.29	68.26	3.96	37.15	8.09	139.26	12.35
1976	77.81	0.52	125.65	7.08	119.88	19.32	323.34	26.92
1977	62.65	0.60	116.64	6.73	127.61	17.95	306.90	25.28
1978	0.34	0.00	73.93	4 46	82.26	11.23	156.54	15.70
1979	5.87	0.06	68.65	4.15	100.96	13.30	175.47	17.51
1980	2.76	0.02	27.73	1.74	116.01	15.76	146.50	17.51
1981	6.31	0.04	57.13	3.52	247.53	38.22	310.97	41.78
1982	1.39	0.02	68.89	3.96	152.82	20.98	223.10	24.96
1983	50.62	0.36	95.04	5.61	166.78	24.21	312.44	30.18
1984	36.37	0.22	102.86	4.86	90.94	12.36	230.17	17.44
1985	102.65	0.69	116.16	6.81	142.92	22.59	361.73	30.10
1986	14.54	0.14	29.80	1.62	74.81	11.64	119.15	13.40
1987	30.11	0.24	84.39	4.05	110.75	15.29	225.26	19.58
1988	2.75	0.05	72.00	3.82	89.67	11.29	164.42	15.16
1989	8.16	0.05	125.50	6.72	115.86	16.27	249.52	23.04
1990	260.87	1.31	166.79	8.10	159.14	21.74	586.80	31.16
1991	51.80	0.36	204.28	9.84	128.08	20.09	384.16	30.28
1992	40.50	0.18	179.45	9.98	153.29	22.03	373.24	32.19

Table 32. Numbers and biomass (kg) per hectare for each size group of largemouth bass in cove rotenone Samples, Chickamauga Reservoir, 1970-92.

	Young-of-Year		Intermediate		Adult		Total	
	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass	Numbers	Biomass
1970	263.10	0.69	22.41	2.05	9.58	2.89	295.09	5.63
1971	64.88	0.35	35.72	1.89	20.59	6.67	121.20	8.90
1972	21.16	0.17	60.90	4.08	14.62	4.94	96.68	9.18
1973	66.45	0.43	69.09	4.86	26.93	6.71	162.46	12.01
1974	27.57	0.11	20.43	1.73	19.07	4.91	67.08	6.76
1975	65.56	0.23	23.82	1.68	17.35	6.32	106.74	8.23
1976	38.80	0.19	34.59	1.36	13.53	5.86	86.92	7.41
1977	251.89	1.07	130.99	3.77	16.76	3.92	399.64	8.76
1978	506.83	1.91	54.77	1.82	19.98	4.96	581.58	8.69
1979	784.76	2.25	27.21	2.00	22.44	7.40	834.42	11.65
1980	863.78	3.82	101.05	1.78	12.01	5.47	976.84	11.08
1981	468.11	2.98	219.40	5.76	28.02	8.13	715.53	16.87
1982	321.76	1.08	91.40	5.62	29.53	6.18	442.69	12.88
1983	259.60	1.37	71.27	2.67	30.79	6.91	361.67	10.95
1984	379.15	1.36	40.84	2.48	10.93	3.39	430.92	7.23
1985	136.96	0.77	115.07	3.65	51.78	13.73	303.81	18.15
1986	91.88	0.54	100.78	3.09	6.69	1.66	199.35	5.28
1987	228.08	1.12	97.65	3.87	28.33	6.64	354.05	11.64
1988	158.10	0.76	72.88	2.54	22.52	6.10	253.50	9.40
1989	375.23	1.27	42.70	3.17	29.46	9.96	447.50	14.40
1990	223.48	0.97	69.44	2.10	23.34	7.27	316.26	10.34
1991	181.30	0.67	53.51	2.85	21.45	8.03	256.27	11.56
1992	717.62	1.90	13.82	1.03	15.99	5.92	747.42	8.85

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