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Evaluation of a 15.0-in. Size Limit on Largemouth Bass In Taylorsville Lake

by

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ABSTRACT

The fish management plan designed prior to the impoundment of Taylorsville Lake (3,050 acres) in 1983 called for stocking three year classes of largemouth bass and the imposition of a 15.0-in size limit. The objectives of this plan were to prevent overharvest of quality-size fish (≥15 in), minimize the normal "boom-bust" cycle associated with new impoundments, and provide for an immediate quality bass fishery. Studies conducted from 1983-1990, showed that the largemouth bass population did portray a "boom-bust" cycle, with largemouth bass fishing pressure (59 man-hours/acre) and harvest (5 fish/acre) peaking in 1986. Harvest of largemouth bass has stabilized at <1 fish/acre from 1988-1990. Declines in the largemouth bass fishery were magnified by poor reproductive success (beginning in 1984) due to suspected water-quality problems. Remedial largemouth bass stockings began in 1985 and are now contributing to improvements in recruitment. Poor reproductive success and recruitment offset some of the benefits of the 15.0-in size limit. The size limit lessened this impact by protecting quality-size fish (12.0-14.9 in) for a longer duration which created a very good catch and release fishery. The catch and release fishery for harvestable-sized fish was also important and was found to increase from 21% in 1985 to 53% of the harvestable-sized fish being released in 1990. Results of this study also indicate spring electrofishing catch-per-unit-effort data can be used to model relationships between largemouth bass size groups, year classes, and relationships of angler catch to electrofishing catch rates of bass.

INTRODUCTION

Management of black bass fisheries throughout the country has gone through periods of creel and size limit liberalization and restrictions (Redmond 1986). The concept of maximum sustained yield during the 1940's resulted in liberalized creel and size-limits. Later studies showed that this concept which maximized harvest could result in overharvest problems and declines in sport fisheries (Patriarche and Campbell 1957, Herman et al. 1969). To reduce overharvest problems and improve quality of sport fisheries, the use of more restrictive limits designed around the concept of optimum sustained yield were developed. These more restrictive limits, when based on sound biological data and properly enforced, can be used to maintain desirable and high-quality fisheries. More restrictive size limits (Kornman 1990) and specialized size limits (Prather 1990, Buynak et al. In Press) have been applied in lakes in Kentucky.

The Taylorsville Lake management plan, designed prior to the lake's impoundment in 1983, centered around the concept of optimum sustained yield which would provide for a quality-size bass to catch and harvest, and respond to the possibility of overharvest of black bass in this new reservoir. Heavy fishing pressure and potential overharvest were anticipated at Taylorsville Lake due to the proximity of this new reservoir to several major metropolitan areas. An additional goal was to minimize the "boom-bust" cycle normally associated with new impoundments (Goddard and Redmond 1986). The black bass management plan consisted of stocking three year classes of largemouth bass and the imposition of a more restrictive (statewide-size limit was 12.0 in) 15.0-inch minimum size limit, both of which together have provided for a long-term quality fishery in other systems (Goddard & Redmond 1986).

The primary objective of this study was to evaluate the effectiveness of the 15.0-in black bass size limit in the newly impounded Taylorsville Lake. The discussion of this size limit will be confined only to its relationship to the largemouth bass fishery since spotted and smallmouth bass populations in the reservoir do not provide for a significant fishery.

STUDY AREA

Taylorsville Lake is a 3,050-acre multipurpose impoundment completed in 1983. The lake impounds the Salt River and is located in Anderson, Nelson, and Spencer counties in central Kentucky. The mainstem length of the reservoir is 18.5 miles while the lake has a shoreline length of 75 mi. The watershed acreage of the lake is primarily in agriculture (70%). Storage ratio has been determined to be 0.26 year. Average depth is 28 ft while maximum depth is 79 ft. The normal winter drawdown is 2 ft, with a winter pool acreage of 2,930 acres. Thermocline depth is generally 12 ft or less with a deoxygenated hypoliminion. The lake is classified eutrophic (personal communications, Lynn Garrett, U.S. Army Corps of Engineers).

In 1983, the year of impoundment, Taylorsville Lake was stocked with a total of 106,330 largemouth bass (34.9 fish/acre) representing three year classes of fish (Table 1). The number stocked by year class was 2,420 fish or 0.8 fish/acre (1981 year class), 10,894 fish or 3.6 fish/acre (1982 year class), and 93,016 fish or 30.5 fish/acre (1983 year class).

METHODS

Multiple-timed electrofishing samples of largemouth bass were taken during daylight hours in the spring and fall of year from 1983-1990 (Reynolds 1983) using boat-mounted DC electrofishing gear. All captured black bass were identified and measured to the nearest 0.1 in; weights to nearest 0.02 lb were taken from fish collected in fall samples. In 1986 and 1987, largemouth bass ≥15.0 in were tagged with Floy anchor tags to determine angler exploitation rates. A $5.00 reward was paid to anglers for each tag returned. Force of fishing mortality and force of total mortality were determined according to the method described in Everhart and Youngs (1953). A follow-up questionnaire sent to anglers returning tags was used to determine if the tagged fish were harvested or released. These data were used to correct exploitation rates.

Scale samples were taken from a representative sample of largemouth bass collected during either the spring or fall electrofishing studies in each year from 1983-1990. Samples were taken from below the lateral line on the left side of the fish at the tip of the extended pectoral fin. Scales were read using a microfiche reader; scales too large to be read on the microfiche were read on an Eberbach scale viewer. Corrections to scale measurements were made because of differences in magnification of the two viewers. Back-calculated lengths at annulus formation were determined using the Fraser-Lee Method (Ricker 1971).

Electrofishing length-frequency data were used to determine trends in proportional stock densities (PSD), relative stock densities (RSD_{15}) (Anderson and Gutreuter 1983), and catch-per-unit-effort (CPUE). All CPUE data for largemouth bass were stratified into the following size classes: <8.0, 8.0-11.9, 12.0-14.9, and ≥15.0 in. Year classes were assigned to largemouth bass CPUE data from 1983-1990 using length at age relationships obtained from spring age and growth and electrofishing length-frequency data. Regression models comparing the CPUE relationship of the various size and age classes of largemouth bass were determined (SAS 1988). Survival and mortality estimates were obtained from age composition data using the Robson-Chapman Method (Ricker 1975). Mortality and survival rates were also determined for the two strong initial year classes (1982 and 1983) of largemouth bass from 1984-1990 (Ricker 1975).

Largemouth bass length-weight relationships and Wr (Wedge and Anderson 1978) indices were obtained from data collected in fall electrofishing studies from 1983-1990. Wr values were calculated for largemouth bass in the 8.0-11.9, 12.0-14.9, and ≥15.0 in classes.

Two cove-rotenone studies totaling 3.15 a were conducted during July-August 1983-1990. Procedures used in these studies were similar to those given in Davis and Shelton (1983). Data obtained from these studies included standing stock estimates and available prey-predator relationships (Jenkins and Morais 1976).

Catch, harvest, and fishing pressure for all species were determined using a non-uniform probability creel survey conducted by a roving clerk from 1984-1986 while an access survey was utilized in 1987-1990 (Malvestuto 1983). The survey was conducted from March-October on 4 days per week for 7.5 hours per day. The creel clerk recorded the size and number of largemouth bass harvested and in most years, the size and number of bass released. Regression models were developed comparing angler catch of largemouth bass by size group to electrofishing CPUE data (SAS 1988).

RESULTS

Cove-rotenone studies

Total standing stock of fish in Taylorsville Lake increased from 301.4 pounds/acre (lb/acre) in 1983 to 719.4 lb/acre in 1985 followed by a decline to only 404.6 lb/acre in 1986 (Table 2). Standing stock remained between 454.7 and 624.4 lb/acre from 1987 through 1990. Gizzard shad standing stock ranged from 57.2 lb/acre in 1983 (year of impoundment) to 297.2 lb/acre in 1987. Standing stock estimates of gizzard shad exceeded 243.0 lb/acre in all years sampled except 1983 and 1986. Gizzard shad represented 41-59% of the total biomass of all fish from 1984-1990.

Largemouth bass standing stock increased from 13.7 lb/acre in 1983 to 20.6 lb/acre in 1984 (Table 2). After 1984, estimates declined and reached their lowest value of 5.1 lb/acre in 1987. Since 1987, the largemouth bass standing stock has increased to 13.3 lb/acre in 1990. Standing stock estimates of quality-size (≥12.0 in) largemouth bass increased from 1.3 lb/acre in 1983 to their highest levels of 16.9 lb/acre in 1985. From 1985-1988, this size group declined to 2.1 lb/acre followed by increases in 1989 (6.3 lb/acre) and 1990 (5.1 lb/acre). Intermediate-sized (5-11 in group) largemouth bass increased from 9.5 lb/acre in 1983 to 11.8 lb/acre in 1984 and then declined to 2.1 lb/acre or less from 1985-1987. This size group then increased each year to 8.0 lb/acre in 1990. Standing stock estimates of fingerling-sized (0-4 in group) largemouth bass remained low in all years sampled except for the year impounded (1983). As a result of this low fingerling production, remedial largemouth bass stockings began in 1985 (Table 1). Detailed results of these efforts will not be discussed in this report.

Creel Surveys

Total fishing pressure as measured in man-hours/acre ranged from 54.4 man-hours/acre in 1985 to 108.6 man-hours/acre in 1990 (Table 3). Total harvest and harvest rate peaked in 1989 at 134 fish/acre (32 lb/acre) and 1.34 fish/h. Fishing pressure for black bass peaked in 1986 at 58.7 man-hours/acre (Table 4) followed by a decline to 34.6 man-hours/acre in 1987. Since 1987, fishing pressure for black bass has increased to 44.0 man-hours/acre in 1990.

Harvest of largemouth bass increased from 2,069 fish (0.68 fish/acre) in 1984 to 15,373 fish (5.04 fish/acre) in 1986 (Table 4). Largemouth bass harvest has declined each year since 1986 to 2,647 fish (0.87 fish/acre) in 1990. Harvest rates were highest (0.03-0.06 fish/h) in the initial study years (1984-1987) and declined to 0.01 fish/h from 1988-1990. Catch and release of harvestable-sized (≥15.0 in) largemouth bass accounted for 47-53% of the total number of harvestable-sized bass caught in each year since 1987. Catch and release of 12.0-14.9 in largemouth bass (Table 4) reached highest levels in 1985 at 52,829 fish (17.3 fish/acre) and declined to only 6,601 fish (2.2 fish/acre) in 1987. Since 1987, the release of 12.0-14.9 in largemouth bass has increased to 12,645 fish (4.1 fish/acre) in 1989 (release data was not recorded in 1990).

Age and Growth

No major yearly differences occurred between age and growth data collected from 1985-1990; therefore, all data were combined. Largemouth bass at Taylorsville Lake reached 12.0 in at age 3+ and 15.0 in early in their sixth year of life or age 5+ (Table 5). Age at length data were determined from scale samples taken from largemouth bass obtained during spring and fall electrofishing studies from 1985-1990. Percentage of each inch class for each age class of largemouth bass for both the spring and fall are shown in Table 6.

Survival-Mortality-Exploitation

Largemouth bass survival estimates for the strong 1982 and 1983 year classes (produced by both stocking and naturally-spawned fish in 1983) were tracked from 1983-1990. Mean survival rates for each age were as follows: 70.5% (age 0 to 1), 37.2% (age 1 to 2), 56.9% (age 2 to 3), 88.9% (age 3 to 4), 46.0% (age 4 to 5), 65.7% (age 5 to 6), and 66.7% (age 6 to 7). Mean annual survival rate for these two strong year classes was 61.7% (SE = 6.4). Catch curve analysis of age composition data for each year produced the following survival rates: 57.5% (1985), 70.4% (1986), 75.4% (1987), 74.7% (1988), 62.1% (1989), and 54.9% (1990). The mean annual survival for these years was 65.8% (SE = 3.6).

Uncorrected exploitation rates for ≥15.0 in largemouth bass determined from tagging studies conducted in 1986 and 1987, were 25.6 and 17.5%, respectively ($\bar{x}$ = 21.6%). Using a survival rate = 0.658, total mortality = 0.342, and exploitation rate of 0.216; then Z (force of total mortality) = 0.419, F (force of fishing mortality) = 0.264, and M (force of natural mortality) = 0.154. Using the same survival and total mortality estimates and the corrected exploitation rate of 9.0% then Z = 0.419, F = 0.110 and M = 0.308. The force of fishing mortality was found to be greater than the force of natural mortality when the exploitation rate was ≥17%.

Condition

Condition of ≥12.0 in largemouth bass collected in fall electrofishing studies was considered excellent from 1983-1990 (Table 7). In 1983 and 1987-1990, condition of 8.0-11.9 in largemouth bass was also considered to be excellent, but declines were observed from 1984-1986. The C-ratios, determined from available prey-predator (AP/P) models of cove-rotenone data, indicated shortages of forage occurred in those years for that size range of predators (Table 8) The length-weight relationship developed from 1,118 largemouth bass collected from 1983-1990 is given in Table 7.

Size-Structure and Density Indices

The PSD value at Taylorsville Lake increased from 7 in 1983 and 1984 to 87 in 1987 (Table 9). Values then declined in years after 1987 to 43 in 1990. Similar trends were observed for RSD_{15} values with a high of 67 in 1987 and a low of 21 in 1990.

Electrofishing catch-per-unit-effort (CPUE) data for each size group of largemouth bass are given in Table 10. The CPUE data for all combined size groups of largemouth bass declined each year from 144.4 fish/hour in 1984 to only 37.2 fish/hour in 1988. Largemouth bass CPUE then increased to 128.2 fish/hour in 1989 and 154.4 fish/hour in 1990. Catch rates for largemouth bass <8.0 in was 50.4 fish/hour in 1984, but declined to only 0.8 fish/hour in 1985. Densities for this size group remained low through 1988 and then increased to 58.6 fish/hour in 1989 and 49.8 fish/hour in 1990. Catch rates of 8.0-11.9 in largemouth bass followed similar trends and declined from 88.0 fish/hour in 1984 to only 5.4 fish/hour in 1987. After 1987, values increased in each year to 57.0 fish/hour in 1990. The highest catch rate for 12.0-14.9 in largemouth bass was obtained in 1985 (74.8 fish/hour) followed by a decline to only 6.0 fish/hour in 1988. Since 1988, CPUE values of 12.0-14.9 in fish have increased to 22.8 fish/hour in 1990. The CPUE of harvestable-sized largemouth bass (≥15.0 in) increased from 0 fish/hour in 1984 to 29.2 fish/hour in 1987; values then declined to 13.8 fish/hour in 1989. In 1990, CPUE for largemouth bass ≥15.0 in increased to 19.2 fish/hour.

Differences in largemouth bass densities are better explained by examining differences in year class strength. Based on confidence limits, the 1983, 1988, and 1989 year classes of largemouth bass were significantly more abundant at age 1 than the 1984-1987 year classes (Figure 1). At age 2, the 1983, 1987, and 1988 year classes were the dominant year classes, with the 1984-1986 year classes being relatively weak (Figure 2). Differences were also found between year-class strength at age 3 (Figure 3), with the 1983, 1986, and 1987 year class more abundant than the 1984 and 1985 year classes. At age 4, when some fish recruited to the fishery (≥15.0 in), differences between year classes became less pronounced (Figure 4). Only the 1984 year class was significantly less important than the other year classes. No major differences were found between the 1983, 1984, and 1985 year classes by age 5 (Figure 5). Because the 1984-1987 year classes were poor, no definite trends were observed between year-class strength at age 1 to age 5, when these fish enter the fishery. However, the strong 1983 year-class did remained strong until these fish entered the fishery.

Linear regression was used to develop predictive models from electrofishing CPUE data for several size and age groups of largemouth bass. A significant positive relationship existed between the spring CPUE of <8.0 in largemouth bass and the CPUE of 8.0-11.9 in bass the following spring (Table 11, Figure 6). A similar relationship existed between the spring CPUE of 8.0-11.9 in bass and the CPUE of 12.0-14.9 in largemouth bass in the following spring (Table 11, Figure 7). A non-significant ($P = 0.13$) positive relationship was detected between the CPUE of 12.0-14.9 in bass and ≥15.0 in bass (Table 11, Figure 8). A significant positive relationship was found between the fall electrofishing CPUE of age 0 largemouth bass and the following spring electrofishing CPUE data for age 1 largemouth bass (Table 11, Figure 9). A similar relationship was also found to exist between the spring electrofishing CPUE data of age 1 largemouth bass to the following year's spring CPUE data for age 2 bass (Table 11, Figure 10). Strong positive relationships were also found between age 2 and 3 (Table 11, Figure 11), and age 3 and 4 (Table 11, Figure 12); however, these relationships were not significant.

Strong linear relationships were found between angler catch and spring electrofishing catch rates of several size groups of largemouth bass. A positive, but statistically insignificant ($P = 0.20$) relationship was found between the angler catch and release of 8.0-11.9 in bass and the spring electrofishing CPUE of the same size largemouth bass within the same year (Table 11, Figure 13). A significant positive relationship was obtained between spring electrofishing CPUE of 12.0-14.9 in bass and the angler catch and release of 12.0-14.9 in bass in the same year (Table 11, Figure 14). Angler catch (release and harvest) of ≥15.0 in largemouth bass could also be predicted using the previous years' electrofishing catch rates of 12.0-14.9 in bass (Table 11, Figure 15).

DISCUSSION

Minimum-size limits, slot limits, and other specialized size limits have been utilized throughout the country in managing black bass populations. Some of the objectives of these limits, which center around the concept of optimum sustained yield, include reducing overharvest problems (Richards 1986), improving growth rates (Martin & Hess 1986), improving angler catch rates (Dent 1986), improving overall size structure of the bass population (Dent 1986), and establishing trophy fisheries (Clady et al. 1975). The primary goals of the Taylorsville Lake management plan were to prevent overharvest of the largemouth bass population due to expected heavy fishing pressure, extend the "boom-bust" cycle normally associated with new reservoirs, and provide for an immediate quality bass fishery.

The stocking of large numbers of age 0, 1, and 2 largemouth bass in Taylorsville Lake in 1983 provided for an excellent fishery even though studies conducted in 1983 and 1984 showed that few harvestable-sized (≥15.0 in) bass were available. In 1984, anglers caught and released over 50,000 largemouth bass 12.0-14.9 in long. The 15.0-in size limit successfully prevented overharvest of the large number of ≥12.0 in bass available to anglers and prolonged the initial fishery. In 1985, electrofishing catch rates of 12.0-14.9 in largemouth bass increased 10-fold with complementary increases in PSD and RSD_{15} levels. Black bass fishing pressure in 1985 remained similar to the 1984 level; however, an increase occurred in numbers of largemouth bass harvested and caught and released (12.0-14.9 in).

Cove-rotenone and electrofishing data collected in 1984 and 1985 determined limited reproductive success occurred for largemouth bass at Taylorsville Lake. The causes of this poor reproduction have not been determined, but are believed to occur at some time during the early life history of the species. Numbers of young-of-year bass collected at Taylorsville Lake were below numbers observed in other lakes in Kentucky having similar levels of nutrients. For instance, from 1978-1989, the average young-of-year production at Barkley and Herrington lakes, was estimated at 131 and 196 young-of-year per acre, respectively. At Taylorsville Lake, only 14 and 27 young-of-year per acre were collected in 1984 and 1985.

The reproductive problems resulted in declines in the 1986 electrofishing catch rates of <8.0 and 8.0-11.9 in bass, while the numbers of quality-sized fish continued to increase. Even though the limited recruitment was beginning to impact the total fishery, fishing pressure doubled in 1986 with anglers experiencing their best year as largemouth bass harvest peaked. However, angler catch and release of 12.0-14.9 in bass declined. The declining numbers of stock to quality-sized largemouth bass due to low recruitment and the continued increases in numbers of ≥15.0 in bass in 1987 resulted in the highest PSD (87) and RSD_{15} (67) levels recorded in all study years. High fishing mortality and low recruitment were factors contributing to the declining largemouth bass fishery in 1987.

As a result of the declining fishery, a largemouth bass stocking program began on a limited basis in 1985 and was formalized in 1986 at a minimum of 10 fish/acre (4 in fish). Studies conducted from 1988-1990 showed increased numbers of ≥8.0 in largemouth bass being collected. These increases were believed due to slight improvements in natural reproduction and the stocking program. The importance of stocked largemouth bass is presently being determined; preliminary results from fin-clipped fish (1988-1990) indicate stocked fish accounted for 50% of the 1988-1990 year classes during fall sampling in 1990.

Improvements in recruitment (partially due to stocking efforts) resulted in increased levels of angler catch and release of largemouth bass <15.0 in from 1987-1989, despite a continued decline in harvest. Improvements in largemouth bass harvest are expected as these sub-legal bass recruit into the fishery. However, catch and release of harvestable-size bass has become more important to the black bass fishery at Taylorsville Lake. From 1985-1987, catch and release of ≥15.0 in largemouth bass accounted for a mean of 21% of all bass ≥15.0 in caught while from 1988-1990, the catch and release fishery has more than doubled (49%).

Results of this investigation also indicated that some significant linear relationships existed between electrofishing catch rates of the various size and age classes of largemouth bass in addition to angler catch. Relationships were developed between fall CPUE for age 0 largemouth bass and the following spring CPUE for age 1 fish; a similar relationship was established for age 1 and 2 fish. Relationships between age 2 and 3 and age 3 and 4 were highly correlated but these relationships were not significant. Significant relationships were also developed between angler catch and electrofishing CPUE for 12.0-14.9 and ≥15.0 in and between the various size groups of largemouth bass through time. Similar relationships have been found between electrofishing CPUE of walleye fingerlings and their density in 13 Wisconsin lakes (Sterns 1982) and between electrofishing CPUE data of largemouth bass and their density in 12 Ohio impoundments (Hall 1986). Kruse (1988), however, did not find any relationship in spring electrofishing catch rates of ≥8.0 in bass and angler catch in any single reservoir studied in Missouri; significant relationships were found when data from all reservoirs were combined. The development of reliable predictive capabilities at Taylorsville Lake could ultimately be used to determine the number of bass needed in each year class at age 1 to provide for a high quality sport fishery at age 4 and 5. This information could then be used to adjust stocking rates, if natural recruitment continues to be a problem.

In summary, the 15.0-in minimum size limit at Taylorsville Lake did not totally avert the "boom-bust" cycle normally associated with new reservoirs. It did, however, prevent the premature decline in the largemouth bass fishery in Taylorsville Lake in comparison to results if the statewide minimum-size limit of 12.0-in had been used to manage the black bass. Gabelhouse (1980) stated that "length limits have proven to be the most effective management tool to prevent an initial overharvest of bass and provide sustained quality fishing for bass as well as their prey". New reservoirs, like Taylorsville Lake, have been characterized as having both high survival rates and yield of largemouth bass during the first 3-4 years of impoundment followed by a sharp decline in angler catch in later years (Patriarche & Campbell 1957). Recently in West Point Reservoir, the abundant first year class was responsible for creating a "boom" (King et al. 1979). Changes in population structure in this reservoir, brought about by both high natural and fishing mortalities resulted in a "bust" in the largemouth bass fishery after 2 years of impoundment. The 15.0-in size limit at Taylorsville Lake extended the good largemouth bass fishery at the lake through 1987, with the 1982 and 1983 year classes sustaining the fishery until 1988. The relative duration of the "boom" portion of the cycle and subsequent "bust" in the largemouth bass fishery at Taylorsville Lake was accentuated by the production of weak natural year classes and subsequent poor recruitment to harvestable-sized bass. Preliminary information obtained from remedial stocking efforts indicate that these efforts are contributing to the improvements observed in the largemouth bass fishery at the lake. The contribution to the creel of these stocked fish will be determined in the future. This study also showed that electrofishing catch-per-unit-effort data when collected in a standardized manner using multiple-timed runs can be used to model relationships and determine trends observed between the various size groups, age or year classes, and the relationship of angler catch to electrofishing catch rates of largemouth bass through time. These relationships when found to be highly correlated and significant can be used as predictors of angler catch, year class strength, and future trends in fisheries in reservoirs.

As a result of this study, it is recommended that (1) remedial stocking of 4.0-in fin-clipped largemouth bass continue until natural reproduction can sustain the fishery, or it is shown that the stocking efforts are not contributing to the fishery; (2) remedial stocking of 4.0-in largemouth bass be increased from 10 to 20 fingerlings/acre for two years followed by not stocking for two years; (3) a minimum of 25 (0.5 hour) spring and fall electrofishing runs be conducted to determine extent of natural reproduction and growth and survival of stocked fish; (4) cove-rotenone studies continue until the completion of the remedial bass stocking evaluation; (5) creel surveys be conducted to determine the contribution of the stocked fish to the anglers creel; (6) angler diary surveys continue to determine the contribution of the stocked bass to the catch and release fishery; and (7) relationships between year-class strength (age 1) and angler catch of ≥15.0 in bass be developed to determine the numbers of age 1 bass needed to provide for a quality bass fishery at Taylorsville Lake that would be similar to the "boom" portion of the cycle.

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Table 1. Number and sizes of largemouth bass stocked into Taylorsville in each year from 1983-1990.

Size(in)	Date stocked	No. stocked
10.5	March 22, 1983	2,420
6.0-10.0	March 23, 24, 28, 1983	10,894
fry	May 27, 1983	47,500
1.0-2.0	June 17, 1983	45,516
4.0-5.0	September 20, 1985	4,700
4.0-5.0	October 4, 1985	2,320
1.8	June 13, 1986	40,665
3.9-4.3	August 22, 27, 29 1986 September 5, 12, 1986 November 12, 1986	39,680
1.5	June 4, 1987	70,000
3.8-3.9	August 12, 20, 1987	20,579
3.9-4.2	September 2, 17, 27, 1987	10,738
4.0-4.5	August 18, 24, 25, 26, 1988	30,013
4.1-4.5	August 23, 24, and September 1, 1989	39,957
4.1-4.5	August 22, 23, 24, 30, 1990	39,082

Table 2. Standing stock data collected from two cove-rotenone samples totaling 3.15 acres at Taylorsville Lake in each year from 1983-1990.

Year	Total standing stock		Largemouth bass standing stock								Gizzard shad standing stock	
			Fingerling		Intermediate		Quality (≥12 in)		Total			
	No./a	Lb/a	No./a	Lb/a	No./a	Lb/a	No./a	Lb/a	No./a	Lb/a	No./a	Lb/a
1983	21,025	301.4	181	2.9	68	9.5	1	1.3	250	13.7	631	57.2
1984	9,178	604.1	14	0.1	28	11.8	8	8.7	50	20.6	2,342	257.0
1985	8,021	719.4	27	0.3	6	2.1	11	16.9	44	19.2	2,074	292.8
1986	6,090	404.6	55	0.5	10	2.0	7	14.4	72	16.9	2,155	180.3
1987	8,728	506.8	1	t	10	2.1	2	2.9	12	5.1	3,751	297.2
1988	7,370	518.6	42	0.6	13	3.6	1	2.1	56	6.4	3,333	243.8
1989	11,588	624.4	61	1.0	17	4.0	4	6.3	82	11.3	4,164	293.2
1990	11,462	454.7	13	0.2	26	8.0	7	5.1	46	13.3	6,280	245.9

t = <0.5 fish/acre and <0.05 lb/acre

Table 3. Creel data for all anglers combined collected at Taylorsville Lake from 1984-1990.

Year	No. of fishing trips/acre	Fishing pressure man-hours/acre	Total harvest rates Fish/h	Fish/acre	Lb/acre
1984	19.7	58.5	0.19	10.99	2.19
1985	12.1	54.4	0.20	10.56	4.51
1986	17.7	85.7	0.51	43.20	15.92
1987	11.0	54.5	0.62	36.73	8.76
1988	12.5	65.4	0.65	40.61	8.55
1989	17.3	99.9	1.34	133.60	32.23
1990	19.9	108.6	0.63	68.05	21.86

Table 4. Largemouth bass harvest and catch and release data collected at Taylorsville Lake from 1984-1990.

Year	No. fishing trips /acre for black bass	Man-hours/ acre for black bass	Largemouth bass harvested No.	Lb	Catch and release 8.0-11.9	12.0-14.9	≥15.0	ALL (≥8.0)	Harvest rate (fish/h)	Catch rate (fish/h)	Mean harvest size Length (in)	Weight (lb)
1984	12.1	37.7	2,069			50,514	2,530	53,044	0.05	0.41	15.8	1.98
1985	8.4	37.6	5,217	9,601		52,829	2,276	55,105	0.03	0.29	15.3	1.80
1986	12.1	58.7	15,373	32,279	12,578	20,565	2,396	35,539	0.06	0.14	15.9	2.10
1987	7.0	34.6	5,106	10,779	12,353	6,601	1,188	20,142	0.03	0.13	16.0	2.10
1988	6.9	35.9	2,899	6,466	16,228	11,009	2,639	29,876	0.01	0.16	16.3	2.23
1989	7.0	40.6	2,757	6,468	18,186	12,645	1,730	32,561	0.01	0.14	16.5	2.31
1990	8.1	44.0	2,647	5,967			2,939		0.01		16.3	2.23

Table 5. Mean back-calculated length (in) at each annulus for largemouth bass collected from Taylorsville Lake in 1985-1989, including the range of lengths of bass at each age and the 95% confidence interval for each age group.

		Age							
Year	No.	1	2	3	4	5	6	7	8
1988	43	5.4							
1987	58	5.6	9.5						
1986	40	5.3	8.5	11.0					
1985	41	5.3	8.5	10.9	13.1				
1984	46	5.1	8.2	11.0	12.8	14.8			
1983	44	5.7	8.6	10.6	13.1	15.0	16.5		
1982	53	5.8	8.7	11.0	13.4	15.3	16.3	17.4	
1981	65	5.7	8.5	10.6	12.7	14.7	16.6	17.7	18.2
1980	29	5.7	8.3	10.3	12.2	14.0	16.2	17.5	18.4
1979	1	5.9	8.5	10.1	13.0	14.6	16.4	19.5	
Mean		5.5	8.6	10.7	12.8	14.7	16.4	17.0	18.3
Number	420	420	377	319	279	238	192	148	94
Smallest		3.4	5.4	7.6	10.4	12.0	13.5	14.9	16.3
Largest		8.6	11.5	14.3	16.3	17.5	18.0	19.5	19.4
Std error		0.05	0.06	0.07	0.08	0.12	0.13	0.20	0.32
95% ConLo		5.4	8.5	10.6	12.7	14.4	16.2	17.2	17.7
95% ConHi		5.6	8.7	10.9	13.0	14.9	16.7	18.0	18.9

Intercept 1.706521
R^2 = 0.91

Table 6. Percent by inch class for each age of largemouth bass collected during the spring (April/May) and fall (September/October) at Taylorsville Lake. Number of fish; spring = 271, fall = 215.

Date	Age	Inch class 3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Spring	1		100	86	83	25	19											
	2			14	17	75	81	88	82	31								
	3							12	18	56	63	14						
	4									13	37	81	45	14				
	5											5	55	64	44	11		
	6													14	50	50	7	
	7													8		33	60	34
	8														6	6	33	66
Fall	0+	100	100	100	31													
	1+				69	100	79	60	27									
	2+						21	40	73	86	57							
	3+									14	24	50	17					
	4+										19	50	66	17				
	5+												17	83	33			
	6+														67	25	20	
	7+															50	60	
	8+															25	20	

Table 7. Wr data obtained for largemouth bass collected at Taylorsville Lake from 1983-1990. Numbers in parentheses are standard errors.

Year	Inch class 8.0-11.9	12.0-14.9	$\geq$15.0
1983	98 (2.7)	110 (2.1)	
1984	82 (1.7)	99 (3.3)	97 (7.1)
1985	89 (2.8)	109 (3.0)	127 (4.4)
1986	81 (2.4)	98 (2.9)	106 (2.4)
1987	108 (4.8)	107 (3.1)	113 (2.0)
1988	109 (1.4)	106 (1.5)	108 (1.5)
1989	101 (0.9)	110 (1.5)	114 (0.9)
1990	95 (1.2)	103 (1.5)	107 (1.7)

Largemouth bass weight (lb) = 0.2674 total length (in) ~ 1.9415

$R^2 = 0.86$

n = 1,118

Table 8. C-ratios obtained from available prey/predator model in each year cove-rotenone data were available at Taylorsville Lake. C-ratios ≥1.0 are needed for predators to have sufficient prey.

Length	1983	1984	1985	1986	1987	1988	1989	1990
2	0.17	0.03	0.01	0.02	0.28	0.06	0.22	0.24
3	1.24	0.07	0.03	0.11	0.43	0.30	0.62	0.33
4	2.89	0.13	0.06	0.18	0.58	0.52	0.93	0.41
5		0.44	0.21	0.30	1.01	1.19	1.36	0.73
6		0.88	0.43	0.43	1.43	1.90	1.80	1.12
7		1.73	1.08	0.70				1.77
8		3.29	2.44	1.18				
9				1.75				

Table 9. PSD and RSD_{15} values obtained for largemouth bass collected at Taylorsville Lake from 1983-1990.

Year	No. fish collected	PSD	95% confidence interval	RSD_{15}	95% confidence interval
1983	22	7	-6.4-19.7	0	
1984	270	7	3.1-10.6	1	-0.5- 1.7
1985	380	64	58.8-68.5	3	1.0- 4.3
1986	1,308	80	77.6-82.0	41	38.5-43.9
1987	1,619	87	85.5-88.9	67	64.5-69.3
1988	640	77	73.7-80.4	61	57.0-64.9
1989	1,081	52	47.5-55.5	28	24.2-31.4
1990	1,870	43	40.4-46.1	21	18.2-22.8

Table 10. Electrofishing catch/unit effort data (no./hour) collected for each size group of largemouth bass collected at Taylorsville Lake from 1984-1990, numbers in parentheses are standard errors.

Year	Catch rate (no./h)				
	<8.0	8.0-11.9	12.0-14.9	≥15.0	All sizes
1984	50.4 (1.8)	88.0 (6.0)	6.0 (2.2)	0.0 (0.0)	144.4 (5.6)
1985	0.8 (0.6)	43.8 (5.4)	74.8 (9.2)	3.4 (1.0)	122.2 (14.4)
1986	1.8 (0.4)	11.2 (1.4)	21.0 (1.8)	22.4 (3.0)	59.0 (5.4)
1987	3.6 (0.6)	5.4 (0.6)	9.2 (1.0)	29.2 (2.6)	48.0 (3.8)
1988	3.2 (0.8)	8.4 (1.2)	6.0 (1.0)	19.6 (3.0)	37.2 (4.8)
1989	58.6 (15.8)	33.4 (5.8)	22.2 (3.4)	13.8 (3.0)	128.2 (24.0)
1990	49.8 (9.2)	57.0 (7.0)	22.8 (2.6)	19.2 (2.0)	154.4 (15.0)

Table 11. Regression equations determined for each relationship of largemouth bass obtained from Taylorsville Lake.

Electrofishing CPUE 8.0-11.9 in bass in year (y+1) = 0.6691 electrofishing CPUE ≤8.0 in bass in year (y) + 6.3691
R^2 = 0.78 P = .020 n = 6

Electrofishing CPUE 12.0-14.9 in bass in year (y+1) = 0.7319 electrofishing CPUE 8.0-11.9 in bass in year (y) + 1.3991
R^2 = 0.86 P = .008 n = 6

Electrofishing CPUE ≥15.0 in bass in year (y+1) = 0.7335 electrofishing CPUE 12.0-14.9 in bass in year (y) + 0.6532
R^2 = 0.76 P = .130 n = 7

Angler catch of 8.0-11.9 in bass in year (y) = 347.7725 electrofishing CPUE 8.0-11.9 in bass in spring year (y) + 12,298
R^2 = 0.78 P = 0.200 n = 4

Angler catch of 12.0-14.9 in bass in year (y) = 1309.0744 electrofishing CPUE 12.0-14.9 in bass in spring year (y) + 3,293
R^2 = 0.96 P = 0.004 n = 6

Angler catch of ≥15.0 in bass in year (y+1) = 355.2346 electrofishing CPUE 12.0-14.9 in bass in spring year (y) + 3,740
R^2 = 89 P = 0.005 n = 6

Electrofishing CPUE age I bass in year (y+1) = 0.3548 no. yoy in cove samples + 2.8867.
R^2 = 0.33 P = 0.18 n = 7

Electrofishing CPUE age I bass in spring of year (y+1) = 0.7875 electrofishing CPUE age 0 in fall year (y) - 0.5251
R^2 = 0.97 P = 0.0003 n = 6

Electrofishing CPUE age II bass in spring of year (y+1) = 1.2143 electrofishing CPUE age 1 bass in spring of year (y) + 9.1513
R^2 = 0.89 P = 0.02 n = 5

Electrofishing CPUE age III bass in spring of year (y+1) = 0.7335 electrofishing CPUE age II bass in spring of year (y) + 0.6532
R^2 = 0.76 P = 0.13 n = 4

Electrofishing CPUE age IV bass in spring of year (y+1) = 0.8084 electrofishing CPUE age III bass in spring of year (y) + 5.1205
R^2 = 0.74 P = 0.34 n = 3

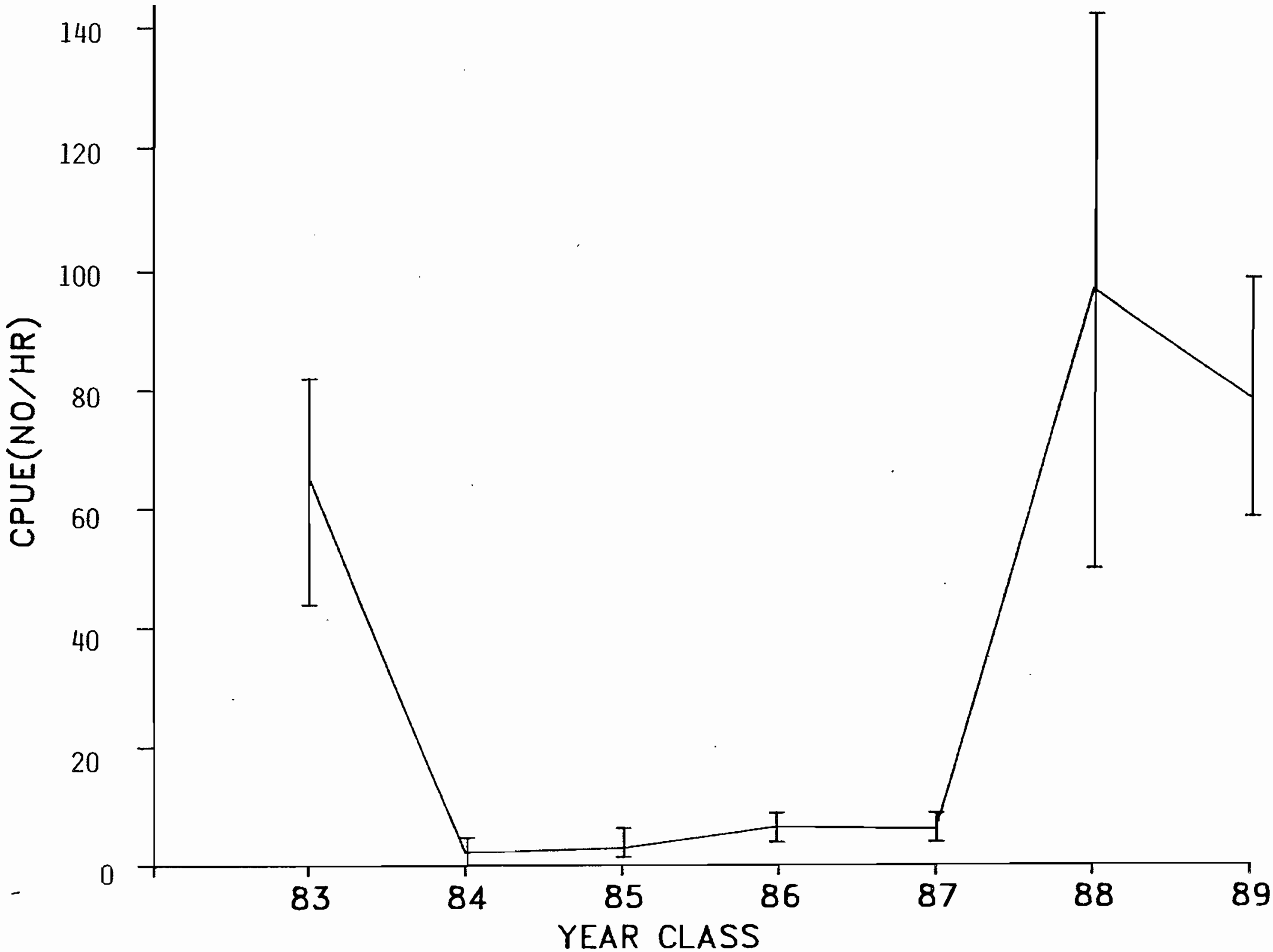

Figure 1. Trends in spring electrofishing CPUE of each year class at age 1 collected at Taylorsville Lake from 1984-1990. Bars are 90% confidence intervals.

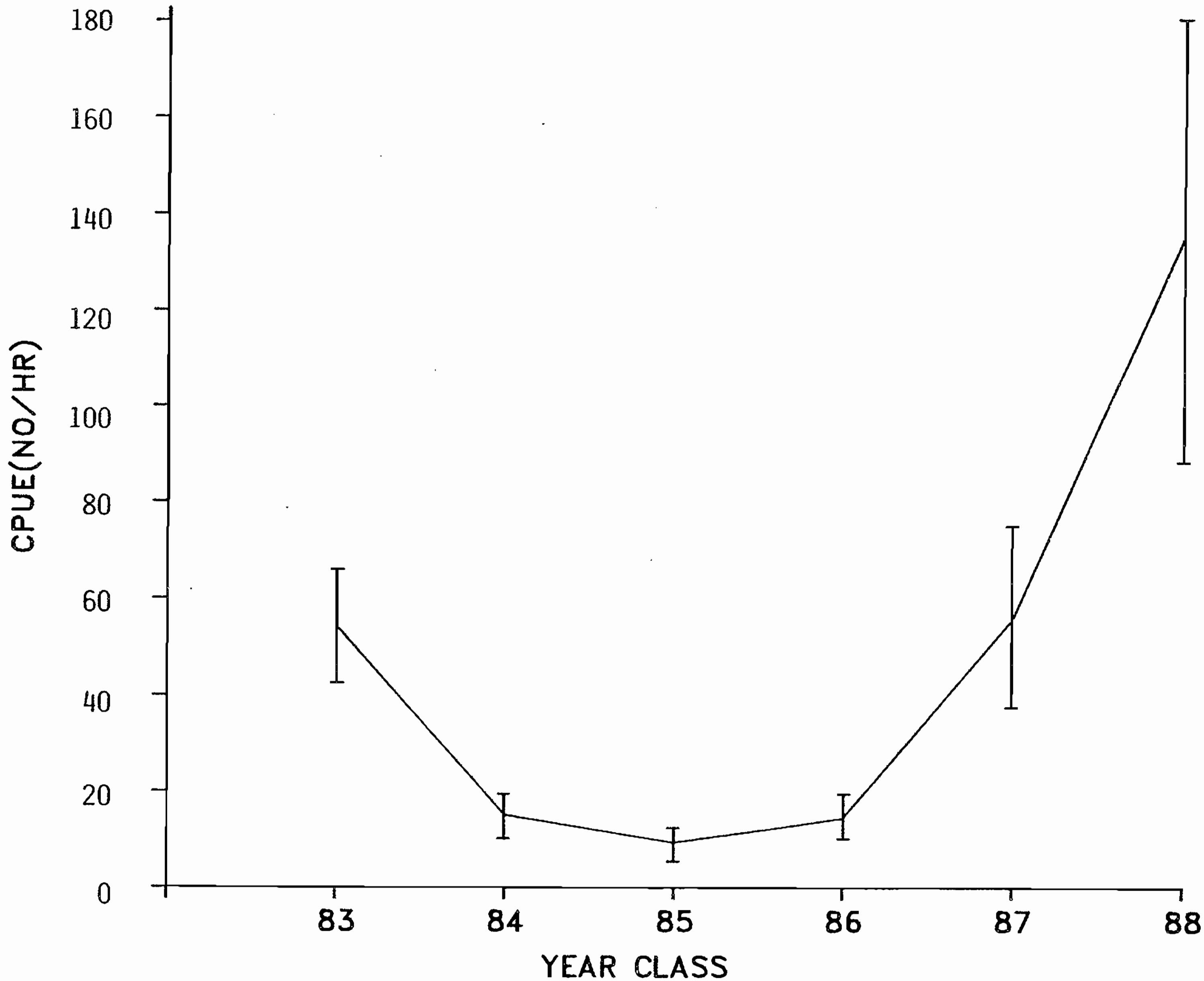

Figure 2. Trends in spring electrofishing CPUE of each year class at age 2 collected at Taylorsville Lake from 1985-1990. Bars are 90% confidence intervals.

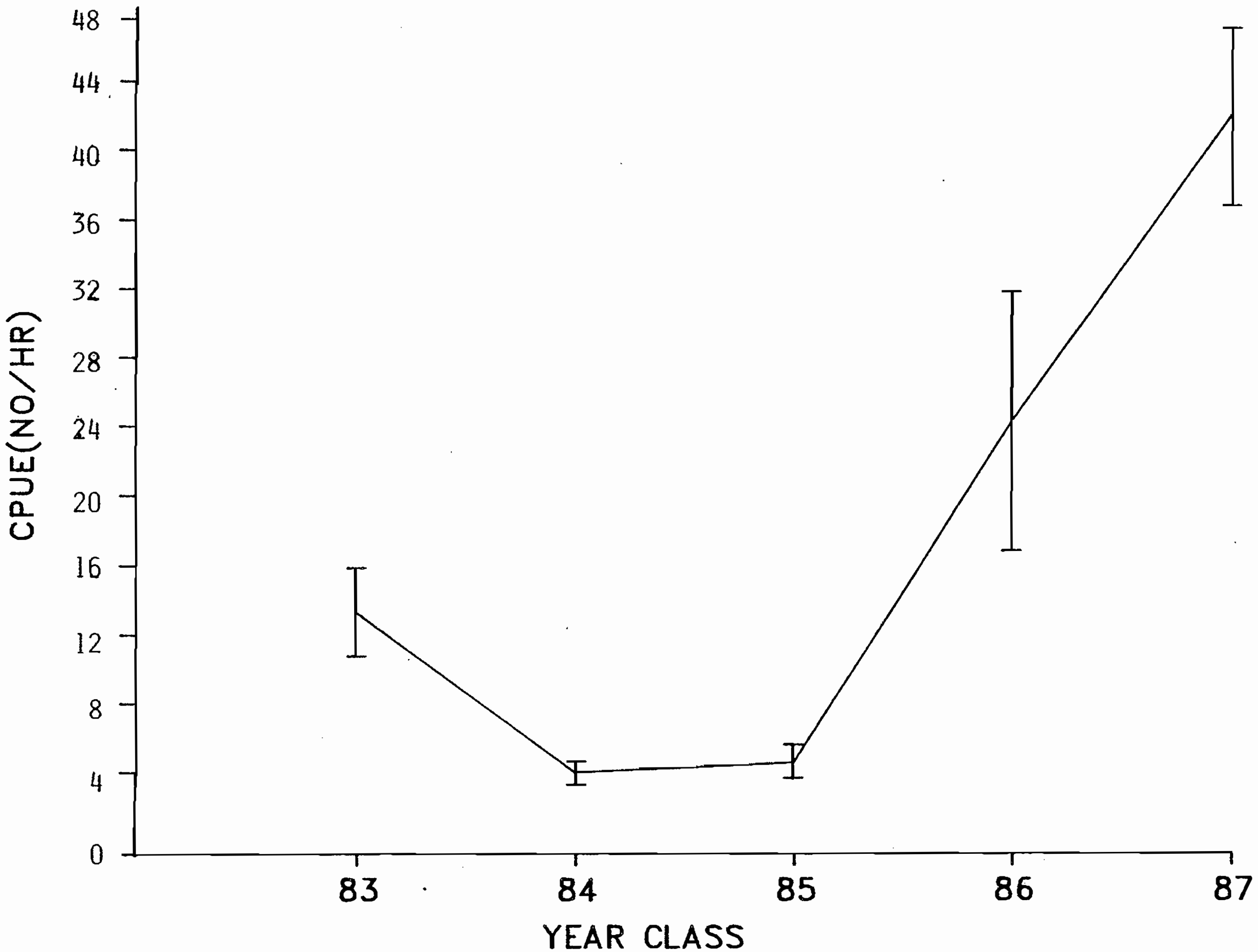

Figure 3. Trends in spring electrofishing CPUE of each year class at age 3 collected at Taylorsville Lake from 1986-1990. Bars are 90% confidence intervals.

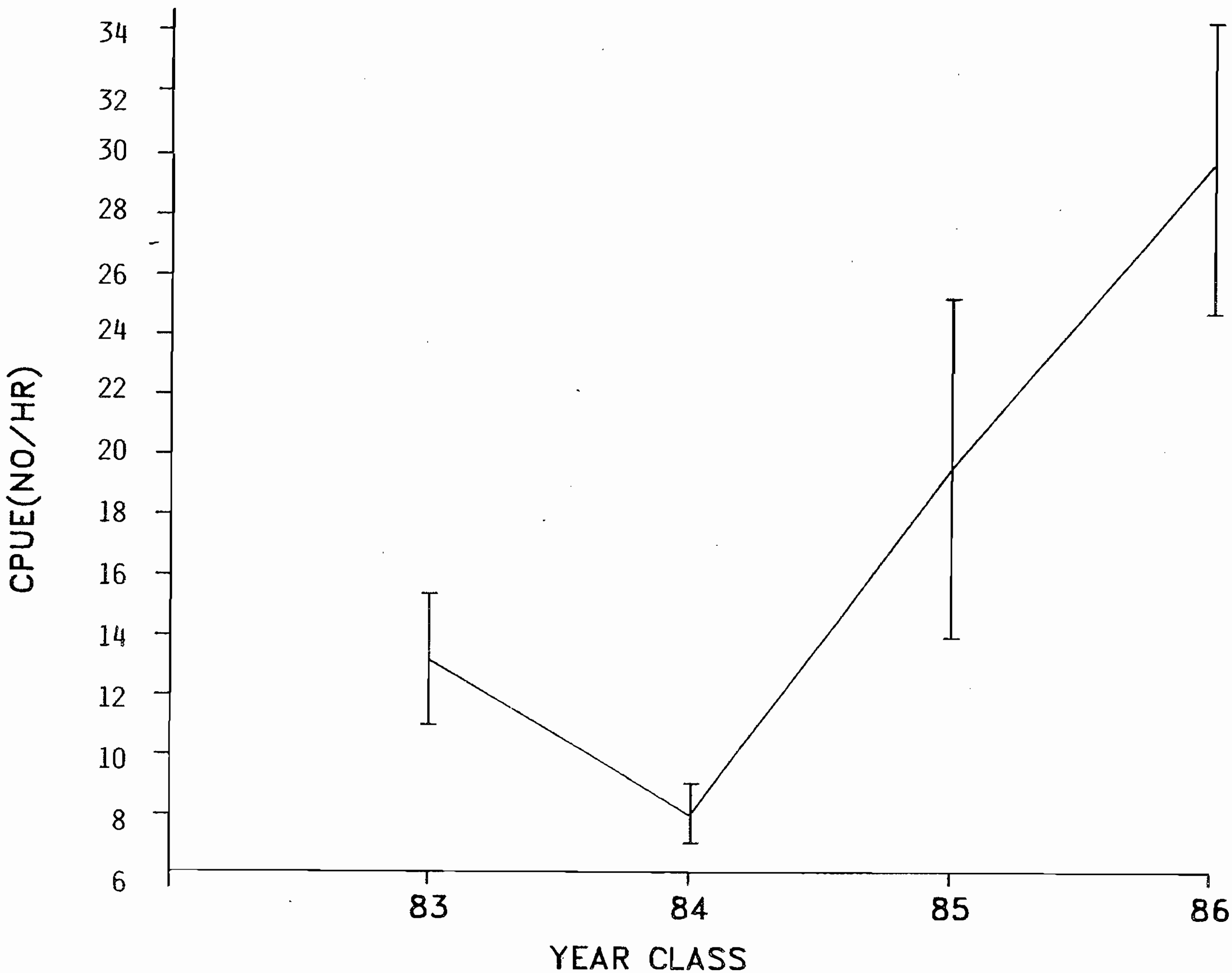

Figure 4. Trends in spring electrofishing CPUE of each year class at age 4 collected at Taylorsville Lake from 1987-1990. Bars are 90% confidence intervals.

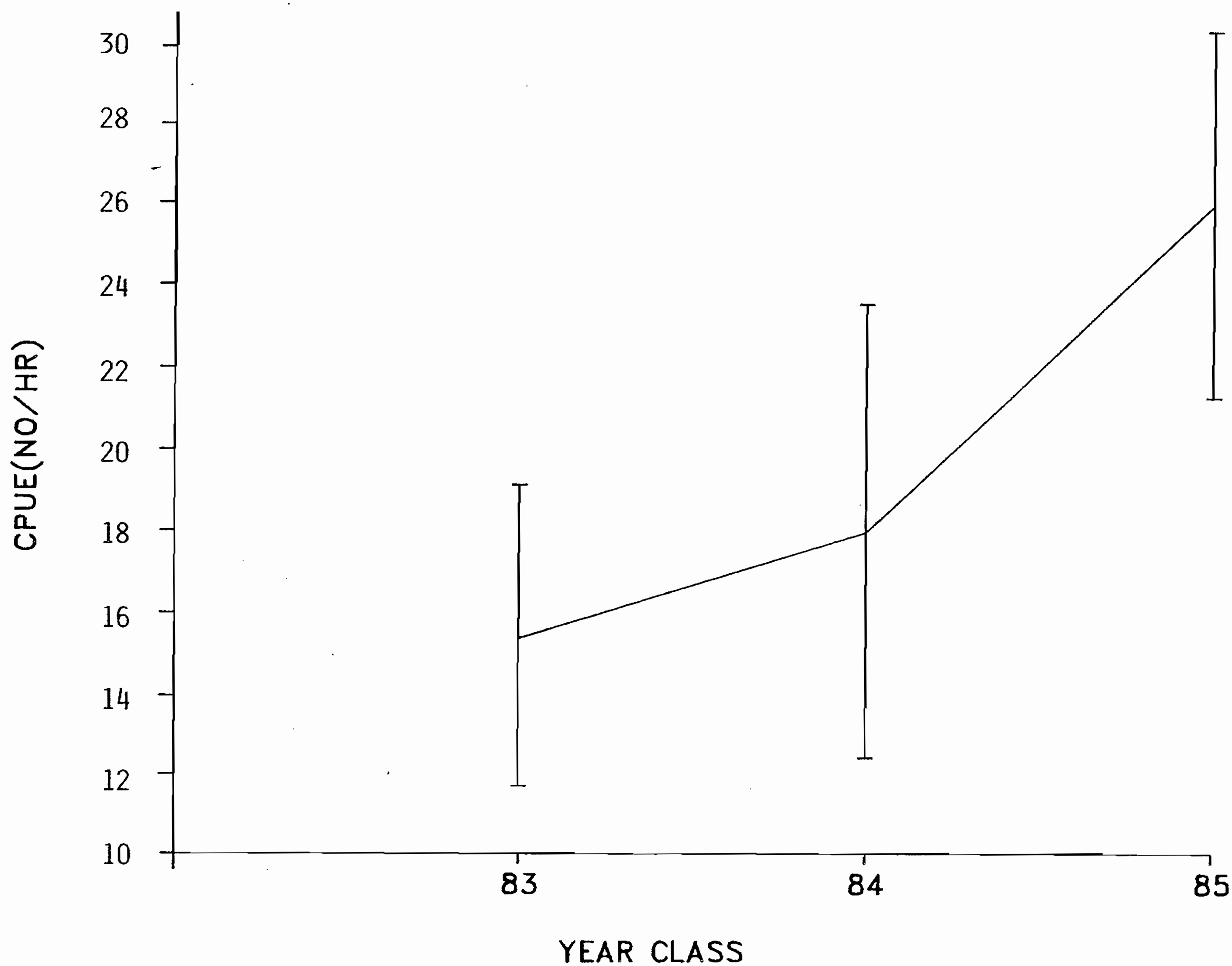

Figure 5. Trends in spring electrofishing CPUE of each year class at age 5 collected at Taylorsville Lake from 1988-1990. Bars are 90% confidence intervals.

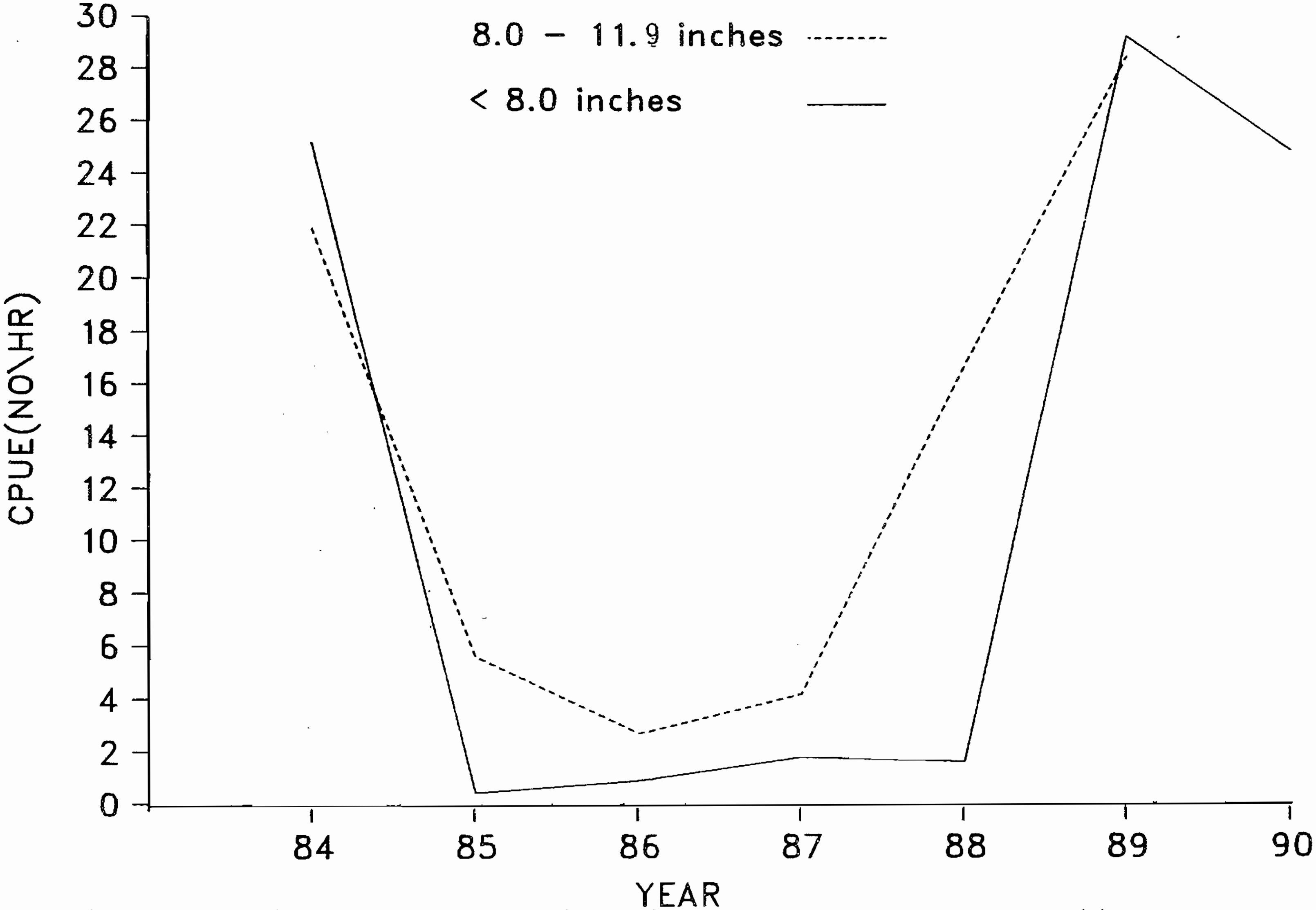

Figure 6. Trends in electrofishing CPUE of <8.0 in largemouth bass in spring of year (y) to trends in CPUE of 8.0-11.9 in largemouth bass in spring of the following year (y+1) from 1984-1990.

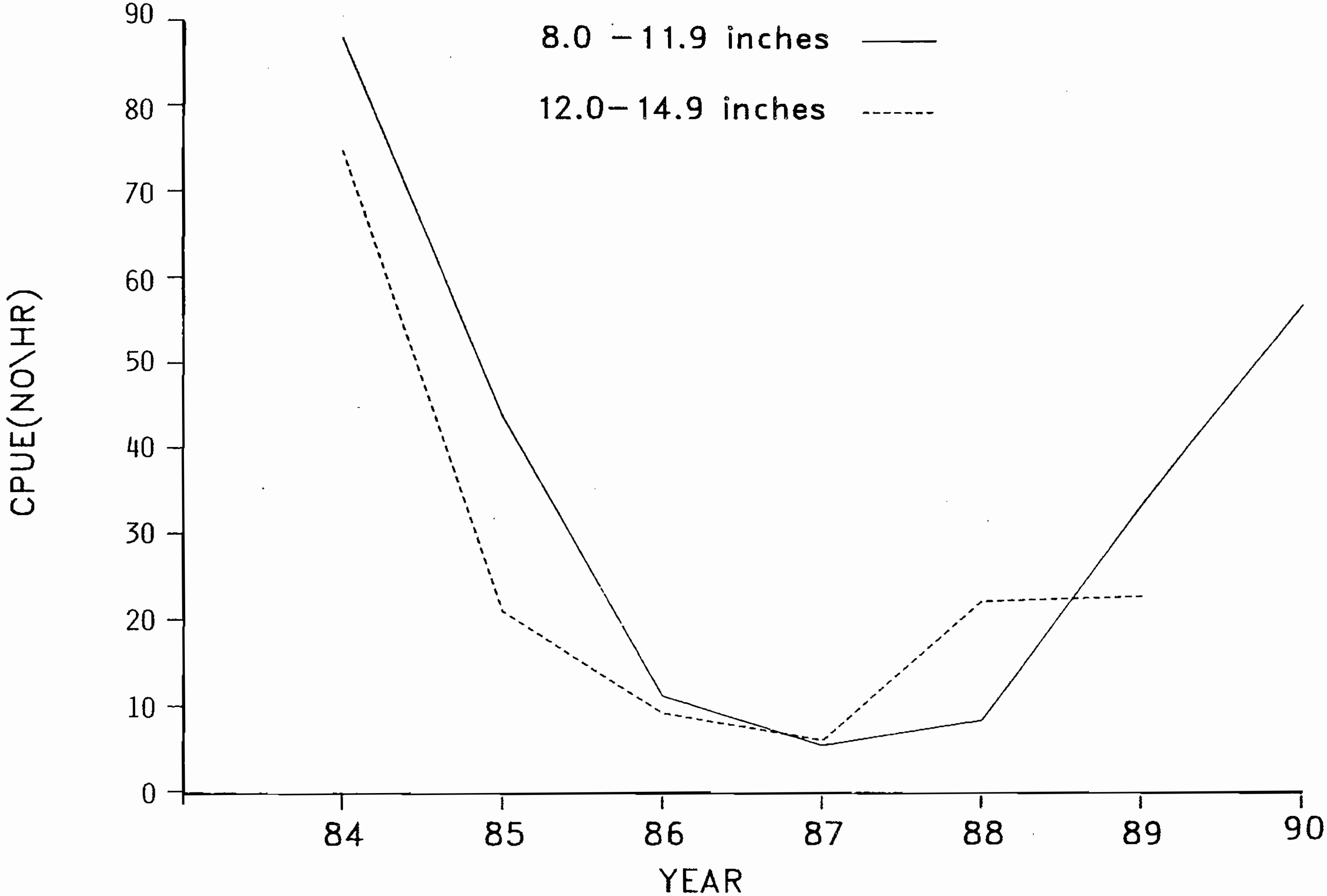

Figure 7. Trends in electrofishing CPUE of 8.0-11.9 in largemouth bass in spring of year (y) to trends in CPUE of 12.0-14.9 in largemouth in spring of the following year (y+1) from 1984-1990.

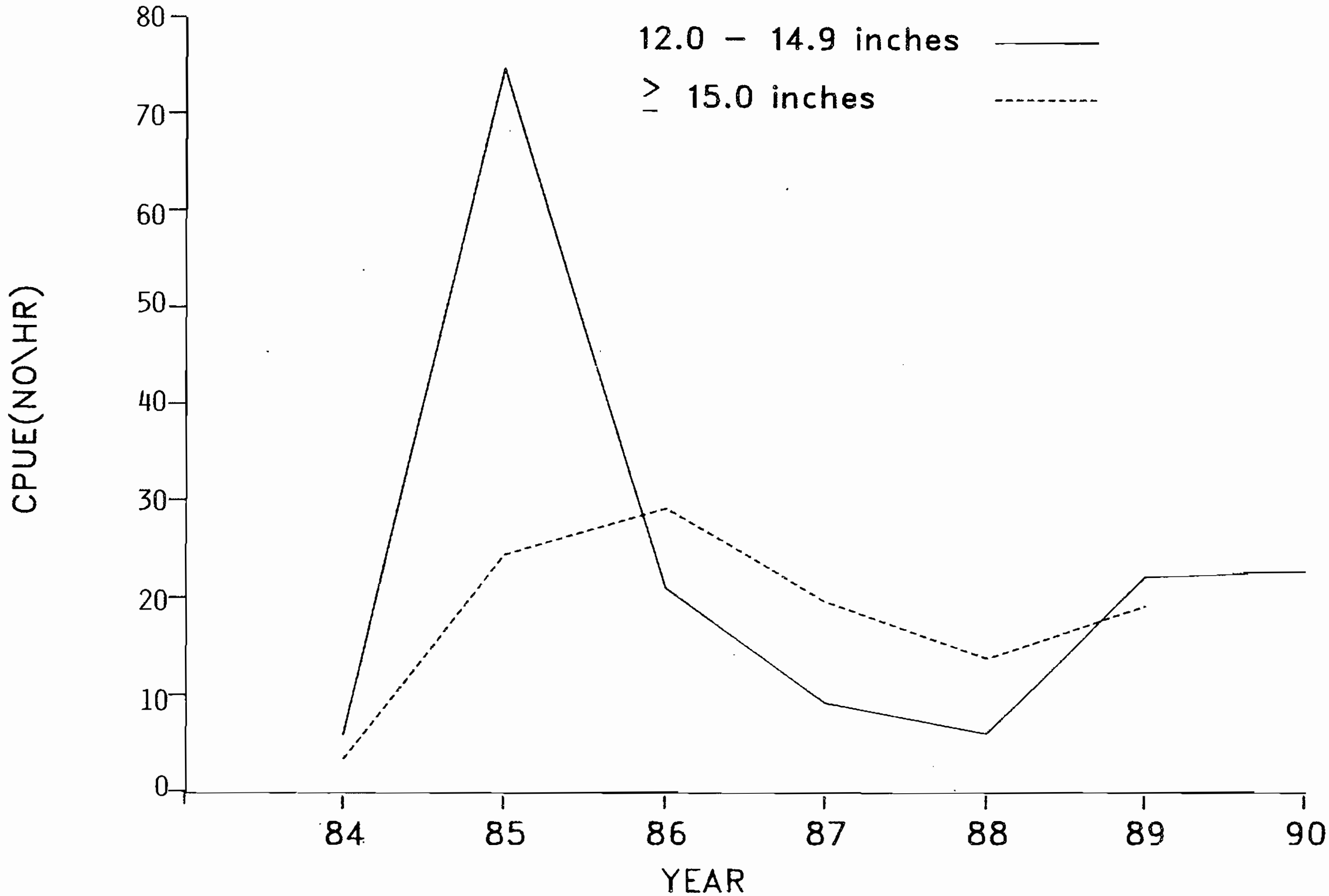

Figure 8. Trends in electrofishing CPUE of 12.0-14.9 in largemouth bass in spring of year (y) to trends in CPUE of ≥15.0 in largemouth bass in spring of the following year (y+1) from 1984-1990.

Figure 9. Trends in fall electrofishing CPUE of age 0+ largemouth bass in year (y) compared to trends in spring electrofishing CPUE of age 1 largemouth bass in year (y+1).

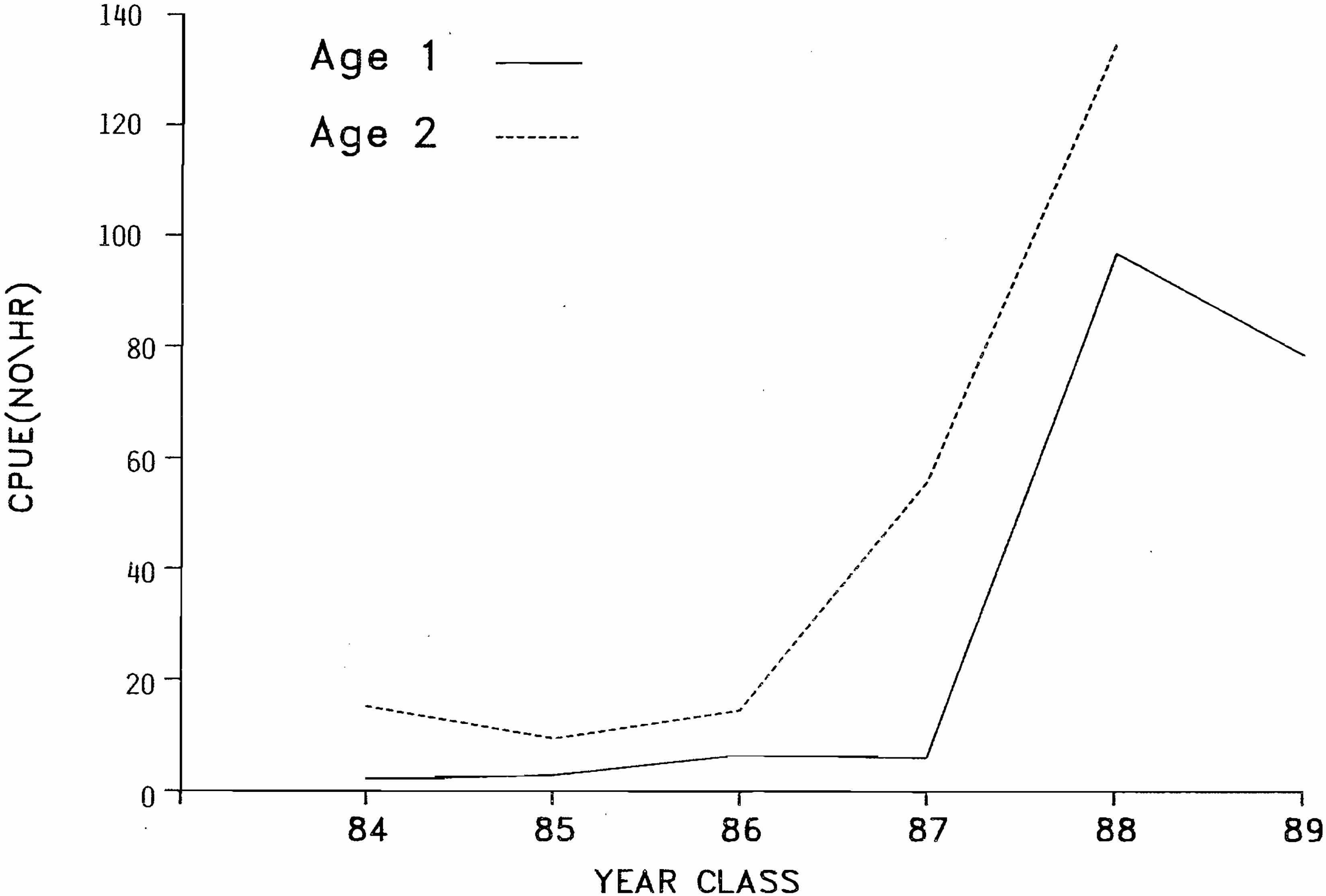

Figure 10. Trends in spring electrofishing CPUE of age 1 largemouth bass in year (y) compared to trends in spring electrofishing CPUE of age 3 largemouth bass in year (y+1).

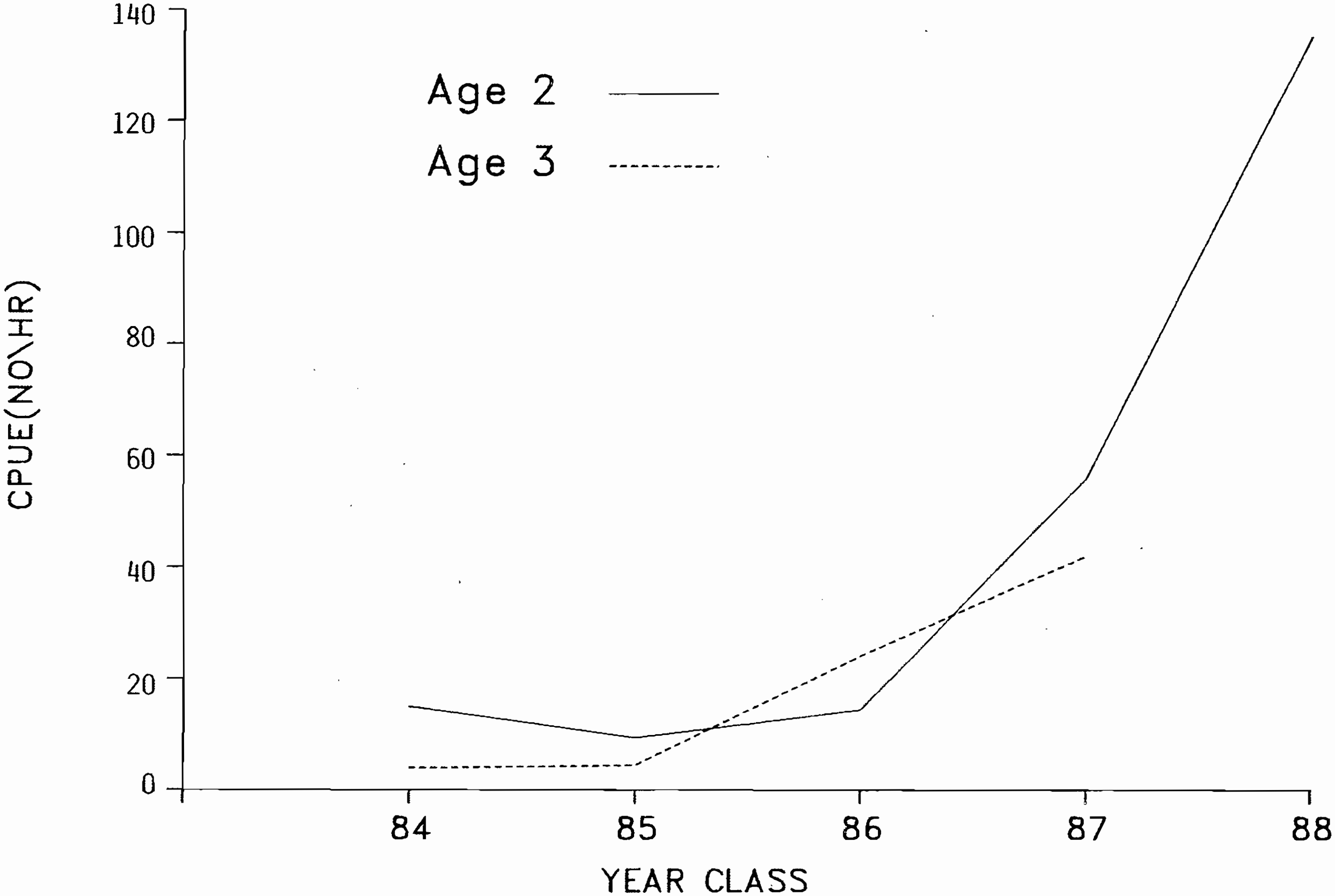

Figure 11. Trends in spring electrofishing CPUE of age 2 largemouth bass in year (y) compared to trends in spring electrofishing CPUE of age 3 largemouth bass in year (y+1).

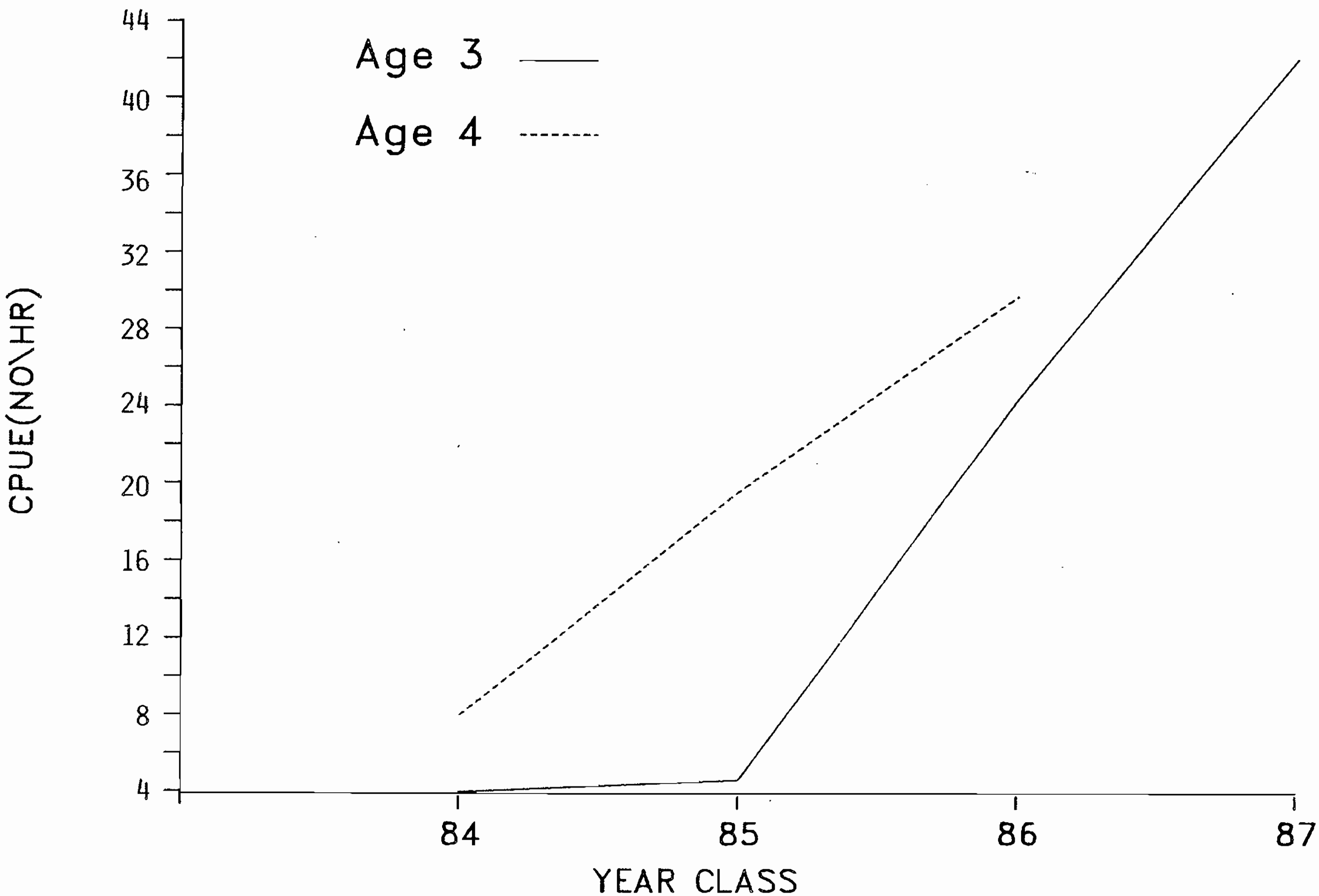

Figure 12. Trends in spring electrofishing CPUE of age 3 largemouth bass in year (y) compared to trends in spring electrofishing CPUE of age 4 largemouth bass in year (y+1).

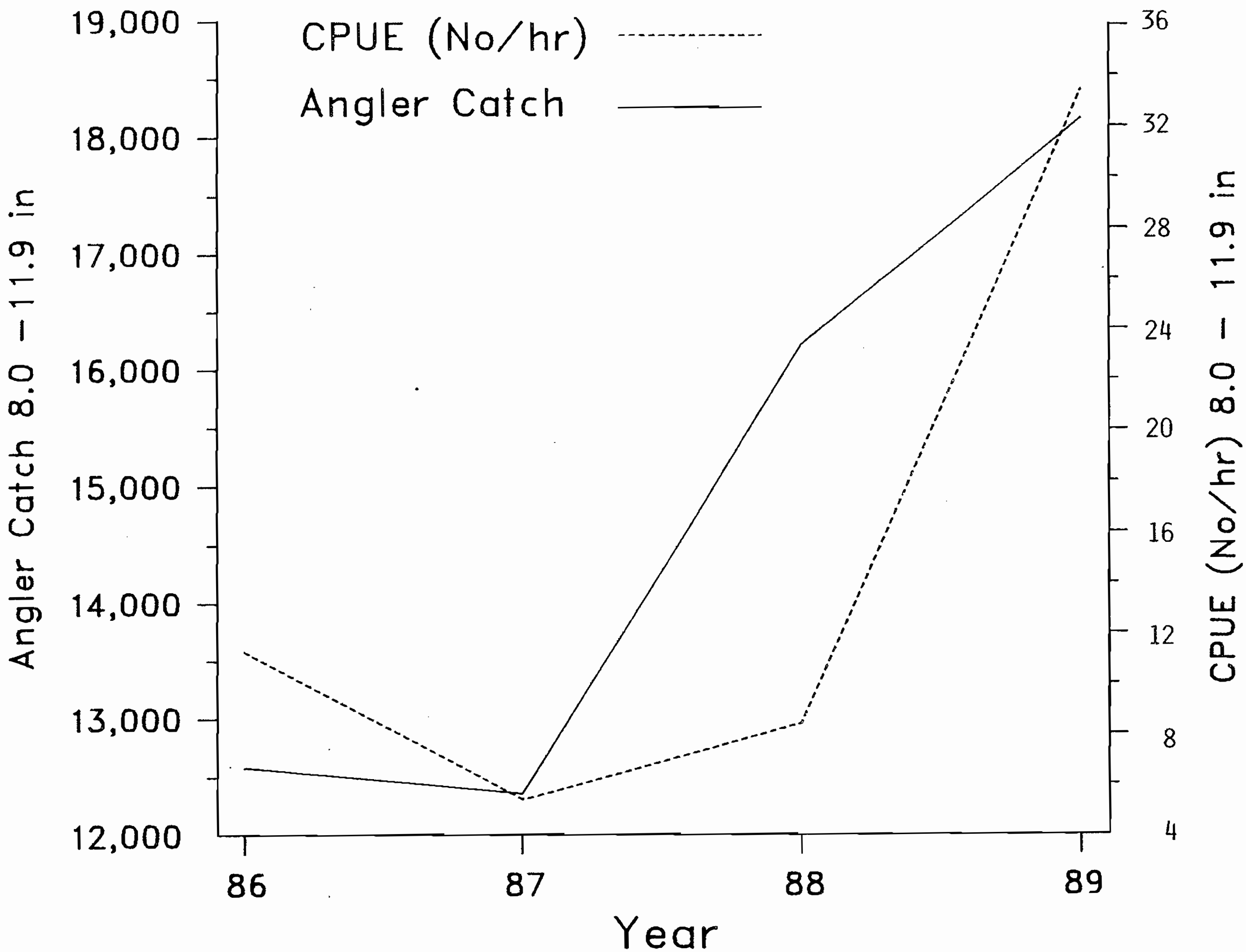

Figure 13. Trends in angler catch and release of 8.0-11.9 in largemouth bass in year (y) to electrofishing CPUE of 8.0-11.9 in largemouth bass in the spring of year (y) from 1986-1989.

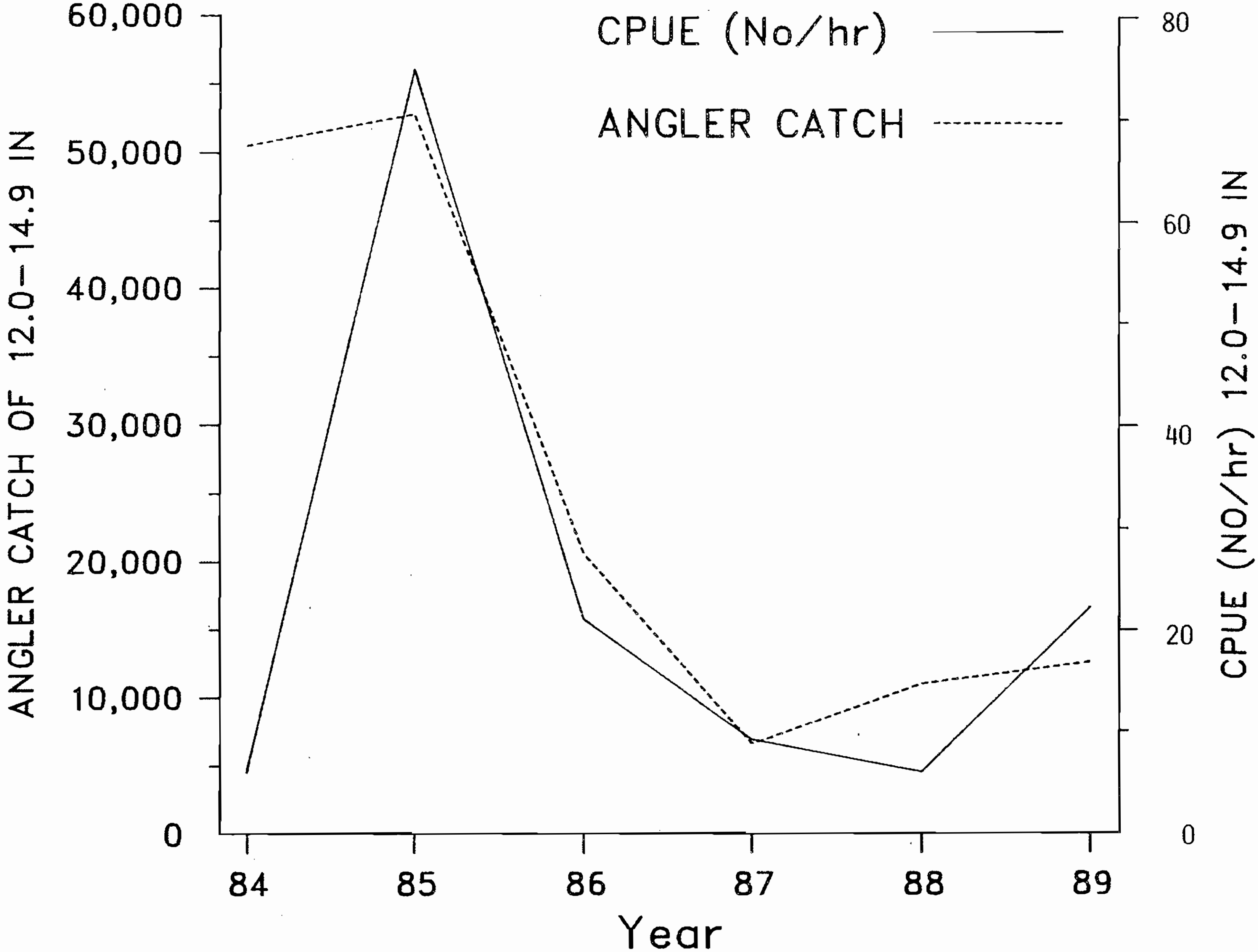

Figure 14. Trends in angler catch and release of 12.0-14.9 in largemouth bass in year (y) compared to trends in spring electrofishing catch rates of 12.0-14.9 in largemouth bass in year (y) from 1984-1989.

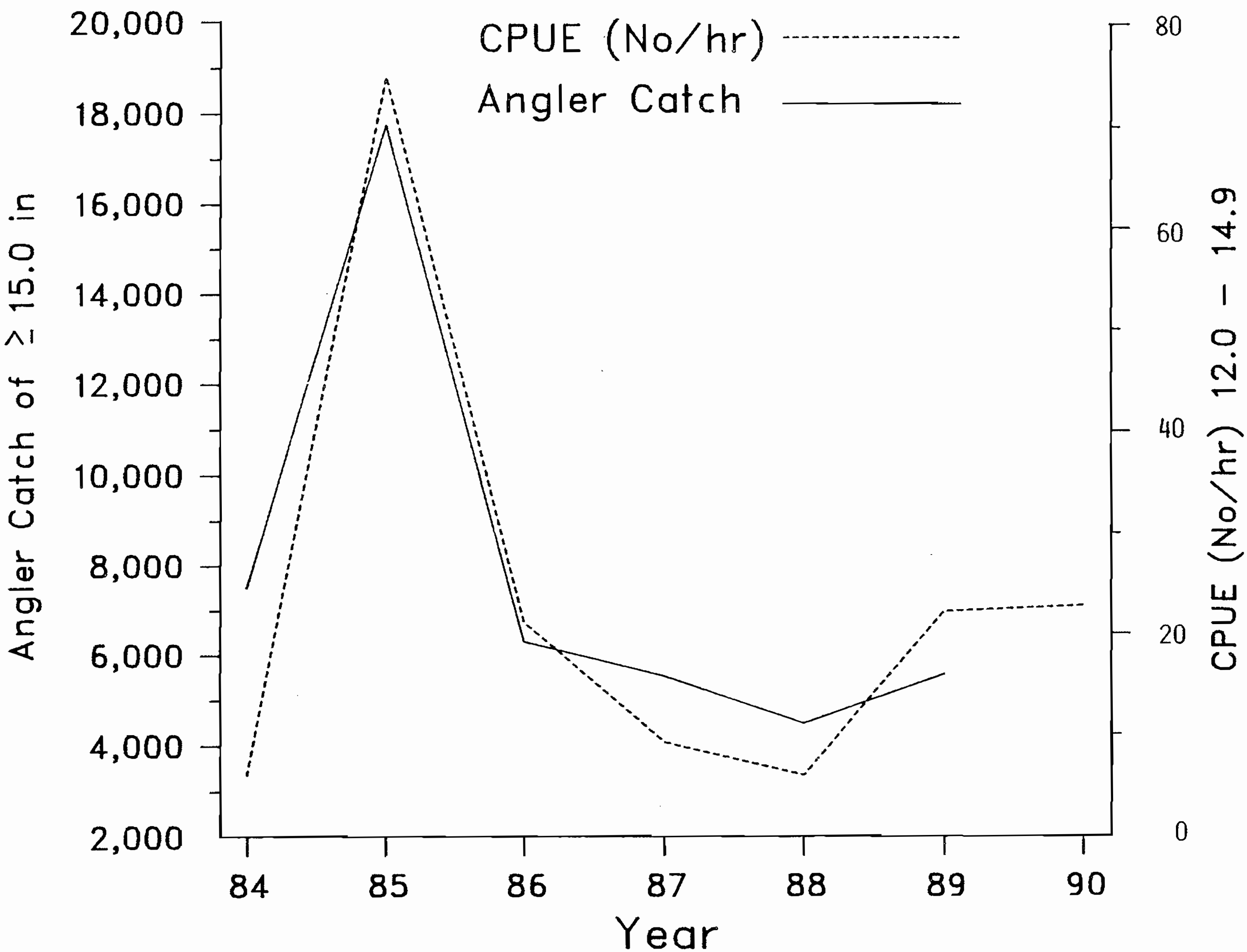

Figure 15. Trends in angler catch and release of ≥15.0 in largemouth bass in year (y+1) compared to trends in spring electrofishing CPUE of 12.0-14.9 in largemouth bass in year (y) from 1984-1990.