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FISHERIES DIVISION
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Abstract.–A cooperative 8-year study was conducted by fisheries managers and researchers to evaluate three techniques for improving stunted bluegill *Lepomis macrochirus* populations in 12 southern Michigan lakes. Four other lakes served as controls. Three years of pre-treatment and 6 years of post-treatment data were collected on bluegill growth, size structure, and recruitment. The techniques tested were (a) treatment with the selective toxicant antimycin to thin-out small bluegills; (b) stocking large fingerling walleye *Stizostedion vitreum* to thin-out small bluegills by predation; and (c) catch-and-release regulations to protect predators and large bluegill. The four treatment groups, each with three replicates, were: antimycin-only, walleye-only, antimycin + walleye, and antimycin + catch-and-release.

All treatment lakes except two showed some response in bluegill growth or size structure to the treatments. In those two lakes apparently insufficient numbers of bluegill were thinned-out by antimycin treatments to elicit a response. By contrast, bluegill population characteristics of control lakes were relatively constant through time. For 2/2 antimycin-only lakes, bluegill populations improved immediately, but only slightly, and benefits lasted for 2-6 years. Populations then reverted to slow growth and sparse numbers of bluegill 7 in and larger. The antimycin effect was similar in other lakes which had been treated in combination. For 3/3 walleye-only lakes, bluegill populations improved considerably as a delayed response evident by the 5th year after stocking and persisting through the last year of study (6th). For 2/2 antimycin + walleye lakes, bluegill showed a combination of those immediate and delayed responses. Quality of those bluegill populations improved considerably with some 8-in bluegills generated. Surprisingly, bluegill responses occurred at relatively low densities of walleye. Antimycin + catch-and-release lakes (3/3) showed the best response of all, with enough large bluegill produced to merit ranks of “excellent”. However, declining bluegill growth signals that even those lakes may eventually revert.

Study results led to the recommendation that large fingerling walleye be routinely stocked as a tool for improving stunted bluegill lakes. Special regulations to limit harvest are continuing indefinitely at the three former catch-and-release lakes and results will be monitored to determine if permanent restructuring of the bluegill population and fish community have been accomplished.

Bluegill *Lepomis macrochirus* populations dominated by slow-growing and small (stunted) individuals are the most common and important management problem in inland lakes of southern

Michigan (Scott et al. 1985). With extreme stunting, few bluegill grow beyond 6 in long, the minimum size acceptable to most anglers. In addition, stunted bluegills tend to suppress recruitment and growth of both bluegill and other fishes (Swingle and Smith 1941; Clark and Lockwood 1990), as well as nip at swimmers. The number of lakes afflicted with extremely stunted bluegill populations has not been carefully estimated, but may be approximately 5% of the 35,000 (Humphrys and Colby 1962) lakes and ponds in Michigan.

Since the 1960s, considerable research has focused on the causes of stunting and considerable management has been directed at alleviating it. The principals seem clear: an undesirable balance among rates of recruitment of young (too high), natural mortality of young (too low) and fishing mortality of adults (too high). The usual scenario is slow growth caused by too many bluegill in relation to the available food supply, but sometimes the lack of larger fish also reflects high rates of fishing or natural mortality among bluegill greater than 6 in.

Stunted bluegill populations and their communities tend to be stable and resist management efforts to affect permanent change (Schneider 1989). Elimination of all fish with chemicals such as rotenone, followed by restocking, has been a remedial management technique used in Michigan since the 1930s (Ball 1948, Spitler 1970, Trimberger 1973). Since the mid-1950s, partial thinning of bluegill populations with rotenone or the more selective Antimycin A has been used to stimulate growth of remaining fish, cause some of them to reach a larger size, and improve fishing (Hooper et al. 1964, Trimberger 1973, Davis 1979). However, benefits were short-lived. As a rule-of-thumb, 1 year of improved growth occurs for every one-third of the bluegill population removed (Hooper et al. 1964). Thus, benefits rarely last more than 3 years, although improvements for up to 7 years have been reported (Smith 1981). Techniques are needed which extend the benefit period or, better yet, permanently alter the structure of the bluegill population and community by establishing a new equilibrium state with more desirable characteristics.

In 1985, a workshop was held to review collective research and management experiences (Scott et al. 1985). Workshop proceedings recommended that an adaptive management approach be taken to fishery management in Michigan. This called for more careful design of management experiments, better evaluation of results and, pending analysis, redirected management. In that context, a long-term experiment, with replication, was developed to evaluate three potential techniques to improve stunted bluegill lakes. Development, oversight, and analysis were primarily delegated to research personnel, while data collection was delegated to management personnel across southern Michigan.

Techniques chosen for evaluation were: (a) a one-time selective partial reclamation with antimiycin; (b) a one-time stocking of fingerling walleye *Stizostedion vitreum*; and (c) an extended period of catch-and-release fishing for all species. Antimycin treatment was expected to selectively eliminate enough small bluegill to stimulate growth of the survivors. Stocked fingerling walleye were expected, over their life span, to eat sufficient quantities of small bluegill to likewise stimulate bluegill growth. Catch-and-release regulations were expected to protect enough large bluegill and other predators to alter growth and recruitment processes within the bluegill population and the entire community. The primary questions were how large a response in bluegill growth and size structure would occur and how long the response would persist. Therefore, sampling was targeted at bluegill and only cursory data were collected for other species.

Methods

Sixteen relatively small, shallow, mesotrophic lakes with a history of stable, small-bodied bluegill populations were selected for study (Table 1). Bluegill growth rates were below the State of Michigan average (Laarman et al. 1981) for all lakes, but only slightly so for Williams Lake. All lakes had similar warmwater fish communities, with bluegill and largemouth bass *Micropterus salmoides* the key species. Northern pike *Esox lucius*, another major piscivore, were present in low abundance in about half the lakes. In one lake (Horseshoe) black crappie *Pomoxis nigromaculatus* were relatively abundant. A list of all species collected in the study lakes is given in Appendix 1.

Selected lakes had not experienced significant changes in fish or aquatic vegetation management for at least a decade before the experiment began. This was important because such changes can potentially affect fish populations for many years. Likewise, fish and aquatic plant management was held relatively constant during the experiment. An unanticipated event, beginning in spring 1993, was a state-wide increase in minimum size limits for largemouth from 12 to 14 in and for northern pike from 20 to 24 in. Potentially, those regulation changes could have had a delayed influence on all experimental lakes except those protected by catch-and-release regulations. However, no indirect effects of the regulation changes on bluegill were evident at either control or experimental lakes by the last sampling date (spring 1996).

Replication was built into the study design because lakes vary in physical and biological structure and previous experience has indicated it would be difficult to apply techniques consistently. Untreated control lakes were included because stochastic events – such as year-to-year variations in weather – are known to affect spawning success and growth of bluegill and many other species.

The experiment was stratified, with three lakes in each of four treatment groups plus a control group (Table 1). In addition, data were collected during both pre-treatment (3 years) and post-treatment periods (6 years). A fourth lake (Joslin) was added to the control group in case one of the other three lakes had to be disqualified for any reason during the course of the experiment. Treatments were: (1) thinning with antimycin (only); (2) thinning with antimycin and stocking with walleye; (3) stocking with walleye (only); and (4) thinning with antimycin and protecting all fish with catch-and-release regulations. One lake (Horseshoe) in private ownership, and two lakes (Algoe and Williams) in state ownership, were most suitable for catch-and-release regulations combined with partial reclamation. The other lakes had public access with many riparians and it would have been difficult to implement catch-and-release regulations. All lakes were accessible to many anglers and fishing pressure was considered to be similar.

Antimycin A (Fintrol concentrate) was applied to the surface of nine lakes in May 1990 to target small (1-4 in) bluegill (Table 2). Dosage rate was 1-2 ppb, depending on pH, for the 0-5 ft strata where most small bluegill are found. The goal was to reduce the numbers of small bluegill by about 2/3. Shoreline counts of dead fish were made at five lakes a few days after application (Table 3). By that time, numbers of dead fish accumulating along shore lines should have reached a peak. However, proportions of the bluegill populations actually killed are unknown. Apparently, too few fish were eliminated at Myers Lake (reason unknown) and Big Lake (antimycin probably too diluted) to elicit bluegill population responses. Thus, those lakes did not provide a fair test of the experimental manipulation.

Fingerling walleye were stocked in six lakes during August-September 1990 at the rate of 15-18 per acre. The desired size was relatively large, 6-8 in, to enhance chances of their survival in bluegill-dominated lakes. However, average sizes stocked were 4.7 to 6.8 in (Table 4).

Catch-and-release regulations were initiated at three lakes on April 1, 1990 and were continued through spring 1996. All fish species were protected from harvest. Angler compliance was believed to have been good at Horseshoe Lake and satisfactory to good at the other two lakes, based on comments by anglers, lake residents or managers, and evidence of winter fishing activity.

Sampling was conducted in most years, 1988-96, primarily during May - June. Some lakes were skipped in 1994 to economize on effort because no population changes were evident in 1993. Data collected in spring 1988-90 represented pre-treatment (baseline) conditions, and data collected in spring 1991-96 represented post-treatment conditions.

Fish were sampled with trapnets and electrofishing gear. Trapnets were 3-ft high with wings of 2.5-in stretched mesh and pots of 1.5-in stretched mesh (Merna et al. 1981). These nets were effective for measuring abundance of bluegill over 5 in. The sampling goal was to net a minimum of 200 bluegill each year; that sample could usually be obtained from several nets set for one night. Trapnet catch per unit of effort was measured as catch per net lift (i.e., one net set for one night is one net lift). Small bluegill were effectively sampled by daytime electrofishing with 240-V DC boom-shocker boat. This sampling goal was a minimum of 200 bluegill each year; this sample could usually be obtained in less than 2 hours of sampling effort. Electrofishing catch per unit of effort was measured as catch per hour of shocking. Samples of fish were measured for total length (to 0.1 in) and all fish were categorized to in group (eg., the 0-in group = 0.1 to 0.9 in).

Shifts in catch-per-unit-of-effort (CPE) and length frequency of large bluegill were considered to be indices of population density and quality. Schneider (1990) provided a system for ranking quality based on the proportions of 6-, 7-, and 8-in bluegill in trap net catches. Rankings are scaled from very poor (1) to excellent (7). Shifts in electrofishing CPE for yearling bluegill (1-2 in long) were considered to be indices of recruitment to age 1 and year class strength. Year class strength was confirmed if weak and strong patterns could be followed through successive ages in collections of scale samples.

Scale samples were taken from 15 or more bluegills per in group for age and growth determinations. Walleye and some other species were scale sampled also. Scales were impressed on acetate and their images were projected on a digitizing pad. Location of annuli were determined according to the criteria of Jearld (1983) and entered into Frie's (1989) computer program. The Fraser-Lee method, with a standard intercept of 0.8 in (Carlander 1982), was used to back-calculate length at annulus formation and growth increments during preceding years for each bluegill. Use of the back-calculation technique avoided the problem of comparing empirical length-at-age of fish collected on different dates between April 30 and July 14.

Growth was expressed as annual growth increment during the preceding year and average length at the last annulus. Average length-at-age data were compared to State of Michigan averages (Laarman et al. 1981).

Means are given with 2 SE (error bounds). Means are considered significantly different when upper and lower confidence limits do not overlap.

Results

Changes in abundance of larger bluegill (7 and 8 in groups) are expressed as changes in relative (percent) and absolute (CPE) indices in the odd numbered figures and in Appendices 2-4. Changes in bluegill growth are expressed as average length-at-age and yearly growth increments in the even numbered figures and Appendices 5-36. Other types of data are summarized in Tables 1-6 and Appendix 1. Statistical confidence limits are given in the appendices.

Control Lakes

As expected, bluegill population indices for the four control lakes did not change appreciably from baseline conditions. In two control lakes, Big Seven and Saddle, percentages of sampled bluegill ≥7.0 in long in trapnet samples remained low (Figure 1) and size frequency rankings continued to range from very poor to acceptable (Table 5). The abundance of 7-in bluegill in these lakes, as measured by trapnet CPE, also show no meaningful trend during the study (Figure 1). Likewise, growth of bluegill remained poor, well below the average for Michigan waters (Figure 2).

In a third control lake, Turk, there was a slight gain in bluegill ≥7 in during 1994-96 (Figure 1). This can be traced to slightly improved growth in 1992-95 among fish age 2 and older (Figure 2 and Appendix 34). The fourth control lake (Joslin) had a relatively high percentage of fish over 7 in but there was no trend through time in size structure or growth (Figures 1 and 2). From the onset this lake had better size ratings – satisfactory to good – than any of the other lakes even though bluegill growth was almost as poor as in the other lakes (length-at-age averaged 0.8 in below State average).

All control lakes produced bluegill year classes of near-average strength in 1990 and 1991 but relatively weak year classes in 1992 (Table 6).

Antimycin-only Lakes

Modest bluegill responses to antimycin treatment occurred in two of three lakes. In Myers Lake, the percentage of bluegill removed by the treatment apparently was too low to stimulate a bluegill population response in either size structure or growth (Figures 3 and 4; Tables 3 and 5).

For the two lakes successfully treated, Fourteen and Island, abundance of bluegill ≥7 in increased as measured by trapnet CPE and percentage (Figure 3). The composite statistic, size index, also improved (Table 5). However, improvements were slight, with overall rankings no higher than "satisfactory", and no 8-in bluegills were generated. Improvements in size structure occurred 1-2 years after treatment and lasted 2-6 years.

This improvement in size structure can be attributed to improved growth increments in 1990-93, but principally in 1990 (Figure 4). Age groups 1-5 responded, but the 1990 cohort, born just after population thinning, did not respond (Figure 4 and Appendices 26 and 28).

Lake Fourteen had normal recruitment of young bluegill the year of treatment and the year after, but Island Lake produced fairly strong year classes in both years (Table 6).

Walleye-only Lakes

Few to many of the stocked fingerling walleye survived in these three study lakes. Peak CPE for walleye, captured while trap netting for bluegills in 1992, were 2.0 for Woodard, 2.6 for Crispell, and 8.0 for Selkirk lakes. A mark-recapture population estimate was attempted in Woodard Lake in spring 1996. However, only 16 different walleye were caught and the rough estimate was 0.5 walleye per acre. Walleye were more abundant in Selkirk Lake. There, CPE was four times higher and walleye growth was very slow, with an average length of only 12.1 in after three growing seasons.

Only weak improvements in bluegill size was evident by 1993, and no sampling was conducted in 1994 (Figure 5). However, all three lakes had markedly improved indices of 7- and 8-in bluegill by 1995 and 1996, the end of the study. Thus, the effect of walleye stocking on bluegill was delayed for 4-5 years. Bluegill growth gradually improved at each lake, with average length-at-age for age 6+ bluegill in Woodard attaining State average (Figure 6). Every age group except age 0 improved significantly (Appendices 25, 33, and 36).

Annual recruitment rate of bluegill to age 1 was not obviously depressed by walleye (Table 6).

Antimycin + Walleye Lakes

This treatment was successfully applied to two lakes, Long and Crescent. In the third lake, Big, fewer bluegill were thinned out by antimycin than intended and no evidence of walleye survival was found. Consequently, the bluegill population in Big Lake did not respond (Figures 7 and 8; Table 5).

Few stocked walleye survived in Crescent and Long lakes. Highest trap net CPEs were 0.8 and 2.0, respectively. A mark-recapture estimate of walleye was attempted at Long Lake in spring 1996. Only 17 walleye were captured and the estimate was approximately 0.3 walleye per acre.

At Long and Crescent lakes, there were marked improvements in bluegill population size structure, soon after the antimycin treatment (Figure 7), which lasted about 3 years. This matched the short-term antimycin effect observed in lakes treated only with antimycin (see section on antimycin-only lakes). In addition, there was a continued improvement of bluegill size in 1995-96 which is attributed to the delayed walleye effect (see section on walleye-only lakes).

Long Lake showed the largest response. There, appreciable numbers of 8-in bluegill were generated and overall size rank improved from poor to good (Table 5). The improvement at Long lake can be partially traced to excellent growth increments in 1990 and better growth increments thereafter which raised length-at-age for ages 4+ up to State average (Figure 8 and Appendices 24 and 30). Crescent Lake had a modest response. There, size rank improved from acceptable to good (Table 5) and average bluegill growth improved for 3 years but did not reach the State average (Figure 8).

Crescent Lake produced a large bluegill year class in 1990, but Long Lake had a relatively weak cohort then (Table 6). For both lakes, long-term average recruitment rate to age 1 was not clearly depressed in the presence of walleye, but sampling was inadequate in 1993 and 1994 (Table 6).

Antimycin + Catch-and-Release Lakes

This combination of treatments was successfully implemented at all three lakes. Adequate numbers of bluegill were removed by antimycin to illicit a response and satisfactory compliance with catch-and-release regulations was obtained.

All three lakes showed a dramatic, immediate, and prolonged improvement in bluegill size structure (Figure 9). Large numbers of 7- and 8-in bluegill were generated, increasing size ranks to "excellent" levels in all three lakes (Table 5).

Bluegill growth increments increased dramatically in 1990 for all ages and sizes except young of the year (Figure 10 and Appendices 21, 27 and 35). However, growth returned to pre-treatment levels in 3-4 years, as it did at the other antimycin lakes. Average length at age briefly reached State average.

We attribute presence of many large bluegill at the end of the study mainly to protection from angling (reduced mortality) rather than continued good growth. All three lakes showed an increase in maximum age attained by bluegill. Also, there were increases in the proportion of scale-sampled bluegill that were age 8+ relative to age 5+. Average proportion of age 8+ in pre-treatment versus post-treatment years increased from 5 to 32% at Algoe Lake, from 1 to 15% at Horseshoe Lake, and from 3 to 5% at Williams Lake. However, comparable statistics increased for control lakes also, and may be due to a combination of the strong 1983 year class and an unexplained improvement in survival of older bluegill.

Recruitment was fairly high in Horseshoe Lake for 2 years after treatment, but average in the other two lakes (Table 6). Again, pre- and post-treatment recruitment rates to age 1 did not clearly indicate increased predation on young-of-the-year by protected adult largemouth bass, large bluegill, and other species.

Discussion

These experiments served dual purposes. One was to evaluate the practicality of specific procedures as management tools for improving fishery characteristics. The other was to gain insight into fish population dynamics by monitoring responses to alterations in mortality rate. Bluegill mortality rate was manipulated by antimycin treatments targeting small and medium bluegill, increasing predation rate on small bluegill with walleye, and a combination of increasing predators and protecting large bluegill from fishing mortality (catch-and-release regulation). Responses in bluegill size structure, growth, and recruitment were monitored. Primary questions for both purposes were how large a response would occur and how long it would last. Long-term or indefinite improvements would be the most favorable for management application and would indicate a new dynamic equilibrium had been achieved.

Two uncontrolled events occurred in both control and treatment lakes. First, the eruption of Mount Penetobo, Philippines, in June 1991 apparently caused the cool summer of 1992. Across southern Michigan, the number of degree days exceeding 65°F was just 58% of the norm. No strong year classes of bluegill were produced in any of the 16 study lakes that summer, and very weak year classes occurred in 10 lakes (Table 6). The other uncontrolled event was the increase, beginning in 1993, of minimum size limits on bass from 12- to 14-in and on pike from 20- to 24-in. These increases were expected to increase predation on small and medium bluegill, and perhaps eventually reduce bluegill recruitment and improve bluegill growth and size structure. However, neither event appeared to have altered bluegill growth or size structure in either control or treatment lakes by the end of the study in spring 1996.

Based on prior experience with these techniques and knowledge of population dynamics, we expected the control lakes to show no significant directional change in bluegill attributes from 1988 to 1996. These lakes met our expectations.

The expected response to antimycin treatment was a one-time increase in mortality of small and medium bluegill, followed by an immediate improvement in growth and a slightly delayed improvement in size structure, both lasting for a few years (Hooper et al. 1964). That was the observed response in 7 out of 9 lakes. In the other two lakes, we believe antimycin was not applied in sufficient amounts and too few fish were eliminated to cause a population response. That is a typical success rate for this management technique, which cannot be applied consistently. We also expected that large cohorts of bluegill might be produced soon after treatments by reducing the density-dependent feedback that small-medium bluegill have on reproductive success (Clark and Lockwood 1990). In either 1990 or 1991, 57% of the lakes with successful antimycin treatments produced large bluegill cohorts, compared to 25% of the control lakes (Table 6). Ultimately, the improvements in bluegill size were expected to improve angling, as was documented at a lake in Minnesota (Davis 1979).

Antimycin treatments may reduce populations of other species such as pumpkinseed *Lepomis gibbosus*, black crappie, yellow perch *Perca flavescens*, and small walleye and northern pike (Davis 1979). Growth and size of pumpkinseed may improve along with bluegill (Davis 1979). Often the recruitment of young largemouth bass is enhanced by antimycin treatment (Davis 1979). For the 16 study lakes, CPE indices of abundance were highly variable and it was difficult to detect changes except for perhaps two species. Among the nine lakes treated with antimycin, black crappie probably increased in five and largemouth bass possibly increased in five. Bass in three of the nine lakes were protected by catch-and-release regulations, but CPE data were not adequate to document increases in adult bass.

Walleye were expected to cause a delayed improvement in bluegill size. Over several years they might consume enough small bluegills to reduce population densities and trigger improved bluegill growth. Such was the case in five out of six lakes; in one lake no walleye survived. Surprisingly, a positive bluegill growth response occurred even though walleye densities were low to moderate (probably less than 0.5 walleye per acre). Better survival of walleye and a better response by bluegill populations may have occurred if the walleye had been stocked at a larger size, as the study design called for. Bluegill growth remained improved through year 5.

Increased consumption of small bluegill in walleye lakes was not directly documented, as by a diet study, and no decline in recruitment of age-1 bluegill was apparent (Table 6). However, substantial predation by walleye on bluegill has been documented elsewhere and adult walleye are capable of preying on bluegill as large as approximately 5 in (age 4) (Schneider 1995, Schneider and Breck 1997).

For Long Lake, the increase in the proportion of 7- and 8-in fish was enhanced by a decline in the abundance of 6-in bluegill. However, CPE of larger bluegill improved at all five lakes, indicating a real increase in density had taken place.

The delayed walleye effect complemented the immediate antimycin effect and resulted in improved bluegill populations for at least 6 years (through 1996). We recommended that walleye stocking be continued at these lakes to maintain or enhance improvements made in bluegill population characteristics.

Likewise, the catch-and-release regulation was expected to prolong the positive response generated by antimycin treatment. Protected fish would not only directly improve size structure statistics, but might also indirectly prey on enough small bluegill to improve recruitment and growth. Observed improvements in bluegill size were both large and prolonged, the best response observed. How long the improved size structure will last is uncertain because growth at Algoe Lake had returned to pre-treatment level by 1993, but the other two lakes had high bluegill growth rates through 1996. Again, a predation effect – principally by largemouth bass, northern pike, and large bluegill – probably occurred, but abundance of age-1 bluegill was not clearly reduced (Table 6). Results were impressive enough that Algoe and Williams lakes were kept on catch-and-release regulations and Horseshoe Lake was protected by daily possession limits of 1 pike, 1 bass, and 10 “sunfish”. Fisheries at these lakes were popular with enough anglers to justify these regulations.

Insight into bluegill dynamics was provided by the population response to decreased density of 1-4 in bluegill. Growth of bluegill that survived treatment with antimycin improved across all sizes and ages except young-of-the-year. This suggests that the diet of young differs significantly from that of older bluegill, and that older bluegill (1-6 in, or longer) compete with each other for food resources. Similar observations on growth and competition have been made at other lakes and ponds (Werner et al. 1983, Clark and Lockwood 1990, Schneider 1995). Recruitment rates of bluegill, as measured by CPE at age 1, responded in a less predictable fashion to reduced suppression by intermediate sizes. Large year classes appeared at 57% of the lakes in 1 or 2 years, similar to the pattern reported elsewhere (Beyerle and Williams 1972, Clark and Lockwood 1990, Breck 1996). Natural mortality rate of intermediate sizes was not carefully measured but there is no indication it was altered.

Use of predators, either walleye or native species, to permanently lower bluegill density and stimulate growth was fairly successful and holds promise as a management technique. Reduced recruitment to age 1 could not be demonstrated, but recruitment is naturally highly variable and effects could extend to older ages and well beyond our 6-year study period. Improved growth of bluegill was demonstrated at relatively low walleye densities. Actually, the apparent increase in growth could be due to either growth gains by each surviving fish, or to elimination of the slower growing fish from the population by selective predation. Walleye stocking is a feasible and potentially popular management tool for improving slow-growing bluegill populations. The key to success remains stocking walleye large enough (>6 in) to achieve an acceptable survival rate (Schneider 1989).

Catch-and-release fishing regulations not only enhance predators, but also preserve large fish for multiple recapture by anglers. It is a tool which needs to be more fully evaluated in lakes with a history of bluegill stunting. Such lakes may be prone to stunting due to a combination of excessive removal of predators (including large bluegill) plus large amounts of vegetative cover which excessively shelter small bluegill from predation. It was been documented that weedy lakes with light exploitation can have excellent bluegill populations (Schneider 1993). However, whether bluegill dynamics in stunted lakes can be permanently improved with stricter controls on harvest remains to be demonstrated. The continued monitoring at Horseshoe, Algoe, and Williams lakes will provide a good test.

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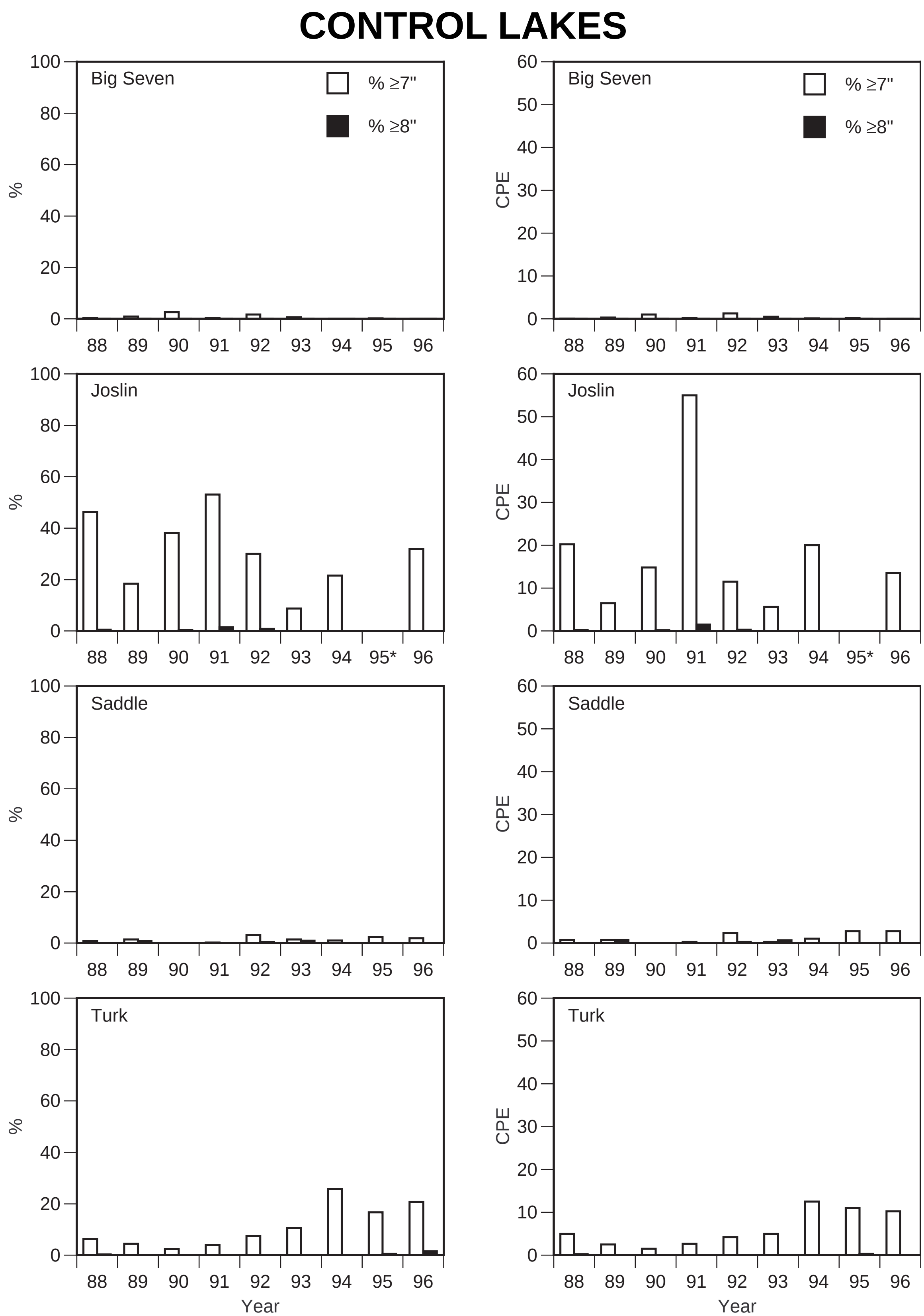

Figure 1.—Size distributions of larger bluegill for control lakes in 1988-96 expressed as percentage of trapnet catch greater than 7.0 or 8.0 in (left panels) and as catch per net lift (CPE) for bluegills greater than 7.0 or 8.0 in (right panels). Legends are in top panels. Asterisk (*) indicates no sample taken that year.

CONTROL LAKES

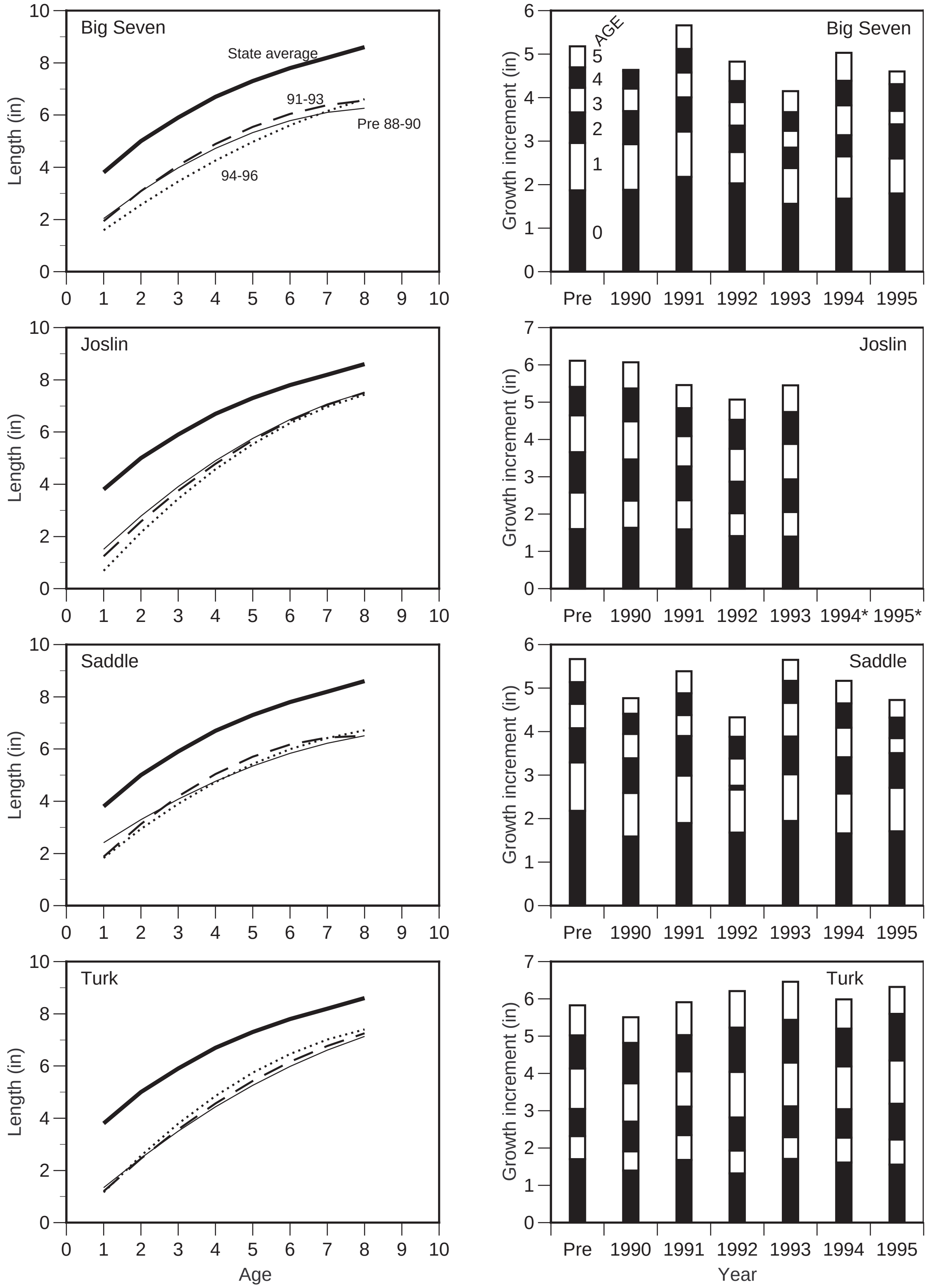

Figure 2.—Growth of bluegill in control lakes expressed as average length-at-age (left panels) and back-calculated growth increment during year by age groups 0-5 (right panels). Labels are in top panels. Asterisk (*) indicates no sample taken that year.

ANTIMYCIN-ONLY LAKES

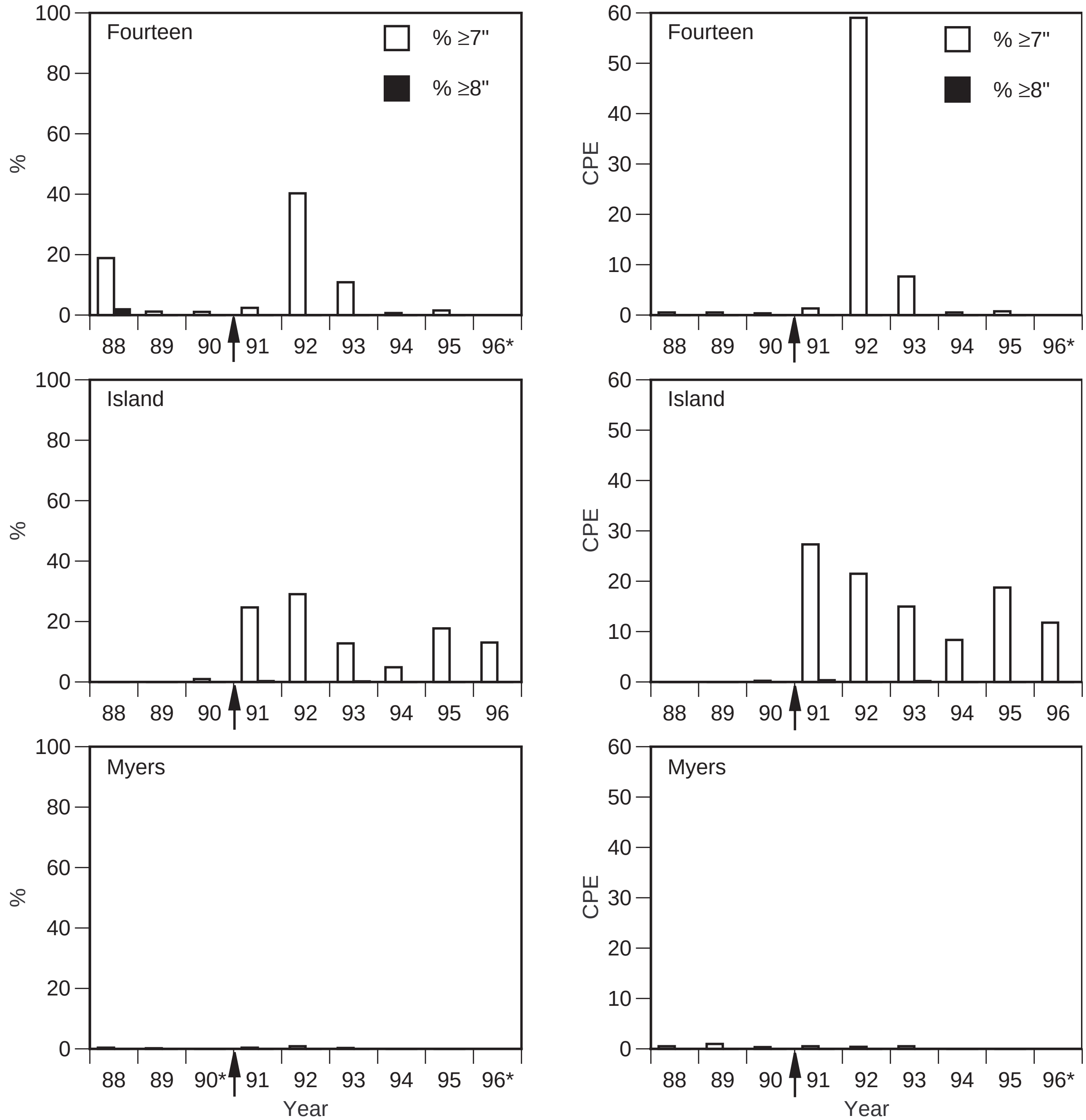

Figure 3.—Size distributions of larger bluegill for antimycin-only lakes in 1988-96 expressed as percentage of trapnet catch greater than 7.0 or 8.0 in (left panels) and as catch per net lift (CPE) for bluegills greater than 7.0 or 8.0 in (right panels). Legends are in top panels. Asterisk (*) indicates no sample taken that year. Arrow indicates treatment in 1990.

ANTIMYCIN-ONLY LAKES

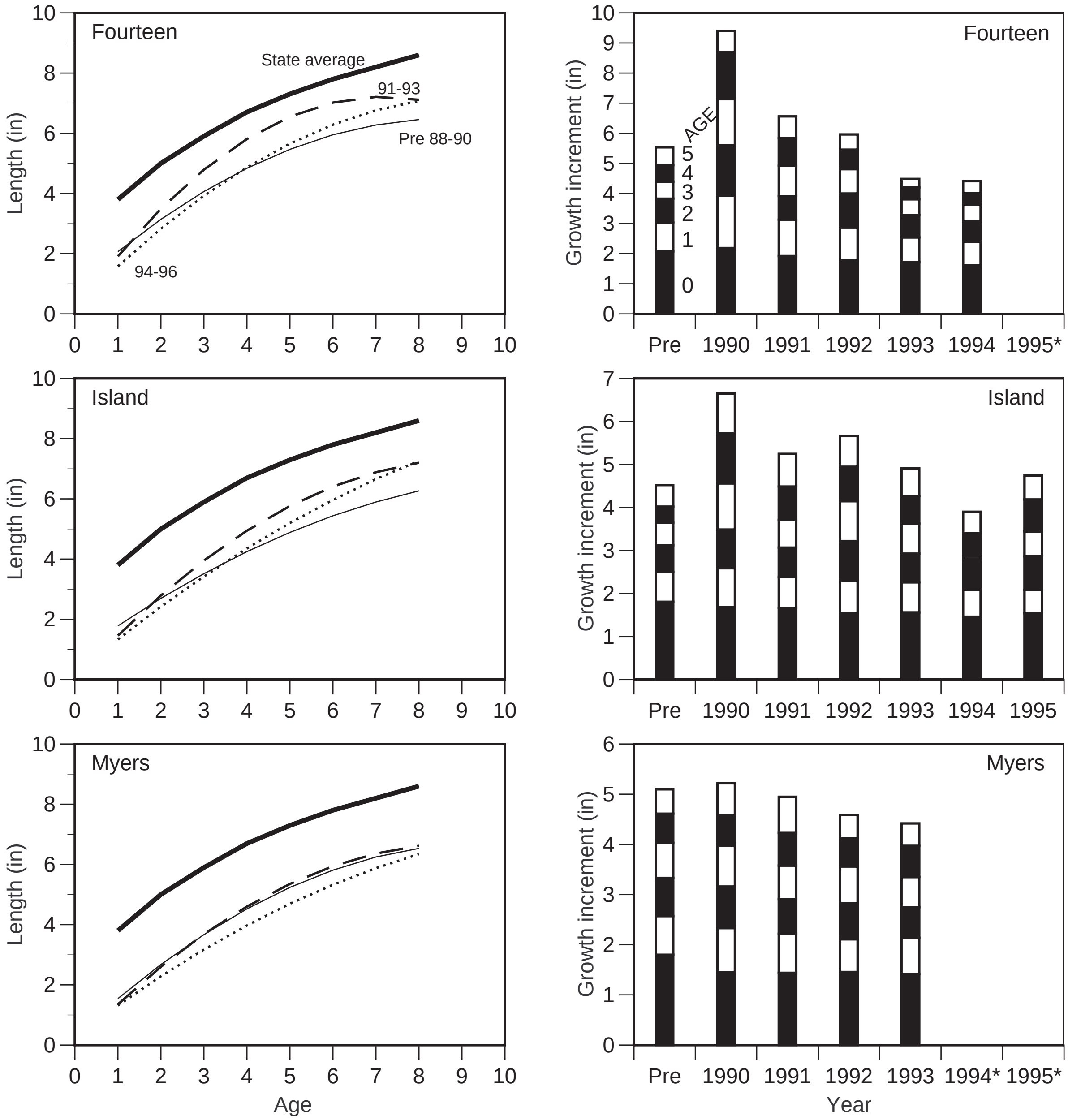

Figure 4.—Growth of bluegill in antimycin-only lakes expressed as average length-at-age (left panels) and back-calculated growth increment during year by age groups 0-5 (right panels). Labels are in top panels. Asterisk (*) indicates no sample taken that year.

WALLEYE-ONLY LAKES

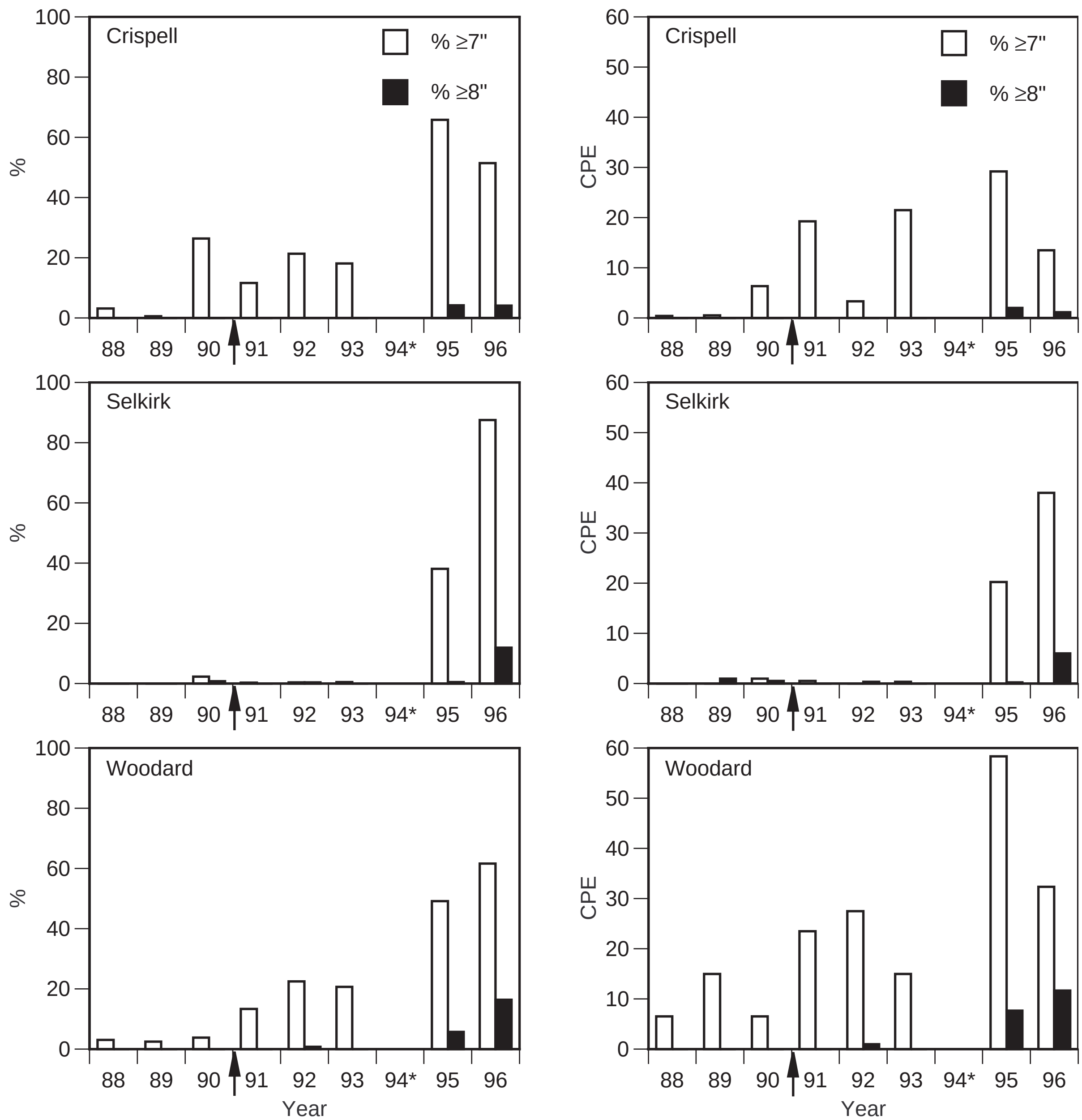

Figure 5.—Size distributions of larger bluegill for walleye-only lakes in 1988-96 expressed as percentage of trapnet catch greater than 7.0 or 8.0 in (left panels) and as catch per net lift (CPE) for bluegills greater than 7.0 or 8.0 in (right panels). Legends are in top panels. Asterisk (*) indicates no sample taken that year. Arrow indicates treatment in 1990.

WALLEYE-ONLY LAKES

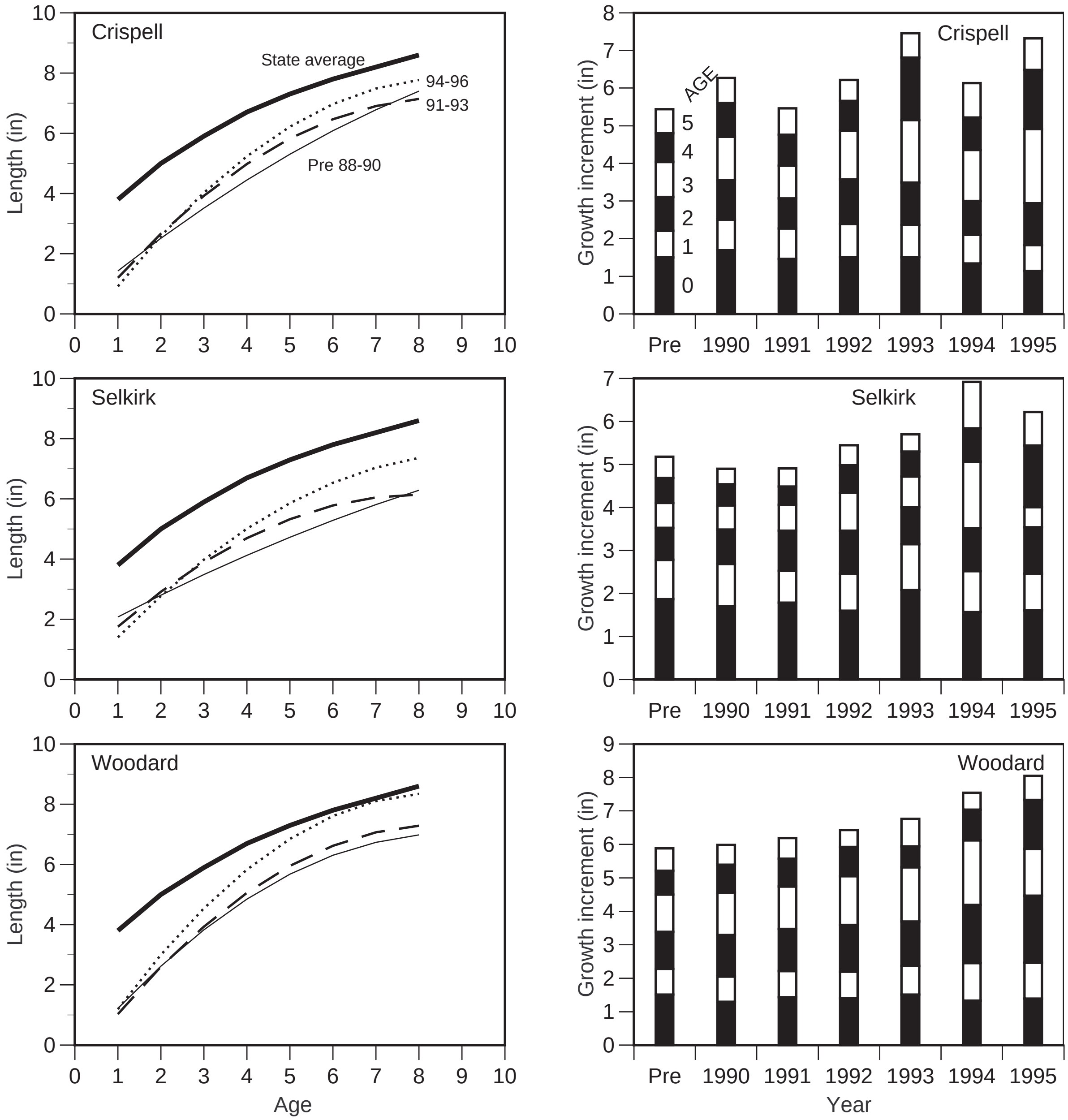

Figure 6.—Growth of bluegill in walleye-only lakes expressed as average length-at-age (left panels) and back-calculated growth increment during year by age groups 0-5 (right panels). Labels are in top panels.

ANTIMYCIN + WALLEYE LAKES

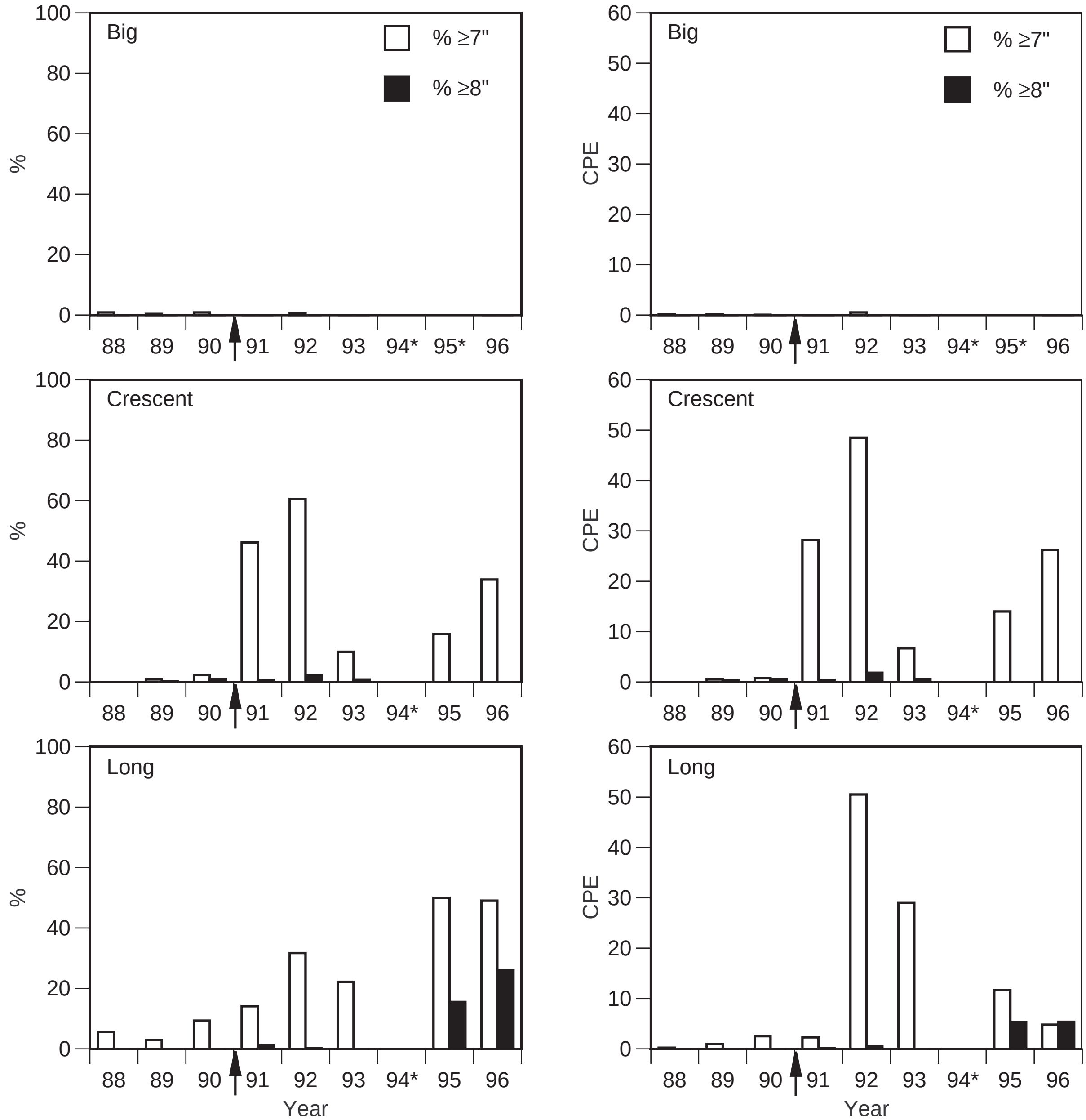

Figure 7.—Size distributions of larger bluegill for antimycin + walleye lakes in 1988-96 expressed as percentage of trapnet catch greater than 7.0 or 8.0 in (left panels) and as catch per net lift (CPE) for bluegills greater than 7.0 or 8.0 in (right panels). Legends are in top panels. Asterisk (*) indicates no sample taken that year. Arrow indicates treatment in 1990.

ANTIMYCIN + WALLEYE LAKES

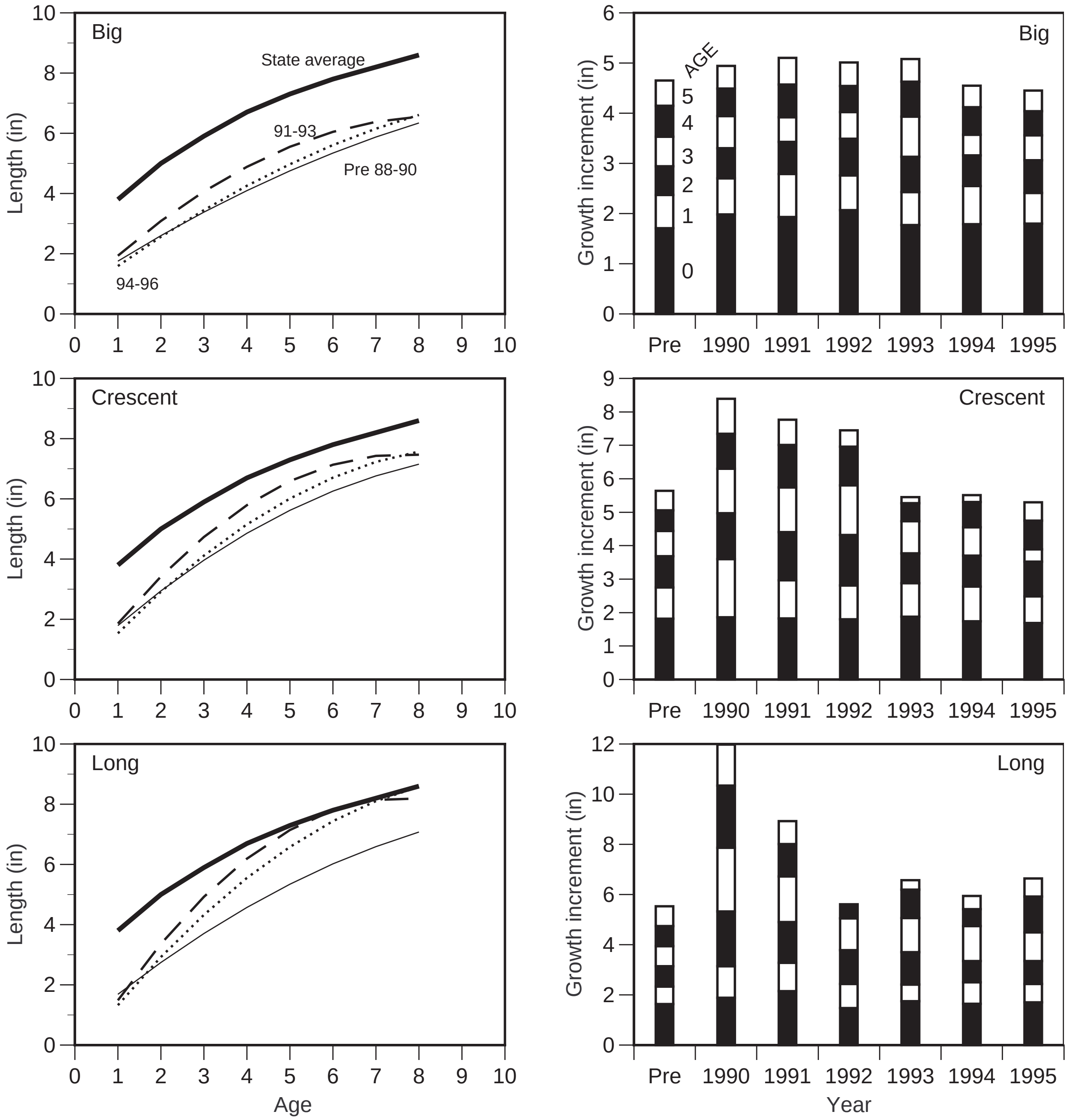

Figure 8.—Growth of bluegill in antimycin + walleye lakes expressed as average length-at-age (left panels) and back-calculated growth increment during year by age groups 0-5 (right panels). Labels are in top panels.

ANTIMYCIN + CATCH-AND-RELEASE LAKES

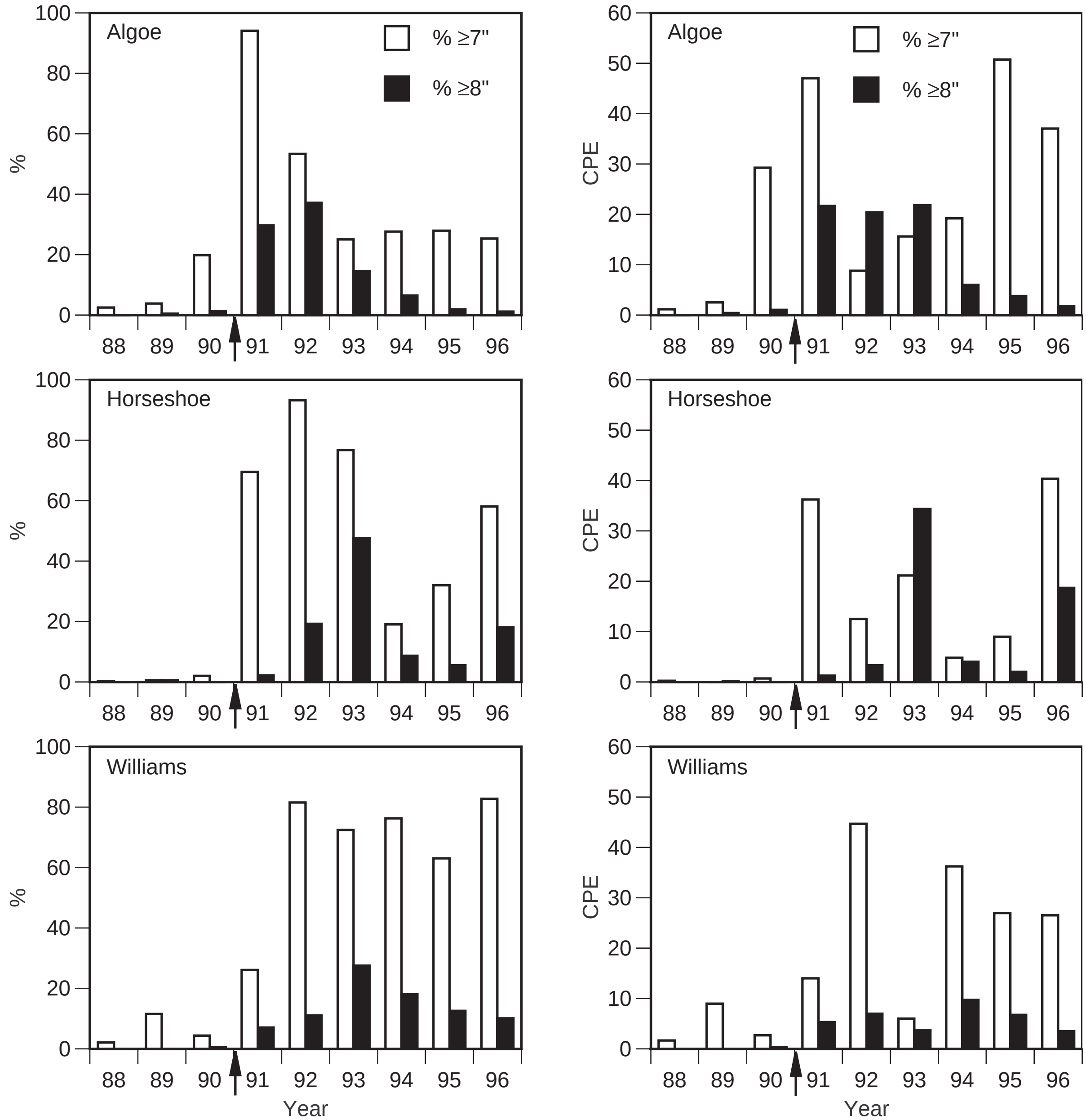

Figure 9.—Size distributions of larger bluegill for antimycin + catch-and-release lakes in 1988-96 expressed as percentage of trapnet catch greater than 7.0 or 8.0 in (left panels) and as catch per net lift (CPE) for bluegills greater than 7.0 or 8.0 in (right panels). Legends are in top panels. Arrow indicates treatment in 1990.

ANTIMYCIN + CATCH-AND-RELEASE LAKES

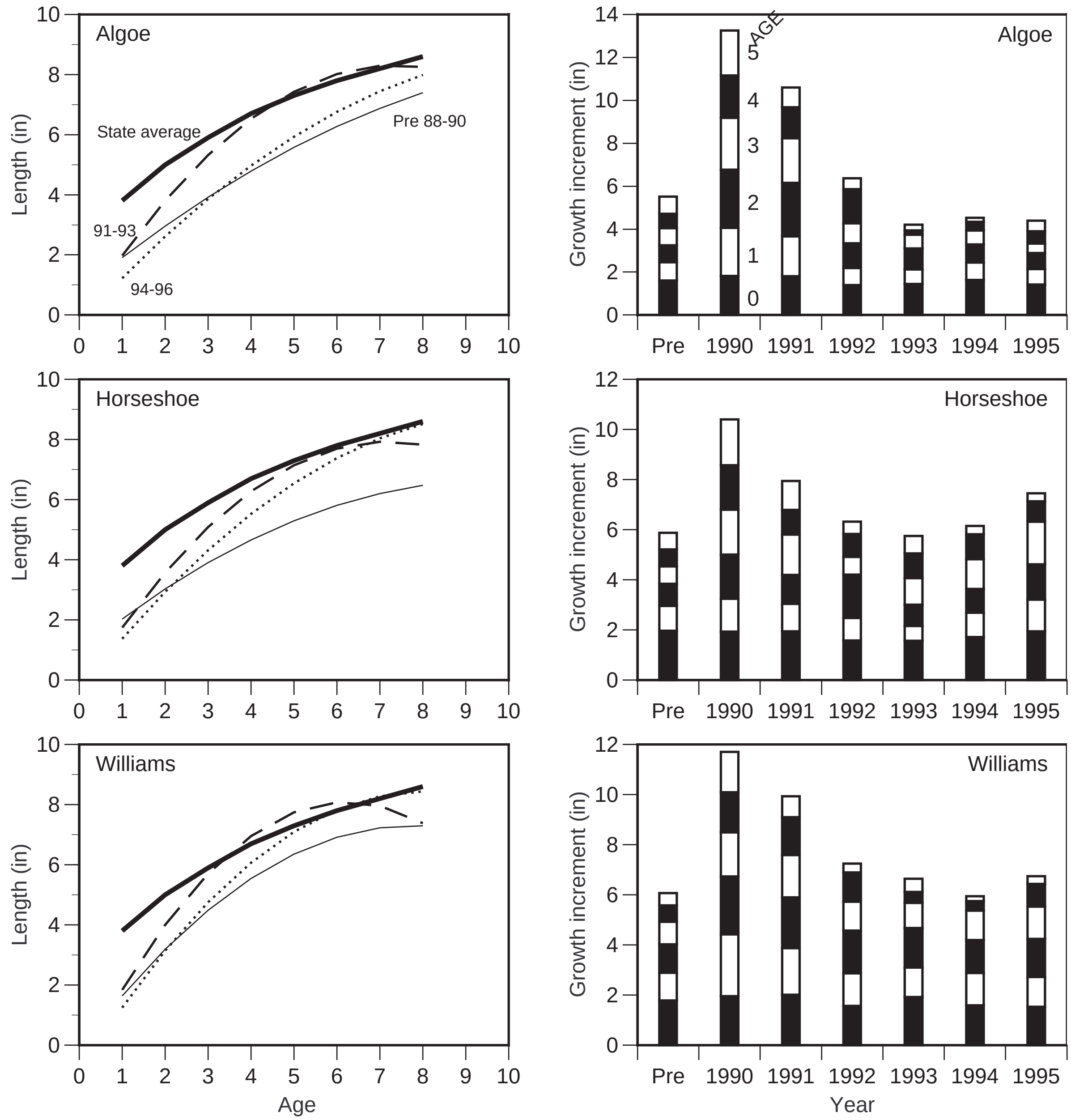

Figure 10.—Growth of bluegill in antimycin + catch-and-release lakes expressed as average length-at-age (left panels) and back-calculated growth increment during year by age groups 0-5 (right panels). Labels are in top panels.

Table 1.–Treatment, location, and physical characteristics of study lakes.

Treatment and lake	County	T. R. S.	Area (acres)	Maximum depth (ft)	Alkalinity (ppm)
Control					
Big Seven	Oakland	5N 7E 19	170	53	145-174
Joslin	Washtenaw	1S 3E 3-4	187	20	134
Saddle	Van Buren	1S 15W 9-10	292	32	95-154
Turk	Montcalm	10N 8W 3,10	151	20	…
Antimycin-only					
Fourteen	Van Buren	1S 15W 14	69	22	57-165
Island	Livingston	1N 6E 4	140	35	120-154
Myers	Kent	9N 10W 27,28	85	41	…
Walleye-only					
Crispell	Jackson	4S 1W 20.21	82	26	163
Selkirk	Allegan	3N 11W 29,32	94	39	53-56
Woodard	Ionia	8N 6W 18	73	22	120
Antimycin + Walleye					
Big	Oakland	4N 8E 28,29	215	14	109-118
Crescent	Oakland	3N 9E 21,27	90	40	151-190
Long	Kent	10N 11W 31	48	27	120
Antimycin + Catch-and-Release					
Algoe	Lapeer	6N 9E 31	16	41	190
Horseshoe	Washtenaw	1S 6E 8,17	85	30	208
Williams	Barry	3N 10W 21	18	22	154

Table 2.–Experimental lakes treated with antimycin in spring 1990, lake pH at or near time of treatment, pints of antimycin applied, and target concentration of antimycin in upper 5 feet of water column.

Lake	pH	Pints applied	Concentration (ppb)
Algoe	7.5	2	1.00
Big	8.5	36	2.00
Crescent	8.5	20	2.00
Fourteen	8.8	19	2.00
Horseshoe	7.9	13	1.25
Island	7.5	16	1.00
Long	7.6	6	1.00
Myers	8.3	14	1.50
Williams	8.2	3	1.50

Table 3.–Mean and 2 SE for counts of dead fish per ft of shoreline in lakes treated with antimycin. Counts were made 2 to 6 d after treatment.

	Bluegill		All species	
Lake	Mean	2 SE	Mean	2 SE
Big	2.09	0.99	2.21	1.99
Fourteen	2.27	2.04	2.87	2.06
Horseshoe	2.20	0.21	2.66	0.95
Island	5.16	4.89	6.27	5.06
Myers	1.34	0.81	2.50	1.08
Williams	2.35	1.53	2.81	1.54

Table 4.–Numbers and mean lengths of fingerling walleye stocked in each lake from late summer to early fall, 1990. Also shown is the highest trapnet catch per net lift (CPE) for surviving walleye in subsequent years.

	Walleye stocked		
Lake	Number	Length (in)	Highest CPE
Big	3,225	6.5	0.0
Crescent	1,350	6.3	0.8
Crispell	1,368	6.8	2.6
Long	874	4.7	2.0
Selkirk	1,410	5.4	8.0
Woodard	1,134	4.7	2.0

Table 5.–Ranking of bluegill size scores based on trapnet catches, 1988-96. Rankings defined by Schneider (1990) are v=very poor; p=poor; a=acceptable; s=satisfactory; go=good; ex=excellent. Good and excellent rankings for treated lakes are highlighted in bold. Blank indicates no sample was taken.

Treatment and lake	1988	1989	1990	1991	1992	1993	1994	1995	1996
Control									
Big Seven	v	p	p	v	v	v	v	v	v
Joslin	go	s	go	go	s	a	s		s
Saddle	v	p	p	v	a	a	p	p	p
Turk	a	p	p	p	a	a	a	s	s
Average[1]	p	p	p	p	p	p	p	p	p
Antimycin (only)									
Fourteen	a	v	p	a	**s**	a	v	v	
Island	v	v	p	**s**	a	a	p	a	a
Myers	p	p		v	v	v	v	p	
Average[1]	p	v	p	a	**s**	a	p	p	a
Walleye (only)									
Crispell	p	p	**s**	**s**	**s**	**s**		**go**	**go**
Selkirk	v	v	p	v	p	p		**go**	**ex**
Woodard	p	p	p	**s**	**s**	a		**go**	**go**
Average	p	p	a	a	a	a		**go**	**go**
Antimycin + Walleye									
Big	v	v	v	v	v	v			v
Crescent	p	a	a	**go**	**go**	a		**s**	**s**
Long	p	p	p	a	**go**	a		**go**	**go**
Average[1]	p	p	a	**s**	**go**	a		**s**	**go**
Antimycin + Catch-and-Release									
Algoe	p	a	**s**	**ex**	**go**	**s**	**s**	**s**	**s**
Horseshoe	v	p	p	**ex**	**ex**	**ex**	**s**	**s**	**ex**
Williams	p	a	a	**s**	**ex**	**ex**	**ex**	**ex**	**ex**
Average	p	p	a	**go**	**ex**	**go**	**s**	**s**	**go**

[1]Averages exclude atypical Joslin Lake, and Meyers and Big lakes where treatments failed to illicit a bluegill population response.

Table 6.–Electrofishing catch-per-hour of age-1 bluegill, by cohort, in pre-treatment (1987-89 cohorts) and post-treatment (1990-95 cohorts) periods. Bold indicates weak or <u>strong</u> cohorts which show up consistently in following years (1995 cohort excepted).

Treatment	Cohort									Average	
and lake	1987	1988	1989	1990	1991	1992	1993	1994	1995	pre	post
<u>Control</u>											
Big Seven	34	3	6	606	180	25	8	17	5	14	140
Joslin	27	26	26	66	55	**6**	0	nd	16	26	29
Saddle	nd	241	13	15	21	**4**	47	57	33	127	30
Turk	nd	231	0	96	**<u>291</u>**	38	0	459	188	116	179
<u>Antimycin-only</u>											
Fourteen	75	7	**4**	39	76	**2**	52	65	nd	29	47
Island	70	3	36	**<u>226</u>**	**<u>240</u>**	**0**	63	53	38	36	103
Myers	nd	241	13	15	21	**4**	47	nd	nd	127	22
<u>Walleye-only</u>											
Crispell	17	25	41	**0**	41	41	nd	96	135	28	62
Selkirk	**5**	6	64	37	**<u>160</u>**	43	nd	129	230	25	120
Woodard	nd	180	**38**	559	81	**38**	nd	91	13	109	156
<u>Antimycin + Walleye</u>											
Big	**<u>179</u>**	16	31	**1**	53	**0**	nd	nd	74	75	32
Crescent	2	3	11	**<u>282</u>**	22	**2**	nd	nd	73	5	95
Long	nd	326	35	**17**	86	**23**	nd	162	76	181	73
<u>Antimycin + Catch-and-Release</u>											
Algoe	42	**2**	76	60	99	**10**	7	22	25	40	37
Horseshoe	16	21	**1**	**<u>178</u>**	**<u>329</u>**	63	30	115	3	12	120
Williams	**<u>132</u>**	17	0	72	76	6	16	74	31	50	46

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Appendix 1.–Fish species present (+) in 16 study lakes as determined by electrofishing and trap-net surveys conducted in spring.

Species	Algoe	Big	Big Seven	Cresent	Crispell	Fourteen	Horseshoe	Island	Joslin	Long	Myers	Saddle	Selkirk	Turk	Williams	Woodward
Bluegill	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pumpkinseed	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Largemouth bass	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Northern pike		+	+	+	+	+	+	+	+	+	+	+		+	+	+
Yellow perch	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Black crappie	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Warmouth		+	+	+		+	+	+	+	+		+		+	+	+
Green sunfish	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Yellow bullhead		+		+	+		+		+	+	+	+	+	+		+
Black bullhead		+	+	+		+	+				+			+	+	+
Brown bullhead		+	+	+	+	+	+				+	+	+	+		+
Bullhead spp.	+							+	+							
Rock bass		+		+				+	+		+			+		
White sucker	+	+	+	+	+		+	+		+	+			+		+
Bowfin		+	+	+		+	+		+			+	+	+	+	+
Central mudminnow	+	+		+	+	+	+		+	+	+	+	+		+	
Golden shiner	+	+	+	+	+	+	+		+	+	+	+	+		+	+
Lake chubsucker		+		+	+	+	+	+	+	+	+	+			+	+
Common carp		+	+	+		+	+	+				+				
Grass pickerel		+	+	+	+	+	+	+	+	+	+	+	+		+	
Minnow spp.				+	+											
Bluntnose minnow		+		+	+			+	+		+		+			
Spotfin shiner				+												
Longnose gar				+					+			+			+	
Longear sunfish		+		+					+							
Blacknose shiner					+				+	+	+			+		
Mimic shiner					+				+							
Johnny darter							+	+						+		
Walleye			+		+					+			+			+
Channel catfish			+		+											
Brown trout	+										+					
Tiger muskellunge		+														
Shortnose gar					+							+				
Brook silverside									+							
Common shiner				+							+					
Smallmouth bass											+					
Rainbow trout												+				
Hybrid sunfish			+		+		+			+	+			+	+	+
Iowa darter	+										+					
Blackchin shiner											+					
Total species	12	22	18	25	22	16	20	16	22	17	24	19	14	17	15	16

*Scientific and common names follow the American Fisheries Society checklist.

Appendix 2.–Percentage of bluegills ≥6.0 in, total length, with 2 SE in parenthesis, captured by trapnet from the 16 study lakes, 1988-96.

Treatment and Lake	1988	1989	1990	1991	1992	1993	1994	1995	1996
<u>Control</u>									
Big Seven	4.89	22.35	40.60	13.87	18.18	13.11	15.56	3.79	1.88
	(2.39)	(3.96)	(6.42)	(4.48)	(4.48)	(3.87)	(7.64)	(1.75)	(1.67)
Joslin	88.14	89.62	90.25	94.66	81.43	71.43	89.57		77.30
	(4.86)	(4.19)	(3.86)	(2.17)	(5.05)	(5.15)	(3.67)		(6.56)
Saddle	21.82	28.94	41.67	20.20	35.14	71.83	36.51	53.43	54.10
	(4.05)	(4.40)	(5.58)	(4.04)	(5.93)	(6.16)	(4.95)	(4.62)	(4.16)
Turk	35.71	33.93	34.69	39.90	64.54	69.66	69.59	63.24	90.19
	(5.23)	(6.33)	(6.08)	(6.87)	(5.70)	(6.01)	(6.61)	(6.75)	(3.65)
<u>Antimycin-only</u>									
Fourteen	54.72	15.61	27.37	52.11	97.61	65.88	10.64	12.06	
	(13.67)	(5.52)	(9.15)	(5.48)	(1.78)	(6.53)	(3.67)	(4.62)	
Island	2.23	0.00	28.70	63.99	68.02	41.47	28.71	62.50	45.71
	(1.97)	(0.00)	(8.71)	(5.24)	(4.43)	(4.07)	(3.97)	(4.70)	(5.24)
Myers	30.25	26.41	[1]	9.74	23.48	13.47	11.17	29.86	
	(3.91)	(3.76)		(3.63)	(5.59)	(3.74)	(3.14)	(6.30)	
<u>Walleye-only</u>									
Crispell	23.08	50.96	83.33	87.80	95.74	89.42		85.21	88.89
	(10.45)	(4.61)	(6.21)	(2.54)	(4.16)	(2.86)		(4.21)	(4.81)
Selkirk	4.98	1.95	10.19	3.04	20.08	52.44		93.95	95.52
	(2.60)	(1.37)	(3.72)	(1.88)	(5.13)	(6.66)		(3.25)	(2.92)
Woodard	52.64	54.23	40.48	86.04	83.40	61.93		89.08	79.44
	(3.46)	(4.06)	(5.36)	(3.70)	(4.68)	(6.58)		(3.11)	(5.53)
<u>Antimycin + Walleye</u>									
Big	5.15	4.86	9.68	12.00	11.36	2.73			14.06
	(2.90)	(1.98)	(5.31)	(4.33)	(2.99)	(2.20)			(5.02)
Crescent	34.56	50.26	67.76	88.11	89.16	42.76		86.36[2]	87.10
	(4.42)	(4.15)	(6.39)	(3.37)	(2.79)	(4.78)		(3.66)	(3.81)
Long	34.39	30.88	34.74	39.61	86.60	83.91		73.79	81.25
	(5.63)	(6.47)	(6.53)	(6.13)	(3.80)	(4.55)		(6.13)	(5.41)
<u>Antimycin + Catch-and-Release</u>									
Algoe	25.39	29.93	58.92	99.09	64.71	64.84	67.61	67.22	61.70
	(14.84)	(3.91)	(3.98)	(1.29)	(5.80)	(3.49)	(4.36)	(3.37)	(3.93)
Horseshoe	0.69	3.23	27.78	100.00	99.04	80.41	54.86	57.50	91.09
	(0.80)	(2.59)	(6.37)	(0.00)	(1.91)	(3.79)	(5.86)	(6.99)	(3.27)
Williams	39.33	51.07	39.90	69.03	97.37	97.5	95.18	93.46	97.84
	(6.32)	(6.55)	(6.87)	(6.15)	(2.32)	(4.94)	(2.71)	(3.38)	(2.47)

[1] Electrofishing and trap netting data combined on the same field sheet.
[2] Measured to nearest inch.

Appendix 3.–Percentage of bluegills ≥7.0 in, total length, with 2 SE in parenthesis, captured by trapnet from the 16 study lakes, 1988-96.

Treatment and Lake	1988	1989	1990	1991	1992	1993	1994	1995	1996
Control									
Big Seven	0.31	0.90	2.56	0.42	1.68	0.66	0.00	0.21	
	(0.61)	(0.99)	(2.07)	(0.84)	(1.49)	(0.92)	(0.00)	(0.42)	
Joslin	46.33	18.40	38.14	53.13	29.96	8.77	21.58		31.90
	(7.50)	(5.32)	(6.32)	(4.81)	(5.95)	(3.22)	(4.93)		(7.30)
Saddle	0.72	1.41	0.00	0.25	3.09	1.41	1.06	2.36	1.92
	(0.83)	(1.14)	(0.00)	(0.50)	(2.15)	(1.61)	(1.05)	(1.41)	(1.15)
Turk	6.25	4.46	2.45	3.96	7.45	10.68	25.77	16.67	20.75
	(2.64)	(2.76)	(1.97)	(2.73)	(3.13)	(4.04)	(6.28)	(5.22)	(4.98)
Antimycin-only									
Fourteen	18.87	1.16	1.05	2.41	40.27	10.90	0.71	1.51	
	(10.75)	(1.63)	(2.09)	(1.68)	(5.73)	(4.29)	(1.00)	(1.73)	
Island	0.00	0.00	0.93	24.70	29.05	12.80	4.82	17.69	13.02
	(0.00)	(0.00)	(1.84)	(4.71)	(4.31)	(2.76)	(1.88)	(3.71)	(3.54)
Myers	0.36	0.18	[1]	0.37	0.87	0.30	0.00	0.00	
	(0.51)	(0.36)		(0.75)	(1.22)	(0.60)	(0.00)	(0.00)	
Walleye-only									
Crispell	3.08	0.64	26.39	11.60	21.28	18.14		65.85	51.46
	(4.28)	(0.73)	(7.35)	(2.49)	(8.44)	(3.58)		(5.63)	(7.64)
Selkirk	0.00	0.00	2.26	0.30	0.41	0.44		38.14	87.56
	(0.00)	(0.00)	(1.83)	(0.61)	(0.82)	(0.89)		(6.63)	(4.66)
Woodard	3.12	2.49	3.87	13.39	22.53	20.64		49.13	61.68
	(1.20)	(1.27)	(2.10)	(3.64)	(5.25)	(5.48)		(4.98)	(6.65)
Antimycin + Walleye									
Big	0.86	0.42	0.81	0.00	0.67	0.00			
	(1.21)	(0.60)	(1.61)	(0.00)	(0.78)	(0.00)			
Crescent	0.00	0.86	2.34	46.22	60.64	10.05		15.91[2]	33.87
	(0.00)	(0.77)	(2.07)	(5.18)	(4.38)	(2.91)		(3.90)	(5.38)
Long	5.61	2.94	9.39	14.12	31.78	22.22		50.00	49.04
	(2.73)	(2.37)	(4.00)	(4.36)	(5.20)	(5.15)		(6.97)	(6.93)
Antimycin + Catch-and-Release									
Algoe	2.48	3.78	19.80	94.06	53.31	25.00	27.61	27.89	25.37
	(1.73)	(1.55)	(3.22)	(3.19)	(6.05)	(3.17)	(4.17)	(3.22)	(3.52)
Horseshoe	0.23	0.54	2.02	69.51	93.27	76.77	19.10	32.00	58.09
	(0.46)	(1.07)	(2.00)	(6.17)	(4.91)	(4.03)	(4.63)	(6.60)	(5.67)
Williams	2.09	11.59	4.43	26.11	81.58	72.5	76.31	63.08	82.73
	(1.85)	(4.19)	(2.89)	(5.84)	(5.62)	(14.12)	(5.39)	(6.60)	(6.41)

[1] Electrofishing and trap netting data combined on the same field sheet.
[2] Measurement to nearest inch.

Appendix 4.–Percentage of bluegills ≥8.0 in, total length, with 2 SE in parenthesis, captured by trapnet from the 16 study lakes, 1988-96.

Treatment and Lake	1988	1989	1990	1991	1992	1993	1994	1995	1996
Control									
Big Seven	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00	
Joslin	0.56	0.00	0.42	1.39	0.84	0.00	0.00		
	(1.13)	(0.00)	(0.85)	(1.13)	(1.19)	(0.00)	(0.00)		
Saddle	0.00	0.71	0.00	0.00	0.39	0.94	0.00	0.00	
	(0.00)	(0.81)	(0.00)	(0.00)	(0.77)	(1.32)	(0.00)	(0.00)	
Turk	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.49	1.51
	(0.59)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.98)	(1.50)
Antimycin-only									
Fourteen	1.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	(3.74)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Island	0.00	0.00	0.00	0.30	0.00	0.17	0.00	0.00	
	(0.00)	(0.00)	(0.00)	(0.59)	(0.00)	(0.34)	(0.00	(0.00)	
Myers	0.00	0.00	[1]	0.00	0.00	0.00	0.00	0.00	
	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Walleye-only									
Crispell	0.00	0.00	0.00	0.00	0.00	0.00		4.23	4.09
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(2.39)	(3.03)
Selkirk	0.00	0.00	0.75	0.00	0.41	0.00		0.47	11.94
	(0.00)	(0.00)	(1.06)	(0.00)	(0.82)	(0.00)		(0.93)	(4.57)
Woodard	0.00	0.00	0.00	0.00	0.79	0.00		5.71	16.36
	(0.00)	(0.00)	(0.00)	(0.00)	(1.11)	(0.00)		(2.31)	(5.06)
Antimycin + Walleye									
Big	0.00	0.00	0.00	0.00	0.00	0.00			
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)			
Crescent	0.00	0.34	0.93	0.54	2.21	0.70		0.0	
	(0.00)	(0.49)	(1.32)	(0.76)	(1.32)	(0.81)		(0.00)	
Long	0.00	0.00	0.00	1.18	0.31	0.00		15.53	25.96
	(0.00)	(0.00)	(0.00)	(1.35)	(0.62)	(0.00)		(5.05)	(6.08)
Antimycin + Catch-and-Release									
Algoe	0.00	0.49	1.31	29.68	37.13	14.57	6.52	1.93	1.15
	(0.00)	(0.57)	(0.92)	(6.17)	(5.86)	(2.58)	(2.30)	(0.99)	(0.86)
Horseshoe	0.00	0.54	0.00	2.24	19.23	47.61	8.68	5.50	18.15
	(0.00)	(1.07)	(0.00)	(1.98)	(7.73)	(4.77)	(3.32)	(3.22)	(4.43)
Williams	0.00	0.00	0.49	7.08	11.05	27.50	18.07	12.62	10.07
	(0.00)	(0.00)	(0.98)	(3.41)	(4.55)	(14.12)	(4.88)	(4.54)	(5.11)

[1] Electrofishing and trap netting data combined on the same field sheet.

Appendix 5.–Mean length-at-age of Algoe Lake bluegills by sample year. Algoe Lake is in the antimycin + catch-and-release group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	1.65	2.67	3.52	4.40	5.14	5.78	7.15	0.00	0.00	0.00
	(0.07)	(0.07)	(0.11)	(0.24)	(0.14)	(0.33)	(0.25)	(-.--)	(-.--)	(-.--)
1989	1.63	2.65	3.48	4.67	5.40	6.18	6.97	7.30	7.70	0.00
	(0.09)	(0.10)	(0.08)	(0.17)	(0.36)	(0.21)	(0.31)	(0.19)	(1.22)	(-.--)
1990	1.37	0.00	3.65	4.91	5.44	6.33	6.95	7.71	6.65	8.70
	(0.16)	(-.--)	(0.19)	(0.17)	(0.30)	(0.31)	(0.23)	(0.37)	(1.10)	(-.--)
Average	1.61	2.66	3.52	4.70	5.26	6.17	6.97	7.46	7.18	8.70
	(0.06)	(0.06)	(0.06)	(0.11)	(0.13)	(0.15)	(0.17)	(0.19)	(0.82)	(-.--)
1991	1.82	0.00	5.53	5.96	6.71	7.53	7.54	8.04	8.12	8.67
	(0.08)	(-.--)	(0.79)	(0.90)	(0.09)	(0.25)	(0.19)	(0.17)	(0.42)	(0.03)
	(+)	(-)	(+)	(0)	(+)	(+)	(+)	(+)	(0)	(0)
1992	1.80	4.10	6.64	7.25	7.89	7.98	8.37	8.38	8.35	7.91
	(0.10)	(0.20)	(0.27)	(0.34)	(0.28)	(0.33)	(0.21)	(0.17)	(0.31)	(-.--)
	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(0)	( )
1993	1.39	2.82	5.38	6.96	7.50	7.92	8.12	8.19	8.34	8.50
	(0.10)	(0.11)	(0.20)	(0.29)	(0.25)	(0.22)	(0.11)	(0.14)	(0.27)	(-.--)
	(0)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(0)	( )
1994	1.44	2.47	3.91	5.75	6.60	7.52	8.80	8.33	0.00	8.65
	(0.18)	(0.13)	(0.30)	(0.20)	(0.45)	(0.84)	(0.00)	(0.16)	(-.--)	(0.70)
	(0)	(0)	(+)	(+)	(+)	(+)	(+)	(+)	( )	(0)
1995	1.63	2.44	3.33	4.56	6.32	6.46	8.00	0.00	8.37	8.40
	(0.16)	(0.10)	(0.14)	(0.21)	(0.24)	(0.49)	(-.--)	(-.--)	(0.27)	(-.--)
	(0)	(-)	(0)	(0)	(+)	(0)	( )	( )	(0)	( )
1996	1.42	2.40	3.16	4.22	5.04	6.62	6.99	8.45	8.40	0.00
	(0.09)	(0.10)	(0.10)	(0.99)	(0.16)	(0.21)	(0.31)	(0.70)	(0.20)	(-.--)
	(-)	(-)	(-)	(0)	(0)	(+)	(0)	(0)	(0)	( )

Appendix 6–Mean length-at-age of Big Lake bluegills by sample year. Big Lake is in the antimycin + walleye group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	1.82	2.94	3.31	3.99	4.72	5.79	5.78	5.85	0.00	0.00
	(0.11)	(0.16)	(0.19)	(0.16)	(0.14)	(0.43)	(0.47)	(0.00)	(-.--)	(-.--)
1989	1.60	2.76	3.76	4.14	4.85	5.61	5.95	6.69	6.44	0.00
	(0.07)	(0.08)	(0.10)	(0.17)	(0.18)	(0.20)	(0.24)	(0.54)	(-.--)	(-.--)
1990	1.57	2.45	3.14	4.26	4.66	4.96	5.73	5.98	7.01	0.00
	(0.05)	(0.09)	(0.09)	(0.14)	(0.24)	(0.18)	(0.17)	(0.00)	(-.--)	(-.--)
Average	1.71	2.71	3.23	4.12	4.76	5.40	5.79	6.38	6.72	0.00
	(0.06)	(0.06)	(0.07)	(0.09)	(0.10)	(0.14)	(0.13)	(0.33)	(0.00)	(-.--)
1991	1.69	2.51	3.19	3.91	4.95	5.27	5.60	5.94	0.00	0.00
	(-.--)	(0.06)	(0.20)	(0.08)	(0.23)	(0.27)	(0.16)	(0.11)	(-.--)	(-.--)
	(0)	(-)	(0)	(-)	(0)	(0)	(0)	(0)	( )	( )
1992	1.93	2.84	3.31	3.82	4.95	5.51	6.01	5.95	6.42	7.72
	(0.07)	(0.17)	(0.07)	(0.23)	(0.17)	(0.64)	(0.18)	(0.18)	(0.24)	(-.--)
	(+)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(-)	( )
1993	0.00	2.72	3.42	3.92	4.63	5.22	0.00	6.07	6.22	0.00
	(-.--)	(0.08)	(0.08)	(0.16)	(0.16)	(0.14)	(-.--)	(-.--)	(-.--)	(-.--)
	(-)	(0)	(+)	(0)	(0)	(0)	( )	( )	( )	( )
1994	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)
	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
1995	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)
	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
1996	1.80	2.40	3.18	3.84	4.32	5.05	5.45	5.91	6.19	6.70
	(0.04)	(0.06)	(0.08)	(0.68)	(0.12)	(0.31)	(0.20)	(0.18)	(0.42)	(0.18)
	(0)	(-)	(0)	(0)	(-)	(0)	(0)	(0)	(-)	( )

Appendix 7.–Mean length-at-age of Big Seven Lake bluegills by sample year. Big Seven Lake is in the control group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	1.87	3.35	4.14	4.62	5.17	5.78	5.59	0.00	0.00	0.00
	(0.08)	(0.11)	(0.20)	(0.27)	(0.13)	(0.16)	(0.00)	(-.--)	(-.--)	(-.--)
1989	1.98	3.22	4.27	4.79	5.11	5.71	6.23	6.23	0.00	0.00
	(0.17)	(0.09)	(0.09)	(0.10)	(0.15)	(0.13)	(0.19)	(0.00)	(-.--)	(-.--)
1990	1.78	2.91	4.08	4.92	4.96	5.75	6.23	6.86	0.00	0.00
	(0.18)	(0.08)	(0.13)	(0.19)	(0.22)	(0.30)	(0.15)	(0.37)	(-.--)	(-.--)
Average	1.87	3.15	4.17	4.79	5.12	5.74	6.21	6.65	0.00	0.00
	(0.07)	(0.05)	(0.07)	(0.12)	(0.09)	(0.10)	(0.11)	(0.25)	(-.--)	(-.--)
1991	1.88	3.05	4.07	4.80	5.45	5.57	6.09	6.30	6.30	0.00
	(0.05)	(0.09)	(0.25)	(0.13)	(0.28)	(0.30)	(0.22)	(0.21)	(-.--)	(-.--)
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	( )	( )
1992	2.18	3.23	4.25	4.85	5.79	6.30	6.70	6.79	6.55	0.00
	(0.09)	(0.06)	(0.16)	(0.13)	(0.14)	(0.18)	(0.60)	(0.47)	(0.13)	(-.--)
	(+)	(0)	(0)	(0)	(+)	(+)	(0)	(0)	( )	( )
1993	2.03	2.81	3.86	4.76	5.63	6.15	6.50	0.00	6.80	0.00
	(0.43)	(0.09)	(0.15)	(0.12)	(0.16)	(0.15)	(0.60)	(-.--)	(-.--)	(-.--)
	(0)	(-)	(-)	(0)	(+)	(+)	(0)	( )	( )	( )
1994	1.56	2.37	3.24	3.97	5.20	6.03	6.11	6.47	0.00	6.70
	(0.13)	(0.05)	(0.12)	(0.39)	(0.13)	(0.13)	(0.23)	(0.64)	(-.--)	(-.--)
	(-)	(-)	(-)	(-)	(0)	(+)	(0)	(0)	( )	( )
1995	1.68	2.69	2.93	4.22	4.84	5.89	6.08	6.36	6.40	0.00
	(0.12)	(0.10)	(0.59)	(0.14)	(0.46)	(0.23)	(0.34)	(0.48)	(-.--)	(-.--)
	(0)	(-)	(-)	(-)	(0)	(0)	(0)	(0)	( )	( )
1996	1.80	2.73	3.67	3.80	5.02	5.01	6.10	0.00	0.00	0.00
	(0.12)	(0.07)	(0.10)	(0.33)	(0.15)	(0.60)	(-.--)	(-.--)	(-.--)	(-.--)
	(0)	(-)	(-)	(-)	(0)	(0)	(0)	( )	( )	( )

Appendix 8.–Mean length-at-age of Crescent Lake bluegills by sample year. Crescent Lake is in the antimycin + walleye group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	1.83	2.94	3.83	4.68	5.69	6.02	6.23	0.00	0.00	0.00
	(0.19)	(0.20)	(0.18)	(0.10)	(0.14)	(0.33)	(0.26)	(-.--)	(-.--)	(-.--)
1989	1.87	2.94	4.06	4.77	5.57	6.37	7.64	7.01	0.00	0.00
	(0.05)	(0.08)	(0.15)	(0.25)	(0.16)	(0.29)	(0.36)	(-.--)	(-.--)	(-.--)
1990	1.72	2.89	4.07	5.12	5.63	6.29	6.78	5.98	0.00	0.00
	(0.07)	(0.11)	(0.17)	(0.28)	(0.19)	(0.23)	(0.53)	(-.--)	(-.--)	(-.--)
Average	1.82	2.91	4.00	4.81	5.63	6.26	6.85	6.50	0.00	0.00
	(0.05)	(0.07)	(0.10)	(0.10)	(0.09)	(0.16)	(0.32)	(0.00)	(-.--)	(-.--)
1991	1.86	3.80	4.51	5.36	6.10	6.77	6.93	6.95	0.00	0.00
	(0.09)	(0.19)	(0.28)	(0.27)	(0.40)	(0.18)	(0.16)	(0.10)	(-.--)	(-.--)
	(0)	(+)	(+)	(+)	(0)	(+)	(0)	(+)	( )	( )
1992	1.83	3.37	5.17	5.86	6.73	7.13	7.46	7.58	8.21	7.01
	(0.15)	(0.14)	(0.18)	(0.20)	(0.23)	(0.45)	(0.45)	(0.23)	(0.20)	(-.--)
	(0)	(+)	(+)	(+)	(+)	(+)	(0)	(+)	( )	( )
1993	1.80	2.94	5.03	6.82	7.16	7.37	7.62	7.35	7.80	7.70
	(0.26)	(0.10)	(0.18)	(0.40)	(0.19)	(0.18)	(0.17)	(0.10)	(0.55)	(-.--)
	(0)	(0)	(+)	(+)	(+)	(+)	(+)	(+)	( )	( )
1994	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)
	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
1995	1.75	2.92	3.90	4.85	6.51	6.74	0.00	0.00	0.00	0.00
	(0.07)	(0.09)	(-.--)	(0.20)	(0.15)	(0.33)	(-.--)	(-.--)	(-.--)	(-.--)
	(0)	(0)	( )	(0)	(+)	(0)	( )	( )	( )	( )
1996	1.69	2.63	3.90	4.41	6.06	6.53	6.99	6.77	0.00	0.00
	(0.05)	(0.08)	(0.12)	(-.--)	(0.25)	(0.18)	(0.17)	(0.24)	(-.--)	(-.--)
	(-)	(-)	(0)	( )	(+)	(0)	(0)	(0)	( )	( )

Appendix 9.–Mean length-at-age of Crispell Lake bluegills by sample year. Crispell Lake is in the walleye-only group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	1.60	2.36	3.08	4.32	5.32	6.10	6.24	0.00	0.00	0.00
	(0.08)	(0.15)	(0.13)	(0.22)	(0.14)	(0.22)	(0.57)	(-.--)	(-.--)	(-.--)
1989	1.52	2.47	3.26	4.42	5.17	6.08	6.34	0.00	0.00	0.00
	(0.06)	(0.08)	(0.14)	(0.36)	(0.21)	(0.15)	(0.30)	(-.--)	(-.--)	(-.--)
1990	1.44	2.36	3.66	4.74	5.39	6.19	6.89	6.69	7.72	0.00
	(0.04)	(0.08)	(0.11)	(0.14)	(0.27)	(0.24)	(0.16)	(-.--)	(-.--)	(-.--)
Average	1.50	2.41	3.48	4.54	5.28	6.13	6.72	6.69	7.72	0.00
	(0.04)	(0.05)	(0.08)	(0.12)	(0.11)	(0.12)	(0.14)	(-.--)	(-.--)	(-.--)
1991	0.00	2.49	3.74	5.03	5.52	6.28	6.73	7.05	0.00	0.00
	(-.--)	(0.10)	(0.13)	(0.23)	(0.26)	(0.43)	(0.13)	(0.14)	(-.--)	(-.--)
	( )	(0)	(+)	(+)	(0)	(0)	(0)	(+)	(-)	( )
1992	1.46	0.00	3.70	4.92	6.12	6.65	6.86	6.92	0.00	0.00
	(0.10)	(-.--)	(0.21)	(0.23)	(0.23)	(0.26)	(0.18)	(0.19)	(-.--)	(-.--)
	(0)	( )	(0)	(+)	(+)	(+)	(0)	(+)	( )	( )
1993	1.51	2.50	3.67	4.97	6.07	6.78	6.61	7.10	7.40	0.00
	(0.08)	(0.12)	(0.17)	(0.22)	(0.20)	(0.18)	(0.29)	(0.11)	(0.20)	(-.--)
	(0)	(0)	(0)	(+)	(+)	(+)	(0)	(+)	(0)	( )
1994	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)
	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
1995	1.36	2.28	3.36	5.13	6.46	7.39	7.19	7.22	8.10	0.00
	(0.05)	(0.11)	(0.19)	(0.20)	(0.46)	(0.31)	(0.30)	(0.41)	(-.--)	(-.--)
	(-)	(0)	(0)	(+)	(+)	(+)	(0)	(+)	( )	( )
1996	1.14	2.19	3.70	5.65	6.79	6.48	7.90	7.84	7.80	0.00
	(0.07)	(0.08)	(0.31)	(0.29)	(0.19)	(0.45)	(0.22)	(0.31)	(0.12)	(-.--)
	(-)	(-)	(0)	(+)	(+)	(0)	(+)	(+)	(0)	( )

Appendix 10.–Mean length-at-age of Lake Fourteen bluegills by sample year. Lake Fourteen is in the antimycin-only group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	2.12 (0.07)	3.17 (0.07)	3.93 (0.34)	4.62 (0.13)	5.82 (0.23)	5.89 (0.26)	0.00 (-.--)	0.00 (-.--)	0.00 (-.--)	0.00 (-.--)
1989	2.05 (0.13)	3.08 (0.09)	4.03 (0.17)	4.88 (0.27)	5.28 (0.15)	6.12 (0.19)	5.90 (0.11)	6.18 (-.--)	0.00 (-.--)	0.00 (-.--)
1990	1.87 (0.19)	3.19 (0.16)	4.12 (0.11)	4.88 (0.14)	5.28 (0.17)	5.89 (0.11)	6.15 (0.21)	7.01 (-.--)	0.00 (-.--)	0.00 (-.--)
Average	2.08 (0.06)	3.14 (0.06)	4.08 (0.09)	4.75 (0.10)	5.53 (0.12)	5.99 (0.10)	6.02 (0.12)	6.59 (0.00)	0.00 (-.--)	0.00 (-.--)
1991	2.19 (0.09) (0)	3.93 (0.12) (+)	5.03 (0.14) (+)	5.91 (0.11) (+)	6.63 (0.19) (+)	0.00 (-.--) ( )	6.78 (0.13) (+)	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )
1992	1.92 (0.09) (0)	3.51 (0.12) (+)	4.48 (0.42) (0)	5.77 (0.33) (+)	6.88 (0.10) (+)	6.69 (0.32) (+)	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )
1993	1.77 (0.14) (-)	3.09 (0.11) (0)	4.72 (0.08) (+)	5.83 (0.21) (+)	6.53 (0.09) (+)	6.87 (0.19) (+)	6.21 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )
1994	1.72 (0.05) (-)	2.45 (0.06) (-)	3.95 (0.09) (0)	5.08 (0.10) (+)	5.85 (0.26) (0)	6.47 (0.29) (+)	6.62 (0.29) (+)	0.00 (-.--) ( )	7.20 (-.--) ( )	0.00 (-.--) ( )
1995	1.63 (0.07) (-)	2.67 (0.06) (-)	3.78 (0.29) (0)	4.68 (0.21) (0)	5.61 (0.19) (0)	6.02 (0.30) (0)	0.00 (-.--) ( )	0.00 (-.--) ( )	7.00 (-.--) ( )	0.00 (-.--) ( )
1996	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )

Appendix 11.–Mean length-at-age of Horseshoe Lake bluegills by sample year. Horseshoe Lake is in the antimycin + catch-and-release group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	2.00	3.07	3.72	4.46	5.03	0.00	0.00	0.00	0.00	0.00
	(0.12)	(0.12)	(0.18)	(0.18)	(0.22)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)
1989	1.92	3.04	4.16	4.84	5.15	5.62	7.18	0.00	0.00	0.00
	(0.12)	(0.13)	(0.46)	(0.22)	(0.13)	(0.23)	(2.65)	(-.--)	(-.--)	(-.--)
1990	1.30	3.03	4.35	4.65	5.79	5.86	6.16	7.80	0.00	0.00
	(0.00)	(0.13)	(0.12)	(0.58)	(0.39)	(0.19)	(0.28)	(-.--)	(-.--)	(-.--)
Average	1.94	3.04	4.09	4.58	5.25	5.77	6.30	7.80	0.00	0.00
	(0.08)	(0.08)	(0.10)	(0.14)	(0.12)	(0.15)	(0.45)	(-.--)	(-.--)	(-.--)
1991	1.94	0.00	5.18	6.53	6.90	7.21	7.15	7.33	0.00	0.00
	(0.09)	(-.--)	(0.41)	(0.17)	(0.29)	(0.34)	(0.44)	(0.29)	(-.--)	(-.--)
	(0)	( )	(+)	(+)	(+)	(+)	(0)	(-)	( )	( )
1992	1.95	3.30	4.41	6.77	7.59	7.71	7.94	7.89	0.00	0.00
	(0.08)	(0.12)	(1.46)	(0.38)	(0.16)	(0.17)	(0.21)	(0.67)	(-.--)	(-.--)
	(0)	(+)	(0)	(+)	(+)	(+)	(0)	(0)	( )	( )
1993	1.58	3.10	5.27	5.66	7.16	7.84	7.96	8.38	8.20	0.00
	(0.11)	(0.13)	(0.17)	(0.85)	(0.31)	(0.28)	(0.36)	(0.42)	(0.80)	(-.--)
	(-)	(0)	(+)	(0)	(+)	(+)	(0)	(+)	( )	( )
1994	1.57	2.44	3.90	6.10	7.20	7.65	8.03	8.04	8.40	8.20
	(0.07)	(0.08)	(0.16)	(0.19)	(0.38)	(0.42)	(0.14)	(0.18)	(0.53)	(-.--)
	(-)	(-)	(0)	(+)	(+)	(+)	(0)	(+)	( )	( )
1995	1.72	2.85	3.51	5.27	7.03	7.34	7.97	8.23	8.15	8.30
	(0.07)	(0.05)	(0.09)	(0.19)	(0.22)	(0.39)	(0.13)	(0.29)	(0.30)	(-.--)
	(-)	(-)	(-)	(+)	(+)	(+)	(0)	(0)	( )	( )
1996	1.95	3.20	4.45	5.06	6.60	7.34	8.12	8.38	8.70	9.02
	(0.17)	(0.18)	(0.15)	(0.27)	(0.22)	(0.30)	(0.11)	(0.32)	(0.40)	(0.17)
	(0)	(0)	(0)	(+)	(+)	(+)	(0)	(+)	( )	( )

Appendix 12.–Mean length-at-age of Island Lake bluegills by sample year. Island Lake is in the antimycin-only group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	1.93	2.94	3.58	4.10	4.75	5.40	6.07	6.36	0.00	0.00
	(0.05)	(0.17)	(0.14)	(0.14)	(0.22)	(0.29)	(0.15)	(0.13)	(-.--)	(-.--)
1989	1.99	2.76	3.59	4.18	4.52	5.73	5.66	6.06	0.00	0.00
	(0.20)	(0.06)	(0.15)	(0.21)	(0.19)	(0.18)	(0.27)	(0.26)	(-.--)	(-.--)
1990	1.67	2.47	3.59	4.52	4.82	5.46	5.88	6.52	0.00	0.00
	(0.07)	(0.07)	(0.09)	(0.12)	(0.24)	(0.44)	(0.16)	(0.48)	(-.--)	(-.--)
Average	1.81	2.63	3.59	4.26	4.69	5.61	5.86	6.23	0.00	0.00
	(0.04)	(0.04)	(0.07)	(0.09)	(0.15)	(0.15)	(0.12)	(0.19)	(-.--)	(-.--)
1991	1.69	2.81	3.70	5.02	5.84	6.17	6.43	7.01	7.19	0.00
	(0.06)	(0.08)	(0.30)	(0.14)	(0.28)	(1.06)	(0.50)	(0.14)	(0.73)	(-.--)
	(0)	(+)	(0)	(+)	(+)	(0)	(0)	(+)	( )	( )
1992	1.66	2.61	3.79	4.58	5.86	6.53	6.68	7.19	6.98	0.00
	(0.07)	(0.09)	(0.10)	(0.15)	(0.22)	(0.32)	(0.48)	(0.12)	(0.85)	(-.--)
	(0)	(0)	(+)	(+)	(+)	(+)	(+)	(+)	( )	( )
1993	0.00	2.64	3.68	4.90	5.96	6.71	7.44	7.28	7.37	7.50
	(-.--)	(0.09)	(0.15)	(0.12)	(0.29)	(0.17)	(0.31)	(0.31)	(0.68)	(-.--)
	( )	(0)	(0)	(+)	(+)	(+)	(+)	(+)	( )	( )
1994	1.56	2.25	3.18	4.58	5.57	6.60	6.81	7.13	6.93	0.00
	(0.11)	(0.14)	(0.11)	(0.20)	(0.22)	(0.24)	(0.26)	(0.07)	(-.--)	(-.--)
	(0)	(-)	(-)	(+)	(+)	(+)	(+)	(+)	( )	( )
1995	1.46	2.28	3.10	3.96	5.29	6.08	6.51	7.07	7.03	4.50
	(0.07)	(0.07)	(-.--)	(0.19)	(0.22)	(0.29)	(0.36)	(0.26)	(0.36)	(0.28)
	(-)	(-)	( )	(-)	(+)	(+)	(+)	(+)	( )	( )
1996	1.54	2.20	3.29	3.81	5.01	6.25	6.78	7.14	6.80	0.00
	(0.06)	(0.10)	(0.12)	(0.62)	(0.16)	(0.29)	(0.20)	(0.11)	(0.60)	(-.--)
	(0)	(-)	(-)	(0)	(0)	(+)	(+)	(+)	( )	( )

Appendix 13.–Mean length-at-age of Joslin Lake bluegills by sample year. Joslin Lake is in the control group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	1.70 (0.05)	2.92 (0.14)	4.04 (0.14)	4.76 (0.19)	5.75 (0.20)	6.83 (0.14)	7.34 (0.21)	7.36 (0.33)	7.20 (-.--)	0.00 (-.--)
1989	1.57 (0.06)	2.60 (0.10)	3.83 (0.10)	4.91 (0.18)	5.78 (0.21)	6.64 (0.13)	7.04 (0.18)	6.86 (0.22)	0.00 (-.--)	0.00 (-.--)
1990	1.50 (0.07)	2.44 (0.09)	3.83 (0.13)	4.93 (0.10)	5.68 (0.16)	6.41 (0.18)	6.94 (0.13)	7.45 (0.94)	0.00 (-.--)	0.00 (-.--)
Average	1.60 (0.03)	2.68 (0.07)	3.87 (0.07)	4.88 (0.08)	5.75 (0.13)	6.66 (0.08)	7.03 (0.10)	7.26 (0.29)	7.20 (-.--)	0.00 (-.--)
1991	1.63 (0.06) (0)	2.39 (0.11) (-)	3.79 (0.12) (0)	5.09 (0.17) (0)	5.96 (0.24) (0)	6.54 (0.21) (0)	7.07 (0.12) (0)	7.57 (0.17) (0)	7.05 (0.31) (0)	0.00 (-.--) ( )
1992	1.59 (0.10) (0)	2.34 (0.16) (-)	3.43 (0.11) (-)	4.85 (0.20) (0)	5.96 (0.16) (0)	6.78 (0.19) (0)	6.98 (0.26) (0)	7.32 (0.30) (0)	7.33 (0.26) (0)	0.00 (-.--) ( )
1993	1.41 (0.07) (-)	2.25 (0.11) (-)	3.20 (0.11) (-)	4.52 (0.20) (-)	5.68 (0.15) (0)	6.48 (0.16) (0)	6.92 (0.14) (0)	7.06 (0.51) (0)	0.00 (-.--) ( )	0.00 (-.--) ( )
1994	1.40 (0.20) (0)	2.15 (0.15) (-)	3.42 (0.19) (-)	4.43 (0.16) (-)	5.57 (0.19) (0)	6.48 (0.21) (0)	7.07 (0.14) (0)	6.82 (0.38) (0)	0.00 (-.--) ( )	0.00 (-.--) ( )
1995	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )
1996	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )

Appendix 14.–Mean length-at-age of Long Lake bluegills by sample year. Long Lake is in the antimycin + walleye group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	1.76	2.57	3.07	4.53	5.42	5.93	6.66	6.78	7.20	0.00
	(0.09)	(0.07)	(0.00)	(0.15)	(0.20)	(0.37)	(0.28)	(0.39)	(-.--)	(-.--)
1989	1.63	2.59	3.75	4.74	5.15	5.98	6.55	6.80	0.00	0.00
	(0.07)	(0.10)	(0.11)	(0.17)	(0.22)	(0.18)	(0.33)	(0.43)	(-.--)	(-.--)
1990	1.52	2.33	3.34	4.56	5.33	6.15	6.71	6.99	0.00	0.00
	(0.07)	(0.08)	(0.08)	(0.12)	(0.22)	(0.23)	(0.20)	(0.19)	(-.--)	(-.--)
Average	1.64	2.51	3.54	4.59	5.32	6.02	6.68	6.85	7.20	0.00
	(0.04)	(0.05)	(0.07)	(0.08)	(0.13)	(0.14)	(0.15)	(0.22)	(-.--)	(-.--)
1991	1.89	2.97	4.81	6.11	7.10	7.54	7.50	7.28	8.44	0.00
	(0.13)	(0.11)	(0.15)	(0.18)	(0.18)	(0.50)	(0.23)	(-.--)	(-.--)	(-.--)
	(+)	(+)	(+)	(+)	(+)	(+)	(+)	( )	( )	( )
1992	2.15	3.24	4.94	6.82	7.20	7.37	7.09	0.00	8.82	0.00
	(0.10)	(0.10)	(0.14)	(0.11)	(0.16)	(0.32)	(-.--)	(-.--)	(-.--)	(-.--)
	(+)	(+)	(+)	(+)	(+)	(+)	( )	( )	( )	( )
1993	1.48	3.11	4.88	6.36	7.37	0.00	0.00	0.00	0.00	0.00
	(0.10)	(0.13)	(0.33)	(0.15)	(0.33)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)
	(0)	(+)	(+)	(+)	(+)	( )	( )	( )	( )	( )
1994	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)
	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
1995	1.66	2.61	3.35	5.74	6.82	7.95	8.06	7.50	7.20	8.10
	(0.07)	(0.13)	(0.15)	(0.22)	(0.92)	(0.16)	(0.11)	(-.--)	(1.00)	(-.--)
	(0)	(0)	(0)	(+)	(+)	(+)	(+)	( )	(0)	( )
1996	1.70	2.60	3.45	5.45	6.68	7.18	8.47	8.60	8.78	8.70
	(0.05)	(0.11)	(0.13)	(1.50)	(0.22)	(0.40)	(0.28)	(0.35)	(0.30)	(0.60)
	(0)	(0)	(0)	(0)	(+)	(+)	(+)	(+)	(+)	( )

Appendix 15.–Mean length-at-age of Myers Lake bluegills by sample year. Myers Lake is in the antimycin-only group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	0.00	0.00	3.89	4.83	5.14	5.88	6.10	6.69	6.81	0.00
	(-.--)	(-.--)	(0.79)	(0.31)	(0.17)	(0.28)	(0.27)	(0.13)	(-.--)	(-.--)
1989	1.60	2.74	3.74	4.69	5.48	5.99	5.87	6.34	0.00	0.00
	(0.06)	(0.11)	(0.10)	(0.13)	(0.28)	(0.11)	(0.48)	(1.50)	(-.--)	(-.--)
1990	1.59	2.55	3.54	4.53	5.02	6.07	6.15	6.24	0.00	0.00
	(0.17)	(0.05)	(0.12)	(0.28)	(0.13)	(0.24)	(0.14)	(0.51)	(-.--)	(-.--)
Average	1.60	2.65	3.60	4.66	5.14	5.98	6.11	6.59	6.81	0.00
	(0.06)	(0.07)	(0.10)	(0.11)	(0.10)	(0.10)	(0.12)	(0.22)	(-.--)	(-.--)
1991	1.45	2.93	3.60	4.74	5.28	5.81	6.39	6.35	0.00	0.00
	(0.09)	(0.19)	(0.11)	(0.13)	(0.34)	(0.16)	(0.14)	(0.33)	(-.--)	(-.--)
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	( )	( )
1992	1.44	2.67	3.62	4.53	5.51	6.22	6.16	6.65	6.65	0.00
	(0.19)	(0.10)	(0.12)	(0.12)	(0.16)	(0.22)	(0.27)	(0.33)	(0.93)	(-.--)
	(0)	(0)	(0)	(0)	(+)	(0)	(0)	(0)	(0)	( )
1993	1.46	2.49	3.50	4.57	5.19	5.99	6.40	7.20	0.00	0.00
	(-.--)	(0.12)	(0.11)	(0.13)	(0.18)	(0.08)	(-.--)	(-.--)	(-.--)	(-.--)
	( )	(0)	(0)	(0)	(0)	(0)	( )	( )	( )	( )
1994	1.42	2.30	3.02	4.11	5.05	5.37	5.79	6.27	0.00	0.00
	(0.07)	(-.--)	(0.08)	(0.20)	(0.19)	(0.17)	(0.21)	(0.22)	(-.--)	(-.--)
	(-)	( )	(0)	(-)	(0)	(-)	(0)	(0)	( )	( )
1995	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)
	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
1996	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)	(-.--)
	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

Appendix 16.–Mean length-at-age of Saddle Lake bluegills by sample year. Saddle Lake is in the control group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	0.00	0.00	4.08	4.72	5.13	5.93	6.09	6.56	6.56	0.00
	(-.--)	(-.--)	(0.59)	(0.08)	(0.11)	(0.17)	(0.15)	(0.15)	(0.51)	(-.--)
1989	2.28	3.49	4.50	4.75	5.04	6.07	6.37	7.74	0.00	0.00
	(0.30)	(0.12)	(0.27)	(0.09)	(0.15)	(0.18)	(0.34)	(0.91)	(-.--)	(-.--)
1990	1.80	3.31	4.51	5.06	5.39	5.82	6.17	5.98	0.00	0.00
	(0.12)	(0.20)	(0.13)	(0.22)	(0.16)	(0.19)	(-.--)	(0.00)	(-.--)	(-.--)
Average	1.87	3.43	4.48	4.85	5.15	5.95	6.19	6.61	6.56	0.00
	(0.11)	(0.10)	(0.12)	(0.09)	(0.08)	(0.11)	(0.16)	(0.14)	(0.51)	(-.--)
1991	1.59	3.08	4.64	5.13	5.48	5.53	6.29	6.43	0.00	0.00
	(0.14)	(0.07)	(0.25)	(0.19)	(0.38)	(0.45)	(0.15)	(0.19)	(-.--)	(-.--)
	(0)	(-)	(0)	(+)	(0)	(0)	(0)	(0)	( )	( )
1992	1.90	3.07	4.26	4.94	5.78	6.58	6.02	6.49	6.76	7.80
	(0.06)	(0.08)	(0.12)	(0.13)	(0.24)	(0.62)	(0.36)	(0.23)	(0.66)	(-.--)
	(0)	(-)	(0)	(0)	(+)	(0)	(0)	(0)	(0)	( )
1993	0.00	3.19	4.23	5.05	5.63	6.14	6.97	6.25	0.00	0.00
	(-.--)	(0.20)	(0.13)	(0.11)	(0.31)	(0.10)	(1.30)	(0.69)	(-.--)	(-.--)
	( )	(0)	(0)	(+)	(+)	(0)	(0)	(0)	( )	( )
1994	1.95	0.00	3.88	4.88	5.48	5.98	6.28	6.27	6.50	0.00
	(0.05)	(-.--)	(0.10)	(0.09)	(0.12)	(0.22)	(0.23)	(0.96)	(1.00)	(-.--)
	(0)	( )	(-)	(0)	(+)	(0)	(0)	(0)	(0)	( )
1995	1.68	3.00	3.57	4.73	5.46	5.97	6.26	7.17	7.35	7.10
	(0.07)	(0.07)	(0.37)	(0.08)	(0.27)	(0.16)	(0.33)	(0.20)	(0.70)	(-.--)
	(0)	(-)	(-)	(0)	(0)	(0)	(0)	(0)	(0)	( )
1996	1.71	2.81	3.97	4.70	5.09	5.97	6.39	6.73	7.00	7.30
	(0.06)	(0.10)	(0.07)	(1.40)	(0.21)	(0.17)	(0.22)	(0.25)	(0.24)	(-.--)
	(0)	(-)	(-)	(0)	(0)	(0)	(0)	(0)	(+)	( )

Appendix 17.–Mean length-at-age of Selkirk Lake bluegills by sample year. Selkirk Lake is in the walleye-only group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	1.89 (0.47)	2.70 (0.07)	3.31 (0.14)	3.84 (0.12)	4.59 (0.18)	5.29 (0.20)	5.79 (0.29)	6.69 (0.16)	0.00 (-.--)	0.00 (-.--)
1989	2.34 (0.17)	3.10 (0.49)	3.77 (0.10)	4.33 (0.57)	4.79 (0.14)	5.34 (0.22)	5.82 (0.30)	5.81 (0.59)	0.00 (-.--)	7.93 (0.13)
1990	1.74 (0.07)	3.23 (0.09)	3.79 (0.56)	4.48 (0.16)	4.60 (0.28)	5.21 (0.21)	5.56 (0.25)	6.19 (0.21)	6.79 (0.80)	7.26 (-.--)
Average	1.87 (0.07)	2.95 (0.06)	3.71 (0.09)	4.07 (0.10)	4.69 (0.11)	5.27 (0.12)	5.69 (0.16)	6.27 (0.16)	6.79 (0.80)	7.71 (0.09)
1991	1.71 (0.06) (0)	3.05 (0.15) (0)	4.34 (0.18) (+)	4.57 (0.11) (+)	4.90 (0.23) (0)	5.19 (0.30) (0)	5.66 (0.18) (0)	5.97 (0.19) (0)	5.97 (0.26) (-)	0.08 (-.--) ( )
1992	1.79 (0.08) (0)	2.60 (0.23) (0)	4.30 (0.32) (+)	4.96 (0.11) (+)	5.20 (0.33) (+)	5.59 (0.22) (0)	5.85 (0.19) (0)	6.10 (0.06) (0)	6.42 (-.--) ( )	7.09 (1.81) (0)
1993	1.60 (0.08) (-)	2.84 (0.07) (0)	3.96 (0.28) (0)	5.12 (0.28) (+)	5.77 (0.16) (+)	5.93 (0.19) (+)	6.11 (0.25) (0)	6.45 (0.40) (0)	6.34 (0.23) (-)	0.00 (-.--) ( )
1994	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )
1995	1.57 (0.05) (-)	2.60 (0.11) (-)	3.34 (0.29) (0)	5.35 (0.18) (+)	5.77 (0.48) (+)	7.04 (0.17) (+)	6.90 (0.23) (+)	6.77 (0.28) (0)	6.87 (0.30) (0)	6.94 (0.20) (-)
1996	1.61 (0.07) (-)	2.62 (0.10) (-)	3.70 (0.37) (0)	4.03 (0.39) (0)	7.14 (0.29) (+)	7.09 (0.23) (+)	7.26 (0.56) (+)	7.87 (0.37) (+)	7.56 (0.21) (+)	7.55 (0.14) (0)

Appendix 18.–Mean length-at-age of Turk Lake bluegills by sample year. Turk Lake is in the control group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	0.00 (-.--)	0.00 (-.--)	0.00 (-.--)	4.38 (0.33)	5.60 (0.25)	5.92 (0.34)	6.22 (0.69)	7.72 (0.00)	0.00 (-.--)	0.00 (-.--)
1989	1.60 (0.07)	2.44 (0.09)	3.32 (0.11)	4.23 (0.24)	4.90 (0.19)	6.18 (0.18)	6.45 (0.42)	7.40 (0.24)	0.00 (-.--)	0.00 (-.--)
1990	0.00 (-.--)	2.33 (0.09)	3.14 (0.12)	4.67 (0.14)	5.17 (0.50)	5.99 (0.19)	6.43 (0.22)	6.50 (0.00)	7.09 (-.--)	0.00 (-.--)
Average	1.60 (0.07)	2.40 (0.06)	3.20 (0.09)	4.52 (0.11)	5.34 (0.16)	6.07 (0.13)	6.39 (0.21)	7.23 (0.10)	7.09 (-.--)	0.00 (-.--)
1991	1.40 (0.08) (-)	2.23 (0.09) (-)	3.26 (0.15) (0)	4.54 (0.18) (0)	5.65 (0.24) (0)	6.05 (0.25) (0)	6.45 (0.18) (0)	6.61 (0.59) (0)	6.81 (-.--) ( )	0.00 (-.--) ( )
1992	1.68 (0.07) (+)	2.40 (0.06) (0)	3.20 (0.15) (0)	4.30 (0.20) (0)	5.51 (0.22) (0)	6.67 (0.20) (+)	7.01 (0.59) (0)	6.97 (0.37) (0)	7.11 (0.11) (0)	7.01 (-.--) ( )
1993	1.32 (0.05) (-)	2.41 (0.08) (0)	3.26 (0.12) (0)	4.50 (0.14) (0)	5.44 (0.14) (0)	6.66 (0.17) (+)	6.71 (0.28) (0)	6.73 (0.29) (0)	7.20 (-.--) ( )	0.00 (-.--) ( )
1994	0.00 (-.--) ( )	2.34 (0.20) (0)	3.39 (0.14) (0)	4.75 (0.21) (0)	5.67 (0.21) (0)	6.65 (0.19) (+)	7.04 (0.17) (+)	7.08 (0.22) (0)	6.75 (1.90) (0)	0.00 (-.--) ( )
1995	1.61 (0.08) (0)	2.39 (0.12) (0)	3.00 (0.26) (0)	4.79 (0.24) (0)	5.94 (0.31) (+)	6.73 (0.35) (+)	7.16 (0.22) (+)	6.98 (0.21) (0)	7.30 (0.42) (0)	0.00 (-.--) ( )
1996	1.56 (0.07) (0)	2.40 (0.09) (0)	3.52 (0.16) (+)	5.08 (-.--) ( )	6.18 (0.19) (+)	6.95 (0.21) (+)	6.97 (0.46) (0)	7.19 (0.27) (0)	7.58 (0.17) (+)	7.60 (-.--) ( )

Appendix 19.–Mean length-at-age of Williams Lake bluegills by sample year. Williams Lake is in the antimycin + catch-and-release group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	1.74 (0.05)	3.02 (0.15)	4.41 (0.16)	5.64 (0.16)	6.40 (0.30)	6.60 (0.19)	6.91 (0.60)	0.00 (-.--)	0.00 (-.--)	0.00 (-.--)
1989	1.57 (0.17)	3.17 (0.09)	4.37 (0.15)	5.59 (0.21)	6.71 (0.21)	6.92 (0.44)	7.09 (0.00)	7.34 (0.51)	0.00 (-.--)	0.00 (-.--)
1990	0.00 (-.--)	2.99 (0.08)	4.42 (0.14)	5.77 (0.20)	6.09 (0.21)	6.67 (0.30)	6.92 (0.26)	7.60 (-.--)	0.00 (-.--)	0.00 (-.--)
Average	1.72 (0.05)	3.05 (0.06)	4.41 (0.09)	5.65 (0.11)	6.47 (0.14)	6.71 (0.17)	6.95 (0.31)	7.43 (0.34)	0.00 (-.--)	0.00 (-.--)
1991	1.96 (0.07) (+)	4.43 (0.19) (+)	5.69 (0.42) (+)	6.55 (0.31) (+)	7.47 (0.28) (+)	7.98 (0.20) (+)	8.14 (0.31) (+)	7.94 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )
1992	2.02 (0.12) (+)	4.04 (0.19) (+)	6.65 (0.28) (+)	6.75 (0.41) (+)	7.66 (0.35) (+)	8.09 (0.42) (+)	8.43 (0.48) (+)	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )
1993	1.57 (0.09) (-)	3.20 (0.16) (0)	5.90 (0.30) (+)	7.36 (0.47) (+)	7.65 (0.28) (+)	7.76 (-.--) ( )	8.05 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )
1994	1.82 (0.12) (0)	2.83 (0.09) (-)	4.94 (0.21) (+)	7.07 (0.04) (+)	7.54 (0.31) (+)	7.60 (0.40) (+)	7.95 (0.22) (+)	7.97 (0.66) (0)	8.80 (0.60) ( )	0.00 (-.--) ( )
1995	1.60 (0.08) (-)	2.86 (0.10) (-)	4.16 (0.16) (-)	6.26 (0.22) (+)	7.69 (0.17) (+)	7.93 (0.33) (+)	7.73 (0.69) (0)	8.00 (-.--) ( )	0.00 (0.60) ( )	0.00 (-.--) ( )
1996	1.54 (0.08) (-)	3.00 (0.11) (0)	4.55 (0.12) (0)	5.57 (0.29) (0)	7.00 (0.24) (+)	7.42 (0.29) (+)	7.53 (0.73) (0)	8.00 (-.--) ( )	8.50 (-.--) ( )	0.00 (-.--) ( )

Appendix 20.–Mean length-at-age of Woodard Lake bluegills by sample year. Woodard Lake is in the walleye-only group. Two standard errors are given in parenthesis immediately below mean length. Individual year means significant less than the 1988-90 average are noted as "(-)", greater as "(+)", and not different as "(0)".

Sample	Age									
Year	1	2	3	4	5	6	7	8	9	10
1988	0.00 (-.--)	0.00 (-.--)	4.02 (0.21)	4.83 (0.20)	5.80 (0.35)	6.34 (0.25)	6.76 (0.22)	6.56 (0.46)	7.26 (0.51)	0.00 (-.--)
1989	1.34 (0.08)	2.43 (0.09)	3.70 (0.16)	4.83 (0.17)	5.46 (0.23)	6.60 (0.18)	6.60 (0.26)	6.79 (0.24)	7.05 (0.08)	7.01 (-.--)
1990	1.45 (0.08)	2.39 (0.12)	3.80 (0.13)	5.09 (0.19)	5.84 (0.33)	6.34 (0.29)	6.70 (0.30)	6.95 (0.43)	7.01 (0.79)	0.00 (-.--)
Average	1.39 (0.06)	2.41 (0.07)	3.79 (0.09)	4.91 (0.11)	5.69 (0.18)	6.43 (0.14)	6.70 (0.16)	6.76 (0.21)	7.11 (0.31)	7.01 (-.--)
1991	1.30 (0.06) (0)	2.48 (0.08) (0)	3.76 (0.10) (0)	5.52 (0.21) (+)	6.06 (0.21) (0)	6.34 (0.24) (0)	6.64 (0.31) (0)	7.16 (0.22) (0)	7.18 (0.09) (0)	0.00 (-.--) ( )
1992	1.43 (0.10) (0)	2.39 (0.11) (0)	3.76 (0.19) (0)	5.02 (0.19) (0)	6.20 (0.19) (+)	6.59 (0.27) (0)	7.03 (0.11) (+)	7.27 (0.38) (0)	7.24 (0.17) (0)	7.24 (0.08) ( )
1993	1.40 (0.31) (0)	2.39 (0.14) (0)	3.94 (0.21) (0)	5.66 (0.18) (+)	6.17 (0.18) (+)	7.07 (0.19) (+)	7.02 (0.13) (+)	7.13 (0.19) (0)	7.50 (-.--) ( )	0.00 (-.--) ( )
1994	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )	0.00 (-.--) ( )
1995	1.34 (0.07) (0)	2.64 (0.16) (+)	4.40 (0.22) (+)	5.95 (0.19) (+)	6.83 (0.31) (+)	7.14 (0.33) (+)	7.83 (0.20) (+)	8.04 (0.29) (+)	7.80 (0.72) (0)	8.40 (-.--) ( )
1996	1.39 (0.11) (0)	2.68 (0.12) (+)	4.84 (0.17) (+)	5.82 (0.81) (0)	7.13 (0.17) (+)	7.17 (0.31) (+)	8.17 (0.35) (+)	8.17 (0.30) (+)	8.60 (0.10) (0)	8.37 (0.24) (+)

Appendix 21.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Algoe Lake (antimycin + catch-and-release group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age interval	Year of growth 1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1	1.65	1.63	1.37	1.61	**1.82**	**1.80**	*1.39*	*1.44*	1.63	*1.42*
	0.14	0.09	0.16	0.06	0.08	0.10	0.10	0.18	0.16	0.09
1 - 2	0.89	0.81		0.85	**2.24**	**1.86**	0.80	0.69	0.82	*0.72*
	0.10	0.05		0.03	0.10	0.12	0.05	0.22	0.05	0.06
2 - 3	0.86	0.65	0.71	0.79	**2.71**	**2.50**	**1.15**	**0.97**	0.84	0.74
	0.16	0.06	0.06	0.04	0.36	0.16	0.08	0.11	0.21	0.06
3 - 4	0.75	0.86	0.76	0.79	**2.41**	**2.08**	0.93	*0.64*	*0.65*	*0.44*
	0.15	0.09	0.07	0.04	0.87	0.26	0.25	0.06	0.04	0.15
4 - 5	0.65	0.73	0.71	0.68	**1.97**	**1.43**	**1.59**	0.20	0.40	0.58
	0.10	0.14	0.14	0.05	0.11	0.56	0.66	0.17	0.06	0.06
5 - 6	0.53	0.87	0.76	0.79	**2.10**	0.92	*0.51*	*0.27*	*0.19*	*0.49*
	0.23	0.10	0.14	0.07	0.17	0.60	0.29	0.10	0.04	0.08
Sum	5.34	5.54		5.51	**13.24**	**10.59**	6.37	*4.21*	*4.53*	*4.39*
2 SE	0.37	0.22		0.12	0.95	0.87	0.76	0.36	0.28	0.21
Upper	5.71	5.76		5.63	14.19	11.46	7.13	4.57	4.81	4.60
Lower	4.96	5.33		5.39	12.29	9.72	5.61	3.85	4.25	4.18

Appendix 22.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Big Lake (antimycin + walleye group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age	Year of growth									
interval	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1	1.82	1.60	1.57	1.71	**1.98**	**1.93**	2.07	1.77	1.79	1.80
	0.11	0.07	0.05	0.06	0.13	0.07	0.71	0.06	0.05	0.04
1 - 2	1.15	0.65	0.52	0.66	0.72	**0.86**	0.69	0.66	**0.76**	0.61
	0.12	0.03	0.05	0.03	0.04	0.09	0.04	0.01	0.04	0.04
2 - 3	0.80	0.73	0.48	0.57	0.60	0.64	**0.73**	**0.70**	0.61	**0.65**
	0.07	0.14	0.03	0.03	0.14	0.05	0.08	0.04	0.00	0.04
3 - 4	0.66	0.58	0.50	0.59	**0.64**	*0.49*	*0.53*	0.80	*0.41*	0.50
	0.06	0.15	0.11	0.07	0.41	0.06	0.07	0.14	0.04	0.05
4 - 5	0.66	0.64	0.51	0.62	0.55	0.65	0.52	0.70	0.55	*0.48*
	0.10	0.09	0.18	0.06	0.14	0.08	0.06	0.09	0.12	0.04
5 - 6	0.69	0.55	0.34	0.50	0.45	0.53	0.47	0.45	0.43	0.41
	0.19	0.08	0.06	0.05	0.24	0.31	0.05	0.08	0.11	0.10
Sum	5.78	4.76	3.92	4.65	4.94	5.10	5.01	**5.08**	*3.57*	4.45
2 SE	0.28	0.24	0.23	0.13	0.52	0.34	0.71	0.20	0.17	0.13
Upper	6.06	5.00	4.15	4.78	5.46	5.44	5.72	5.28	3.74	4.58
Lower	5.50	4.51	3.70	4.52	4.42	4.76	4.30	4.88	3.40	4.32

Appendix 23.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Big Seven Lake (control group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age	Year of growth									
interval	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1	1.87	1.98	1.78	1.87	1.88	**2.18**	2.03	*1.56*	1.68	1.80
	0.08	0.17	0.18	0.07	0.05	0.09	0.43	0.13	0.12	0.12
1 - 2	1.15	1.09	1.03	1.09	1.05	1.04	*0.72*	*0.82*	*0.97*	*0.80*
	0.07	0.04	0.05	0.03	0.06	0.08	0.04	0.05	0.05	0.07
2 - 3	0.69	0.73	0.67	0.70	0.76	0.79	0.61	*0.47*	*0.49*	0.79
	0.12	0.07	0.07	0.05	0.13	0.07	0.06	0.03	0.02	0.082
3 - 4	0.59	0.57	0.55	0.57	0.52	0.57	0.54	*0.39*	0.68	*0.31*
	0.15	0.08	0.07	0.06	0.06	0.07	0.06	0.08	0.05	0.12
4 - 5	0.47	0.48	0.44	0.47	0.40	0.54	0.48	0.43	0.57	**0.61**
	0.06	0.06	0.08	0.04	0.07	0.07	0.05	0.07	0.15	0.08
5 - 6	0.52	0.44	0.50	0.48	0.03	0.54	0.45	0.48	0.64	*0.29*
	0.09	0.05	0.12	0.04	0.08	0.14	0.09	0.07	0.162	0.13
Sum	5.29	5.30	4.97	5.18	*4.64*	**5.66**	*4.83*	*4.15*	5.03	*4.60*
2 SE	0.24	0.22	0.25	0.12	0.20	0.21	0.44	0.19	0.26	0.25
Upper	5.53	5.51	5.22	5.30	4.84	5.87	5.27	4.34	5.29	4.85
Lower	5.05	5.08	4.72	5.06	4.45	5.45	4.39	3.96	4.77	4.35

Appendix 24.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Crescent Lake (antimycin + walleye group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age	Year of growth									
interval	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1	1.83	1.87	1.72	1.82	1.86	1.83	1.80	1.88	1.74	1.69
	0.19	0.05	0.07	0.05	0.10	0.15	0.26	0.07	0.07	0.05
1 - 2	0.91	0.92	0.95	0.93	**1.74**	**1.14**	**1.01**	1.00	**1.04**	*0.80*
	0.08	0.05	0.05	0.03	0.19	0.07	0.05	0.00	0.04	0.05
2 - 3	0.77	1.01	1.00	0.94	**1.37**	**1.44**	**1.51**	0.89	0.92	1.03
	0.09	0.08	0.08	0.05	0.16	0.12	0.09	0.98	0.00	0.06
3 - 4	0.66	0.89	0.85	0.75	**1.33**	**1.33**	**1.48**	**0.96**	**0.85**	*0.37*
	0.04	0.14	0.09	0.04	0.15	0.08	0.03	0.08	0.06	0.00
4 - 5	0.57	0.65	0.68	0.62	**1.05**	**1.27**	**1.16**	0.54	**0.76**	**0.86**
	0.07	0.08	0.11	0.05	0.20	0.15	0.36	0.28	0.08	0.11
5 - 6	0.50	0.65	0.55	0.58	**1.04**	**0.76**	0.49	*0.18*	*0.20*	0.55
	0.12	0.12	0.09	0.06	0.11	0.04	0.09	0.00	0.076	0.08
Sum	5.24	5.99	5.74	5.64	**8.38**	**7.78**	**7.45**	5.45	5.51	*5.30*
2 SE	0.26	0.22	0.21	0.11	0.37	0.26	0.45	1.00	0.15	0.17
Upper	5.50	6.21	5.95	5.75	8.75	8.04	7.90	6.45	5.66	5.47
Lower	4.98	5.77	5.54	5.53	8.01	7.52	7.00	4.45	5.36	5.13

Appendix 25.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Crispell Lake (walleye-only group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age	Year of growth									
interval	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1	1.60	1.52	1.44	1.50	**1.69**	1.46	1.51	1.51	*1.34*	*1.14*
	0.08	0.06	0.04	0.04	0.05	0.10	0.08	0.06	0.05	0.07
1 - 2	0.54	0.75	0.74	0.71	**0.82**	0.81	**0.88**	0.85	0.76	0.69
	0.07	0.04	0.04	0.05	0.05	0.08	0.07	0.09	0.08	0.04
2 - 3	0.55	0.72	1.05	0.90	**1.05**	0.80	**1.18**	**1.13**	0.90	**1.11**
	0.06	0.08	0.06	0.04	0.04	0.09	0.11	0.07	0.12	0.126
3 - 4	0.66	0.87	1.14	0.93	**1.15**	0.87	**1.30**	**1.66**	**1.36**	**1.97**
	0.09	0.17	0.06	0.05	0.11	0.04	0.08	0.32	0.10	0.17
4 - 5	0.56	0.88	0.95	0.76	0.90	0.82	0.79	**1.66**	0.86	**1.57**
	0.06	0.10	0.17	0.06	0.09	0.08	0.10	0.18	0.24	0.12
5 - 6	0.50	0.60	0.74	0.64	0.66	0.70	0.56	0.65	0.91	0.84
	0.09	0.10	0.10	0.06	0.22	0.08	0.09	0.16	0.252	0.17
Sum	4.41	5.35	6.05	5.44	**6.28**	5.46	**6.22**	**7.46**	**6.13**	**7.32**
2 SE	0.19	0.24	0.22	0.12	0.27	0.19	0.22	0.41	0.39	0.30
Upper	4.60	5.59	6.26	5.56	6.54	5.66	6.44	7.87	6.52	7.62
Lower	4.23	5.11	5.83	5.32	6.01	5.27	6.00	7.05	5.74	7.02

Appendix 26.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Lake Fourteen (antimycin-only group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age interval	1987	1988	1989	Pre	Year of growth 1990	1991	1992	1993	1994	1995
0 - 1	2.12	2.05	1.87	2.08	2.19	*1.92*	*1.77*	*1.72*	*1.62*	ND
	0.07	0.13	0.19	0.060	0.094	0.086	0.140	0.048	0.070	
1 - 2	1.00	0.93	0.96	0.96	**1.74**	**1.21**	**1.10**	*0.82*	*0.78*	
	0.05	0.07	0.07	0.040	0.076	0.058	0.048	0.048	0.040	
2 - 3	0.74	0.80	0.79	0.79	**1.67**	0.78	**1.13**	0.75	0.68	
	0.14	0.12	0.05	0.050	0.124	0.212	0.034	0.036	0.090	
3 - 4	0.51	0.64	0.59	0.56	**1.53**	**1.01**	**0.81**	0.52	0.56	
	0.05	0.21	0.07	0.050	0.110	0.323	0.098	0.052	0.080	
4 - 5	0.61	0.51	0.44	0.55	**1.57**	**0.92**	**0.65**	*0.39*	*0.37*	
	0.08	0.08	0.06	0.050	0.206	0.092	0.054	0.092	0.052	
5 - 6	0.47	0.53	0.67	0.59	ND	0.72	0.50	*0.29*	*0.40*	
	0.10	0.08	0.08	0.050		0.115	0.064	0.076	0.134	
Sum	5.46	5.47	5.31	5.53	**8.71**	**6.57**	**5.96**	*4.49*	*4.41*	
2 SE	0.21	0.29	0.24	0.12	0.28	0.42	0.20	0.15	0.20	
Upper	5.67	5.76	5.55	5.65	8.99	6.99	6.16	4.64	4.61	
Lower	5.25	5.17	5.07	5.41	8.42	6.15	5.76	4.34	4.21	

Appendix 27.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Horseshoe Lake (antimycin + catch-and-release group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age	Year of growth									
interval	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1	2.00	1.92	1.30	1.97	1.94	1.95	*1.58*	*1.57*	*1.72*	1.95
	0.12	0.12		0.09	0.09	0.08	0.11	0.07	0.07	0.17
1 - 2	1.01	1.01	1.00	1.00	**1.31**	1.10	0.90	0.60	0.97	1.27
	0.08	0.06	0.06	0.04	0.23	0.07	0.07	0.07	0.04	0.12
2 - 3	0.80	1.05	0.92	0.88	**1.76**	**1.15**	**1.73**	0.84	0.95	1.40
	0.09	0.24	0.08	0.06	0.24	0.50	0.08	0.06	0.08	0.11
3 - 4	0.65	0.90	0.60	0.69	**1.80**	**1.61**	0.71	**1.06**	**1.19**	**1.71**
	0.08	0.17	0.26	0.07	0.14	0.33	0.44	0.08	0.07	0.34
4 - 5	0.53	0.69	0.86	0.68	**1.77**	0.98	0.91	**0.99**	**0.99**	0.81
	0.08	0.11	0.27	0.08	0.30	0.24	0.23	0.22	0.16	0.10
5 - 6		0.67	0.65	0.66	**1.82**	1.16	0.49	0.69	*0.33*	*0.32*
		0.13	0.12	0.09	0.17	0.49	0.11	0.28	0.142	0.17
Sum		6.25	5.33	5.88	**10.39**	**7.95**	6.32	5.75	6.15	**7.46**
2 SE		0.36		0.18	0.49	0.80	0.52	0.38	0.25	0.45
Upper		6.62		6.06	10.89	8.75	6.84	6.13	6.40	7.91
Lower		5.89		5.70	9.90	7.15	5.80	5.37	5.90	7.01

Appendix 28.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Island Lake (antimycin-only group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age	Year of growth									
interval	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1	1.93	1.99	1.67	1.81	*1.69*	*1.66*	*1.54*	*1.56*	*1.46*	*1.54*
	0.05	0.20	0.07	0.040	0.062	0.070	0.062	0.114	0.074	0.062
1 - 2	0.86	0.69	0.66	0.69	**0.90**	0.72	**0.77**	0.70	*0.63*	0.54
	0.08	0.04	0.03	0.020	0.045	0.039	0.050	0.172	0.032	0.052
2 - 3	0.64	0.57	0.63	0.62	**0.90**	0.69	**0.91**	0.67	0.71	**0.79**
	0.13	0.07	0.03	0.030	0.143	0.047	0.060	0.034	0.340	0.066
3 - 4	0.50	0.46	0.60	0.53	**1.07**	**0.64**	**0.93**	**0.70**	*0.06*	0.57
	0.06	0.06	0.06	0.030	0.092	0.066	0.066	0.074	0.058	0.448
4 - 5	0.36	0.37	0.47	0.37	**1.16**	**0.78**	**0.80**	**0.64**	**0.55**	**0.75**
	0.04	0.05	0.15	0.030	0.189	0.099	0.108	0.104	0.110	0.06
5 - 6	0.38	0.53	0.58	0.50	**0.93**	**0.76**	**0.71**	0.64	0.49	0.55
	0.09	0.08	0.16	0.060	0.344	0.129	0.080	0.108	0.096	0.156
Sum	4.66	4.61	4.62	4.52	**6.66**	**5.25**	**5.66**	**4.91**	*3.90*	4.74
2 SE	0.19	0.23	0.23	0.09	0.43	0.19	0.18	0.26	0.38	0.48
Upper	4.85	4.85	4.86	4.61	7.08	5.44	5.84	5.17	4.28	5.22
Lower	4.47	4.38	4.39	4.43	6.23	5.05	5.48	4.65	3.53	4.26

Appendix 29.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Joslin Lake (control group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age	Year of growth									
interval	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1	1.70	1.57	1.50	1.60	1.63	1.59	1.41	1.40	ND	ND
	0.05	0.06	0.07	0.03	0.06	0.10	0.07	0.20		
1 - 2	1.19	0.88	0.80	0.98	*0.73*	*0.78*	*0.61*	*0.66*		
	0.10	0.05	0.05	0.04	0.08	0.10	0.05	0.15		
2 - 3	1.09	1.09	1.06	1.08	1.11	*0.91*	*0.85*	*0.87*		
	0.09	0.08	0.06	0.04	0.05	0.04	0.05	0.09		
3 - 4	0.81	0.93	1.09	0.99	1.02	*0.81*	0.88	0.95		
	0.11	0.13	0.06	0.05	0.06	0.08	0.06	0.09		
4 - 5	0.74	0.73	0.87	0.76	0.88	0.75	0.78	0.86		
	0.06	0.10	0.12	0.05	0.14	0.08	0.07	0.09		
5 - 6	0.74	0.67	0.71	0.70	0.70	*0.62*	*0.54*	0.71		
	0.09	0.07	0.10	0.05	0.19	0.08	0.07	0.13		
Sum	6.27	5.86	6.04	6.11	6.07	*5.46*	*5.07*	*5.45*		
2 SE	0.21	0.20	0.19	0.11	0.26	0.20	0.15	0.32		
Upper	6.48	6.07	6.23	6.22	6.33	5.66	5.22	5.77		
Lower	6.06	5.66	5.85	6.00	5.81	5.26	4.92	5.13		

Appendix 30.–Back-calculated growth increments (mean ±2 SE, in) of bluegill in Long Lake (antimycin + walleye group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age	Year of growth									
interval	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1	1.76	1.63	1.52	1.64	**1.89**	**2.15**	*1.48*	1.75	1.65	1.70
	0.09	0.07	0.07	0.04	0.13	0.10	0.10	0.07	0.07	0.05
1 - 2	0.69	0.78	0.59	0.69	**1.26**	**1.13**	**0.96**	0.66	**0.86**	0.74
	0.04	0.04	0.04	0.02	0.09	0.08	0.07	0.06	0.07	0.06
2 - 3	0.65	0.90	0.68	0.82	**2.18**	**1.62**	**1.35**	**1.30**	0.84	0.91
		0.05	0.06	0.04	0.11	0.08	0.16	0.09	0.12	0.07
3 - 4	0.84	0.96	0.68	0.79	**2.53**	**1.82**	**1.26**	1.35	**1.39**	1.14
	0.08	0.08	0.04	0.04	0.15	0.08	0.08	0.49	0.08	1.31
4 - 5	0.86	0.86	0.63	0.81	*2.49*	**1.29**	0.56	**1.14**	0.68	**1.43**
	0.10	0.09	0.10	0.06	0.21	0.26	0.36	0.16	0.26	0.11
5 - 6	0.88	0.83	0.64	0.78	**1.63**	0.92	ND	*0.37*	*0.52*	0.72
	0.21	0.10	0.11	0.07	0.77	0.57		0.10	0.11	0.15
Sum	5.67	5.96	4.74	5.53	**11.97**	**8.93**	**5.61**	**6.57**	5.94	6.64
2 SE		0.18	0.18	0.11	0.82	0.64	0.41	0.53	0.33	1.30
Upper		6.14	4.93	5.64	12.79	9.57	6.02	7.10	6.27	7.94
Lower		5.78	4.56	5.42	11.15	8.29	5.20	6.04	5.61	5.34

Appendix 31.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Myers Lake (antimycin-only group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age	Year of growth									
interval	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1		1.60	1.59	1.60	*1.45*	1.44	1.46	*1.42*	ND	ND
		0.06	0.17	0.05	0.09	0.19		0.07		
1 - 2		0.77	0.70	0.74	0.88	0.78	*0.65*	0.72		
		0.04	0.04	0.03	0.13	0.04	0.05			
2 - 3	0.84	0.87	0.72	0.76	0.83	0.69	0.72	*0.61*		
	0.04	0.10	0.06	0.05	0.06	0.05	0.05	0.03		
3 - 4	0.86	0.70	0.64	0.70	0.81	0.67	0.73	0.60		
	0.22	0.06	0.12	0.05	0.06	0.05	0.07	0.10		
4 - 5	0.66	0.57	0.49	0.58	0.61	0.65	0.56	0.62		
	0.05	0.09	0.05	0.03	0.15	0.06	0.07	0.06		
5 - 6	0.51	0.50	0.41	0.49	**0.64**	**0.72**	0.47	0.45		
	0.08	0.05	0.08	0.04	0.08	0.17	0.05	0.09		
Sum		5.01	4.55	4.87	**5.22**	4.94	*4.59*	*4.42*		
2 SE		0.17	0.24	0.10	0.24	0.27	0.12	0.16		
Upper		5.18	4.78	4.97	5.46	5.21	4.71	4.58		
Lower		4.84	4.31	4.77	4.98	4.67	4.47	4.26		

Appendix 32.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Saddle Lake (control group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age	Year of growth									
interval	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1		2.28	1.80	2.18	*1.59*	*1.90*	*1.68*	*1.95*	*1.66*	*1.71*
		0.30	0.12	0.10	0.14	0.06	0.13	0.05	0.05	0.06
1 - 2		1.09	1.05	1.11	1.00	1.09	0.99	1.07	*0.92*	1.00
		0.10	0.13	0.07	0.04	0.05	0.16	0.31	0.04	0.06
2 - 3	0.81	0.71	0.80	0.79	0.80	0.91	*0.09*	0.87	0.83	0.80
	0.07	0.23	0.05	0.05	0.11	0.11	0.09	0.04	0.04	0.046
3 - 4	0.57	0.56	0.55	0.56	0.56	0.48	0.62	**0.77**	**0.68**	*0.34*
	0.07	0.07	0.09	0.05	0.06	0.06	0.08	0.06	0.06	0.15
4 - 5	0.53	0.43	0.46	0.50	0.46	0.50	0.50	0.51	0.56	0.47
	0.05	0.05	0.09	0.03	0.11	0.12	0.09	0.07	0.12	0.09
5 - 6	0.51	0.57	0.48	0.53	0.36	0.51	0.45	0.48	0.52	0.41
	0.06	0.13	0.08	0.06	0.16	0.23	0.04	0.09	0.084	0.08
Sum		5.63	5.14	5.67	*4.76*	5.39	*4.33*	5.65	*5.17*	*4.73*
2 SE		0.41	0.23	0.15	0.27	0.29	0.25	0.33	0.17	0.21
Upper		6.04	5.37	5.82	5.04	5.68	4.58	5.98	5.34	4.94
Lower		5.22	4.91	5.52	4.49	5.09	4.08	5.32	5.00	4.52

Appendix 33.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Selkirk Lake (walleye-only group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age interval	Year of growth									
	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1	1.89	2.34	1.74	1.87	*1.71*	1.79	*1.60*	**2.08**	*1.57*	*1.61*
	0.47	0.17	0.07	0.070	0.059	0.080	0.078	0.052	0.056	0.07
1 - 2	0.88	1.18	0.92	0.91	0.98	0.74	0.86	1.07	0.95	0.85
	0.05	0.29	0.05	0.040	0.082	0.153	0.038	0.310	0.068	0.06
2 - 3	0.51	0.79	0.83	0.75	0.80	0.93	1.00	0.86	**1.00**	1.08
	0.16	0.06	0.18	0.050	0.114	0.134	0.288	0.060	0.170	0.32
3 - 4	0.58	0.73	0.53	0.58	0.56	0.60	**0.88**	0.71	**1.55**	0.47
	0.08	0.14	0.10	0.060	0.171	0.092	0.122	0.086	0.13	0.182
4 - 5	0.53	0.63	0.55	0.58	0.49	0.43	0.64	0.58	0.77	**1.43**
	0.08	0.07	0.07	0.050	0.114	0.106	0.080	0.072	0.306	0.19
5 - 6	0.51	0.47	0.48	0.49	*0.36*	0.42	0.47	0.40	**1.08**	0.78
	0.06	0.09	0.07	0.040	0.050	0.074	0.086	0.144	0.122	0.308
Sum	4.90	6.14	5.04	5.18	4.90	4.92	5.45	**5.70**	**6.92**	**6.22**
2 SE	0.50	0.38	0.24	0.13	0.26	0.26	0.34	0.36	0.39	0.51
Upper	5.41	6.52	5.28	5.31	5.16	5.19	5.79	6.06	7.31	6.73
Lower	4.40	5.76	4.80	5.05	4.65	4.66	5.11	5.34	6.53	5.71

Appendix 34.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Turk Lake (control group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age	Year of growth									
interval	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1		1.60		1.60	*1.40*	1.68	*1.32*	1.71	1.61	*1.56*
		0.07		0.07	0.08	0.07	0.05	0.08	0.08	0.07
1 - 2		0.65	0.56	0.62	*0.51*	0.67	0.61	0.58	0.67	0.67
		0.04	0.05	0.03	0.04	0.04	0.04	0.07	0.06	0.04
2 - 3		0.86	0.68	0.73	0.80	0.76	**0.89**	0.83	0.76	**0.96**
		0.07	0.05	0.04	0.07	0.11	0.08	0.07	0.12	0.09
3 - 4	0.88	1.11	1.11	1.08	1.03	0.95	1.22	1.17	1.15	1.16
	0.04	0.12	0.08	0.06	0.08	0.10	0.11	0.11	0.10	0.00
4 - 5	0.84	1.03	1.11	0.89	**1.08**	0.97	**1.19**	**1.15**	1.01	**1.25**
	0.09	0.10	0.19	0.06	0.11	0.08	0.09	0.09	0.13	0.08
5 - 6	0.70	0.95	0.74	0.81	0.69	0.88	**0.98**	1.02	0.79	0.72
	0.13	0.10	0.09	0.06	0.97	0.08	0.10	0.19	0.126	0.18
Sum		6.20		5.73	5.51	5.91	**6.21**	**6.46**	5.99	**6.32**
2 SE		0.21		0.13	0.97	0.20	0.20	0.26	0.25	0.23
Upper		6.41		5.86	6.48	6.11	6.41	6.72	6.24	6.55
Lower		5.99		5.60	4.55	5.71	6.01	6.20	5.74	6.09

Appendix 35.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Williams Lake (antimycin + catch-and-release group). Bold indicates significantly greater than pre-year data; italics significantly less.

Age	Year of growth									
interval	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1	1.74	1.57		1.79	1.96	2.02	1.57	1.92	1.59	1.54
	0.05	0.17		0.04	0.07	0.12	0.09	0.12	0.09	0.08
1 - 2	1.04	1.18	1.07	1.10	2.47	1.86	1.30	1.18	1.29	1.18
	0.10	0.05	0.05	0.03	0.17	0.10	0.08	0.06	0.07	0.07
2 - 3	1.15	1.13	1.14	1.14	2.30	2.02	1.71	1.58	1.32	1.52
	0.09	0.05	0.05	0.04	0.38	0.10	0.10	0.07	0.07	0.108
3 - 4	0.81	0.93	0.96	0.90	1.76	1.69	1.15	1.00	1.18	1.30
	0.08	0.09	0.12	0.06	0.32	0.25	0.25	0.16	0.09	0.13
4 - 5	0.55	0.79	0.46	0.65	1.60	1.51	1.16	0.44	0.37	0.90
	0.19	0.12	0.08	0.08	0.41	0.33	0.34	0.13	0.09	0.13
5 - 6	0.39	0.55	0.56	0.49	1.62	0.83	0.36	0.52	0.20	0.31
	0.14	0.21	0.29	0.12	0.28	0.46	0.00	0.17	0.05	0.05
Sum	5.68	6.15		6.07	11.71	9.94	7.25	6.64	5.95	6.75
2 SE	0.28	0.31		0.17	0.71	0.63	0.44	0.30	0.18	0.24
Upper	5.97	6.46		6.24	12.42	10.57	7.69	6.94	6.13	6.99
Lower	5.40	5.84		5.90	11.00	9.31	6.81	6.34	5.77	6.51

Appendix 36.–Back-calculated growth increments (mean ñ 2 SE, in) of bluegill in Woodard Lake (walleye-only group). **Bold** indicates significantly greater than pre-year data; *italics* significantly less.

Age	Year of growth									
interval	1987	1988	1989	Pre	1990	1991	1992	1993	1994	1995
0 - 1		1.34	1.45	1.45	1.30	1.43	1.40	1.51	*1.33*	1.39
		0.08	0.08	0.04	0.14	0.10	0.31	0.07	0.07	0.11
1 - 2		0.65	0.74	0.70	0.75	0.78	0.80	0.86	**1.12**	**1.07**
		0.07	0.08	0.04	0.05	0.08	0.08	0.09	0.10	0.07
2 - 3	1.31	0.99	1.16	1.11	**1.24**	1.26	**1.39**	**1.33**	**1.74**	**2.01**
	0.14	0.08	0.06	0.05	0.05	0.12	0.10	0.10	0.21	0.09
3 - 4	1.09	1.08	1.15	1.11	**1.27**	**1.27**	**1.46**	**1.62**	**1.93**	1.39
	0.08	0.08	0.11	0.05	0.14	0.09	0.13	0.27	0.09	0.67
4 - 5	0.72	0.73	0.66	0.71	0.83	0.83	0.87	0.62	0.92	**1.47**
	0.09	0.11	0.15	0.07	0.14	0.12	0.11	0.30	0.16	0.11
5 - 6	0.68	0.73	0.56	0.67	0.59	0.62	0.51	0.82	*0.50*	0.72
	0.11	0.12	0.15	0.07	0.14	0.11	0.14	0.21	0.08	0.16
Sum		5.53	5.73	5.75	5.97	**6.19**	**6.43**	**6.76**	**7.54**	**8.05**
2 SE		0.22	0.26	0.13	0.28	0.25	0.39	0.47	0.31	0.70
Upper		5.74	5.99	5.88	6.25	6.44	6.82	7.23	7.85	8.75
Lower		5.31	5.46	5.62	5.69	5.95	6.04	6.29	7.23	7.35

See attached Figures 1-10 errata, pages 9-18.

Errata – This revision includes corrections to the legends for Figures 1, 3, 5, 7, and 9 and the State average curves were shifted slightly for Figures 2, 4, 6, 8, and 10. The associated text and conclusions were unaffected.

CONTROL LAKES

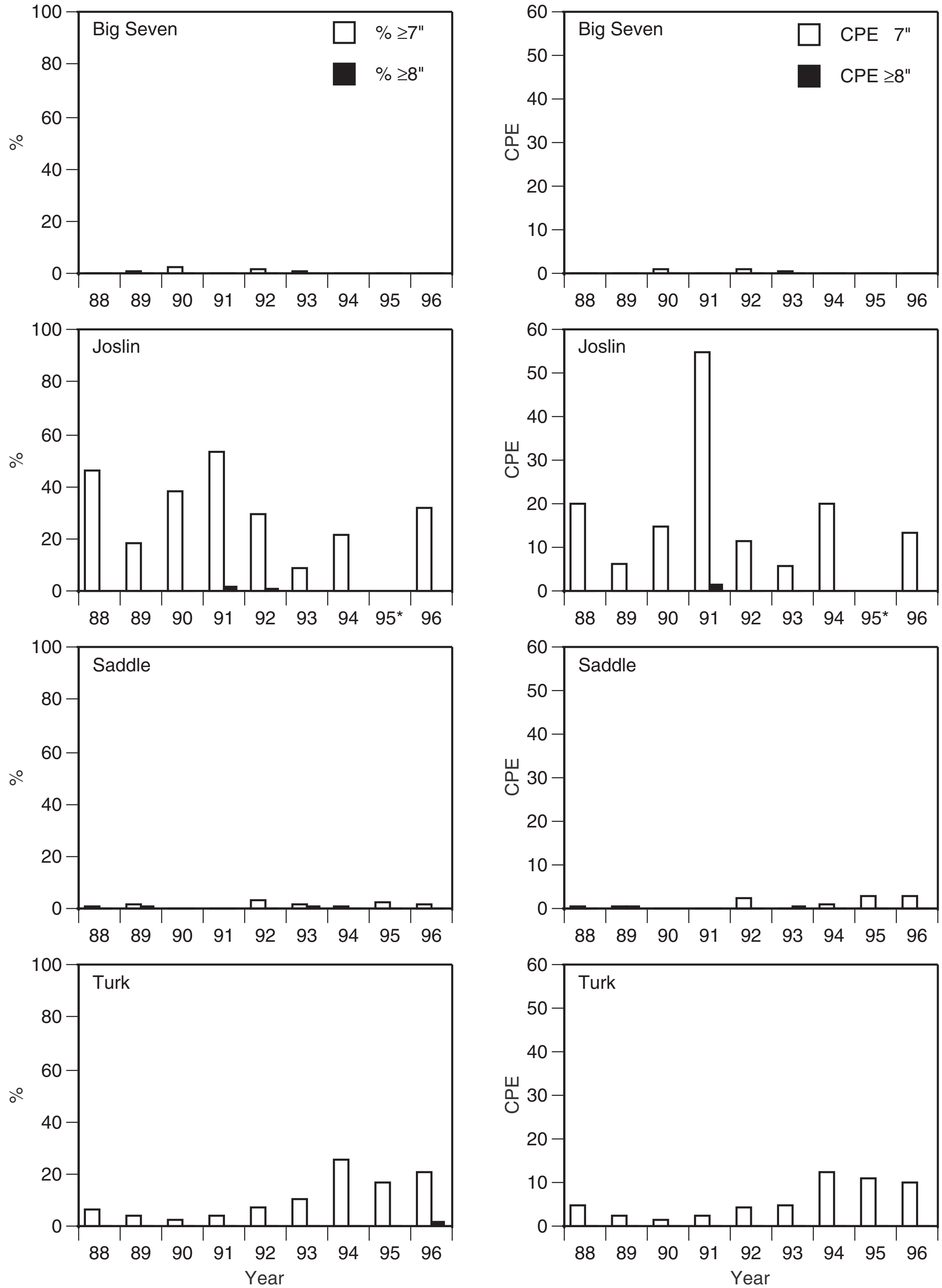

Figure 1.—Size distributions of larger bluegill for control lakes in 1988-96 expressed as percentage of trapnet catch greater than 7.0 or 8.0 in (left panels) and as catch per net lift (CPE) for bluegills greater than 7.0 or 8.0 in (right panels). Legends are in top panels. Asterisk (*) indicates no sample taken that year.

(Errata August 15, 2000)

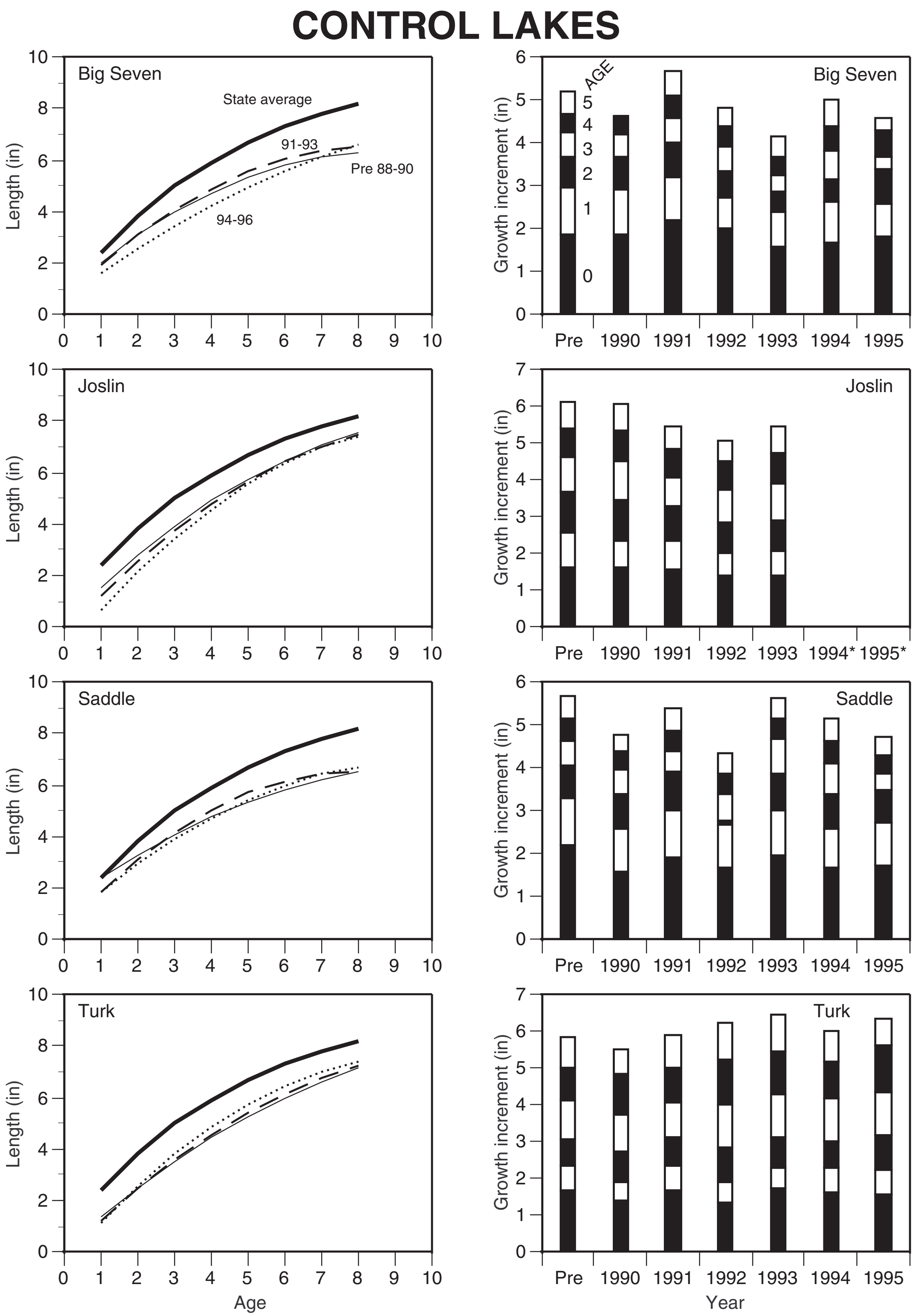

Figure 2.—Growth of bluegill in control lakes expressed as average length-at-age (left panels) and back-calculated growth increment during year by age groups 0-5 (right panels). Labels are in top panels. Asterisk (*) indicates no sample taken that year.

ANTIMYCIN-ONLY LAKES

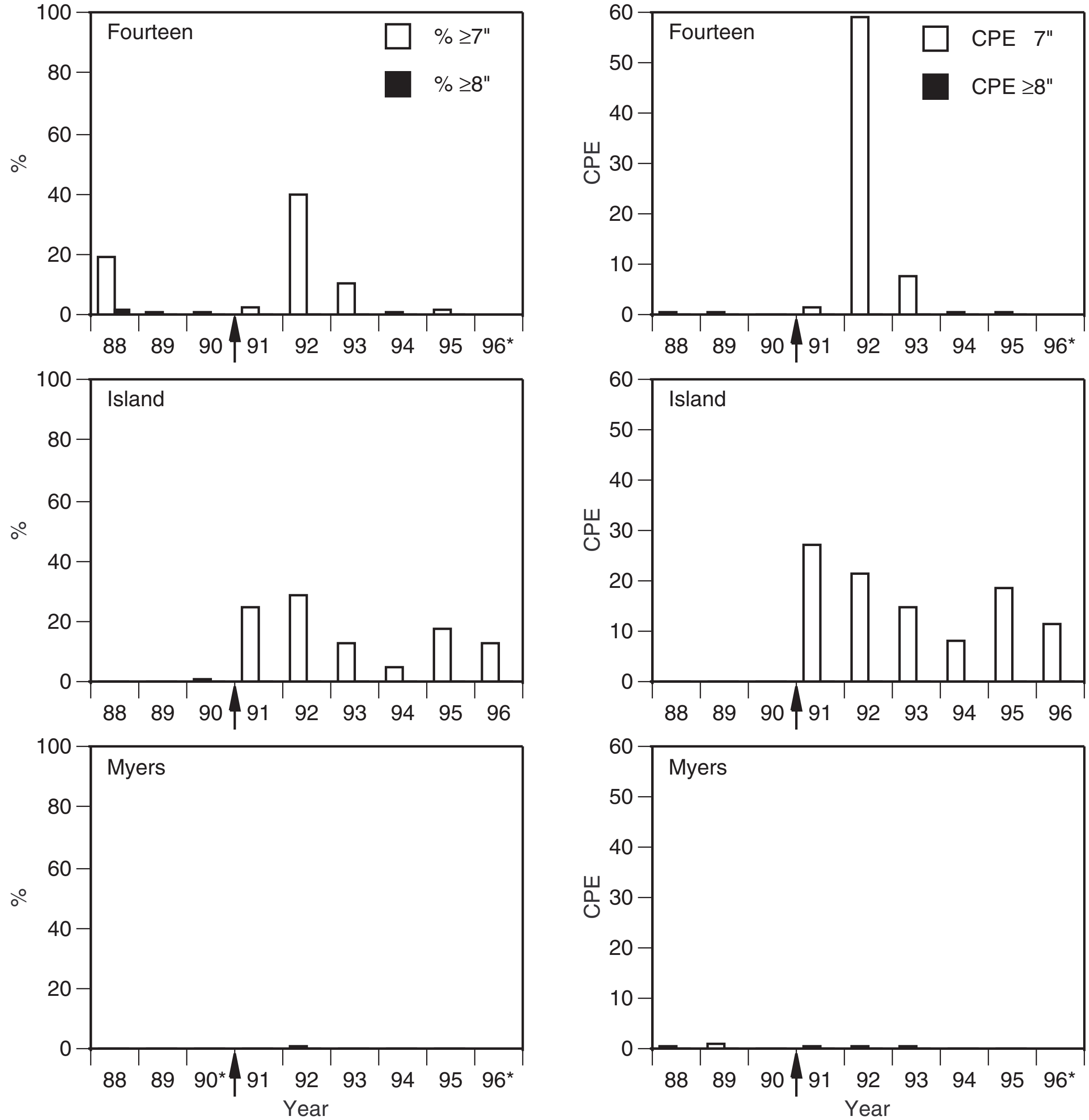

Figure 3.—Size distributions of larger bluegill for antimycin-only lakes in 1988-96 expressed as percentage of trapnet catch greater than 7.0 or 8.0 in (left panels) and as catch per net lift (CPE) for bluegills greater than 7.0 or 8.0 in (right panels). Legends are in top panels. Asterisk (*) indicates no sample taken that year. Arrow indicates treatment in 1990.

(Errata August 15, 2000)

ANTIMYCIN-ONLY LAKES

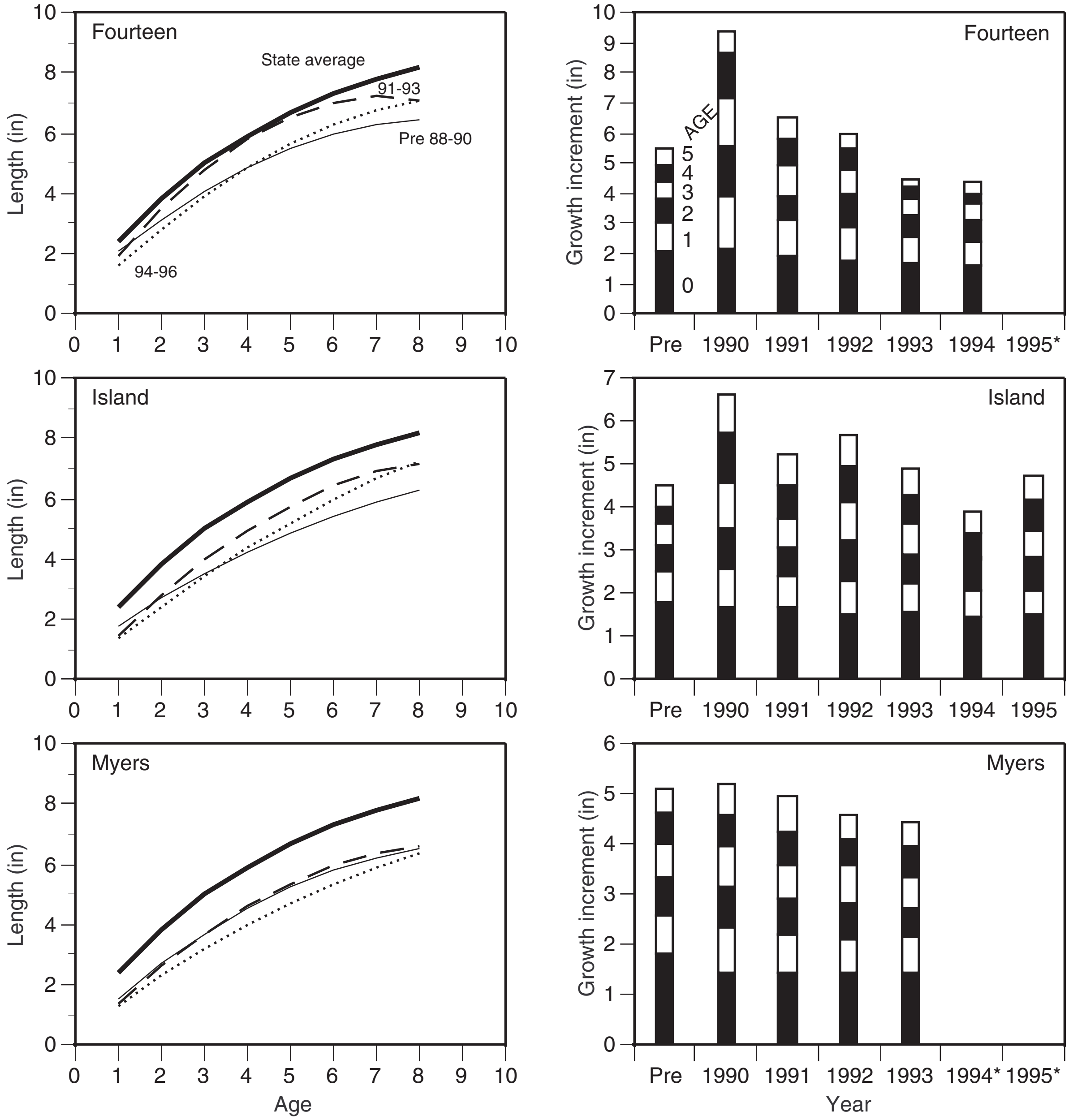

Figure 4.—Growth of bluegill in antimycin-only lakes expressed as average length-at-age (left panels) and back-calculated growth increment during year by age groups 0-5 (right panels). Labels are in top panels. Asterisk (*) indicates no sample taken that year.

WALLEYE-ONLY LAKES

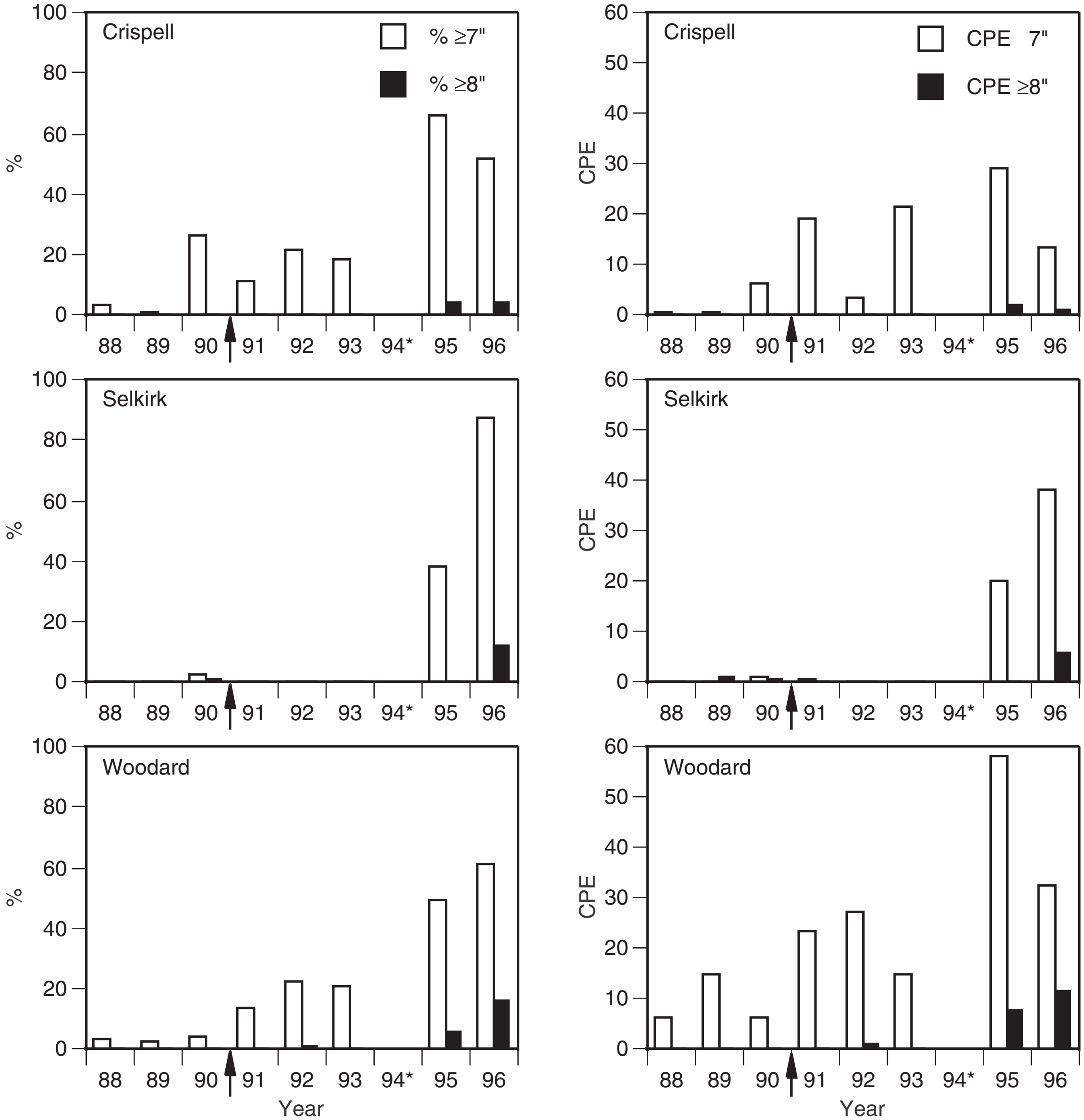

Figure 5.—Size distributions of larger bluegill for walleye-only lakes in 1988-96 expressed as percentage of trapnet catch greater than 7.0 or 8.0 in (left panels) and as catch per net lift (CPE) for bluegills greater than 7.0 or 8.0 in (right panels). Legends are in top panels. Asterisk (*) indicates no sample taken that year. Arrow indicates treatment in 1990.

WALLEYE-ONLY LAKES

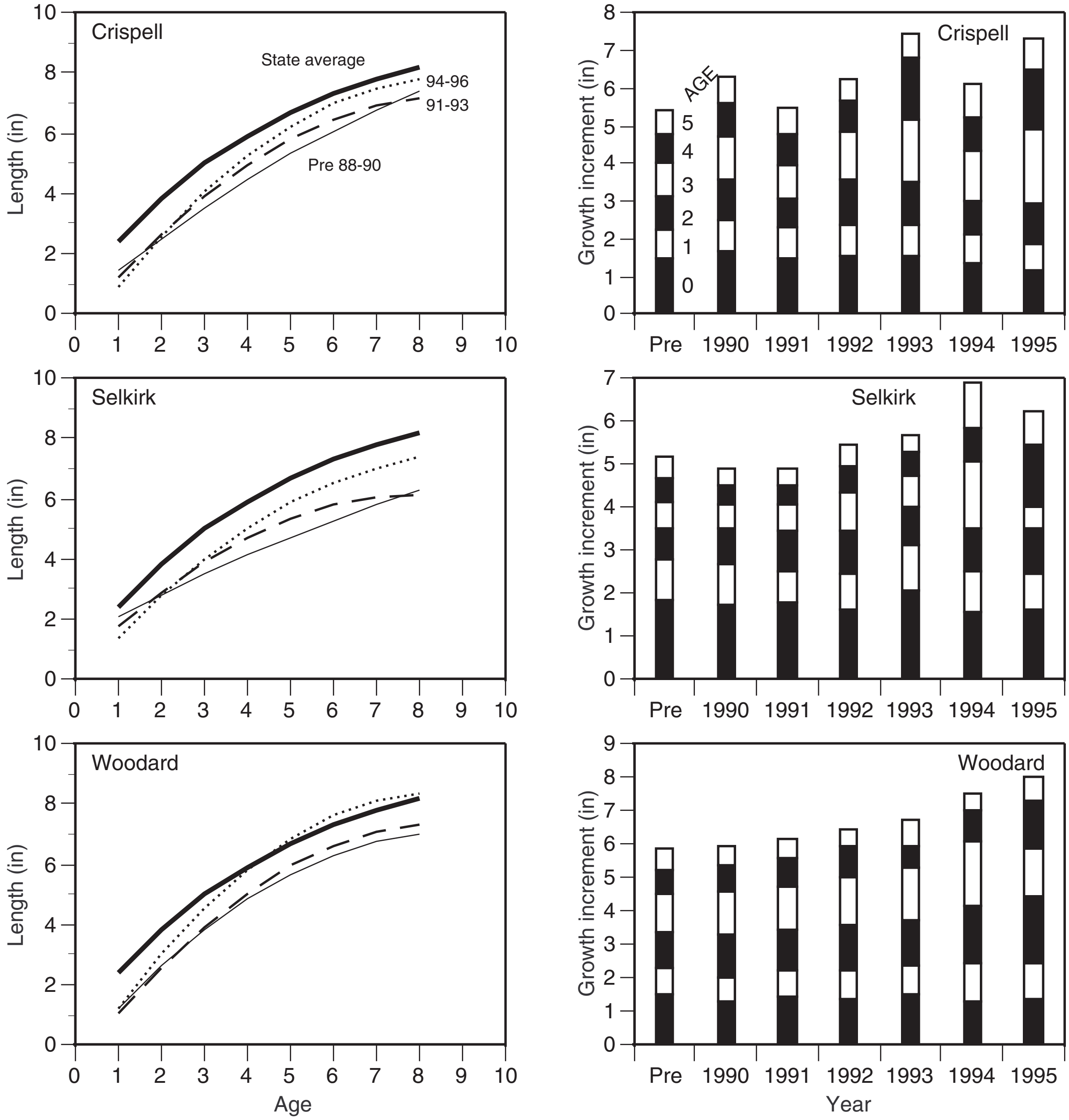

Figure 6.—Growth of bluegill in walleye-only lakes expressed as average length-at-age (left panels) and back-calculated growth increment during year by age groups 0-5 (right panels). Labels are in top panels.

ANTIMYCIN + WALLEYE LAKES

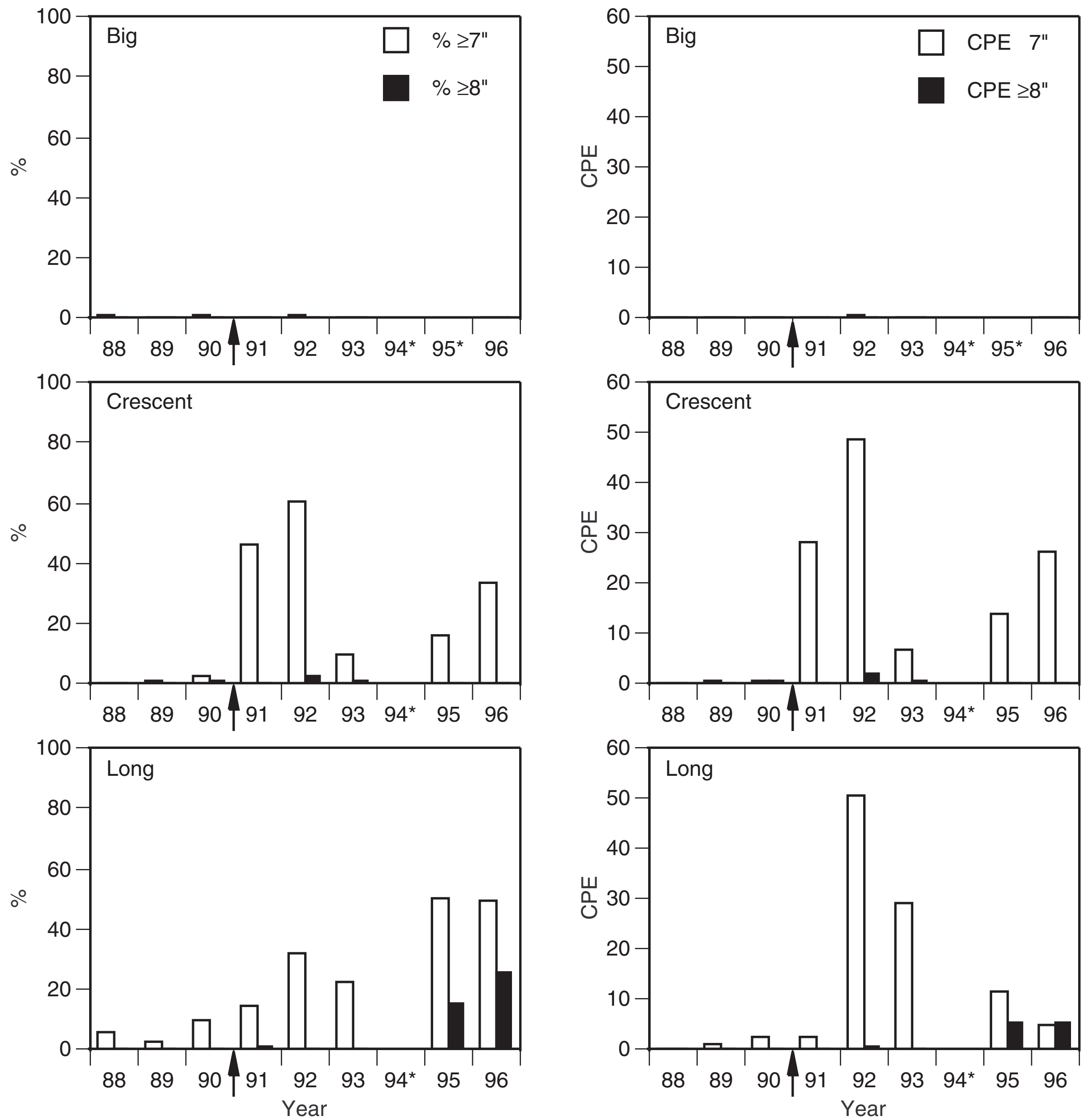

Figure 7.—Size distributions of larger bluegill for antimycin + walleye lakes in 1988-96 expressed as percentage of trapnet catch greater than 7.0 or 8.0 in (left panels) and as catch per net lift (CPE) for bluegills greater than 7.0 or 8.0 in (right panels). Legends are in top panels. Asterisk (*) indicates no sample taken that year. Arrow indicates treatment in 1990.

(Errata August 15, 2000)

ANTIMYCIN + WALLEYE LAKES

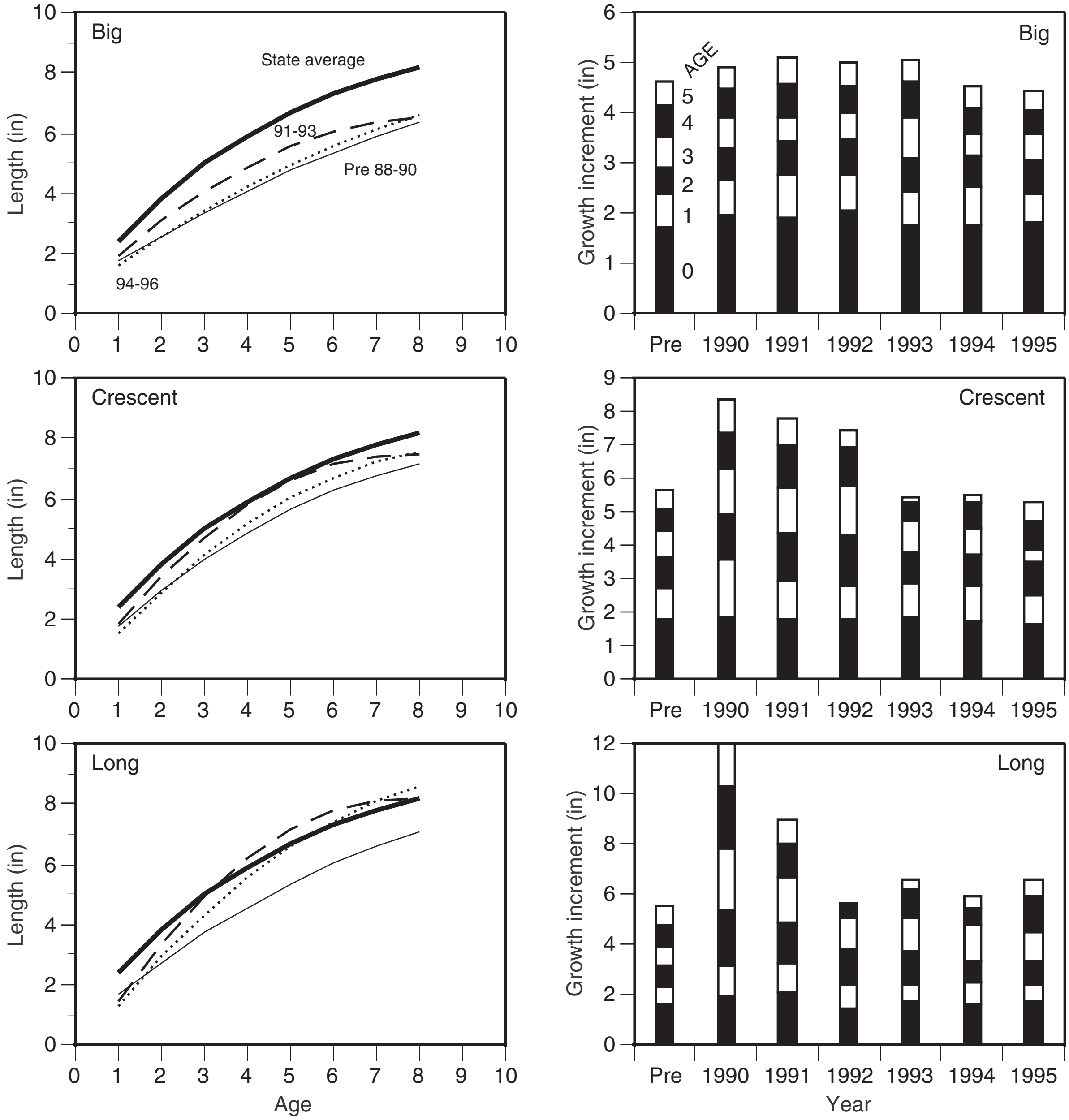

Figure 8.—Growth of bluegill in antimycin + walleye lakes expressed as average length-at-age (left panels) and back-calculated growth increment during year by age groups 0-5 (right panels). Labels are in top panels.

ANTIMYCIN + CATCH-AND-RELEASE LAKES

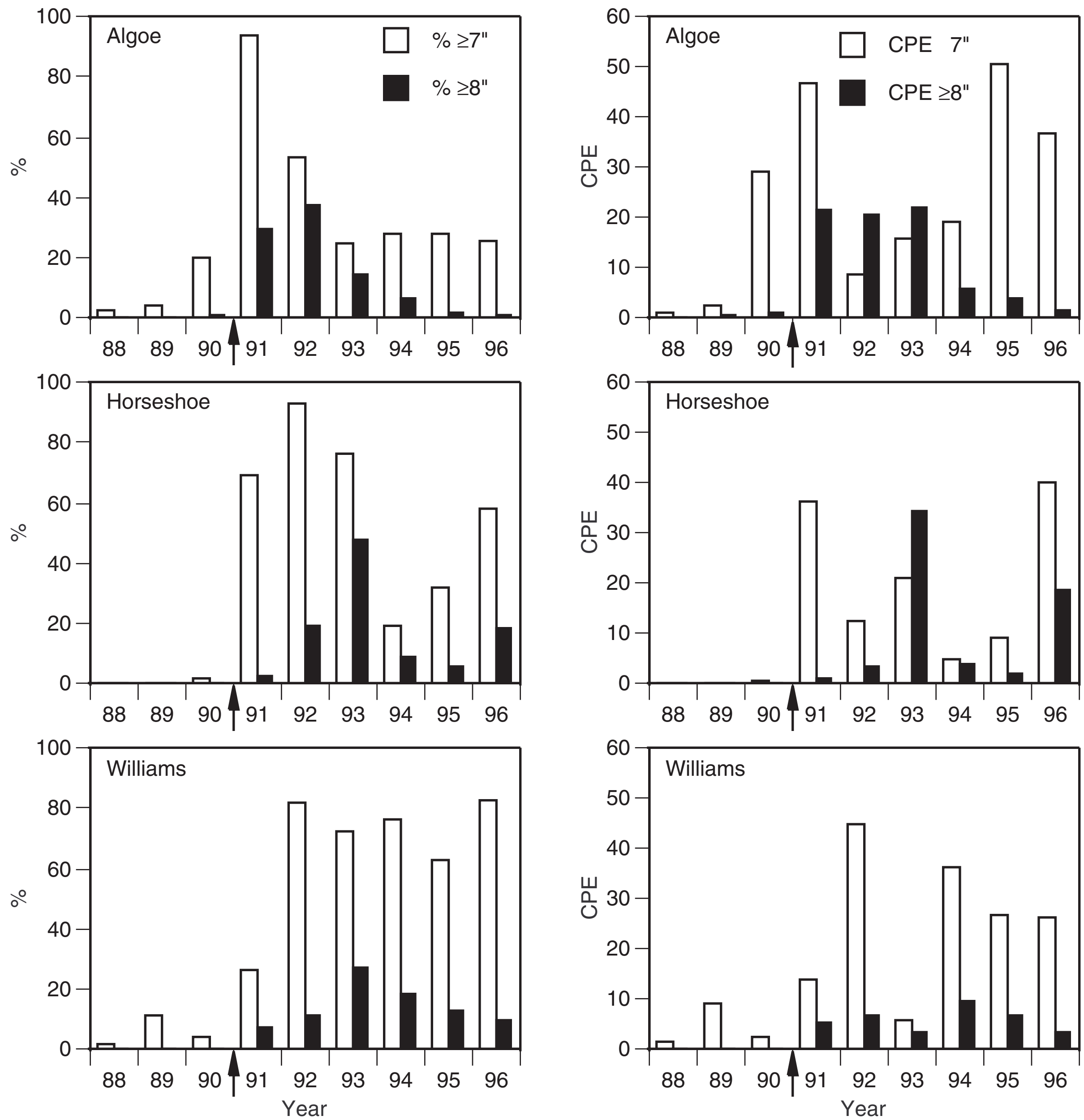

Figure 9.—Size distributions of larger bluegill for antimycin + catch-and-release lakes in 1988-96 expressed as percentage of trapnet catch greater than 7.0 or 8.0 in (left panels) and as catch per net lift (CPE) for bluegills greater than 7.0 or 8.0 in (right panels). Legends are in top panels. Arrow indicates treatment in 1990.

ANTIMYCIN + CATCH-AND-RELEASE LAKES

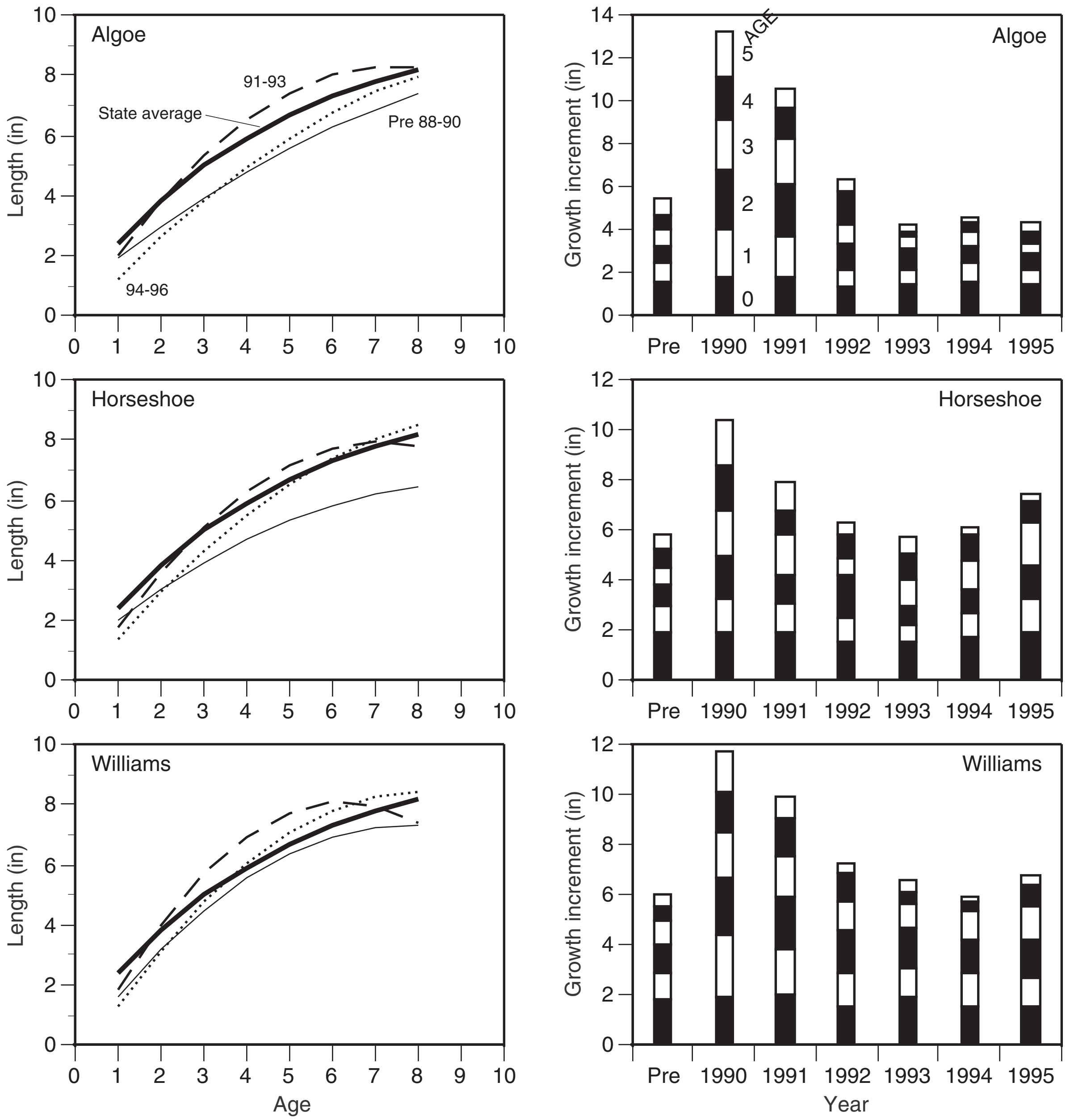

Figure 10.—Growth of bluegill in antimycin + catch-and-release lakes expressed as average length-at-age (left panels) and back-calculated growth increment during year by age groups 0-5 (right panels). Labels are in top panels.