Golden Shiner, Bluegill, and Green Sunfish Production in a small Lake

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A small lake located 43 miles southeast of Dallas in Kaufman County, owned by Dr. Ozro T. Woods, was treated with rotenone in February, 1952. With a surface area of about two acres, the lake contained 5.4 acre-feet of water, with a maximum depth of six feet. It was constructed in 1947 and filled the same year.

In 1948 it was stocked with 300 golden shiners, *Notemigonus chrysoleucas seco* (Raf.), and during that year 300 pounds of dried blood were applied to the water as fertilizer. During 1949-50, 2200 pounds of 5-10-5 fertilizer were added to the water. Bluegill (*Lepomis macrochirus* (Raf.) and green sunfish (*L. cyanellus* (Raf.) got into the lake by overflow from a small pond, probably in late 1947. During 1950-51 the bluegills were so abundant that one could catch small ones (less than 3.5 inches) almost as fast as he could bait his hook. Green sunfish 5-10 inches long also were caught.

In early December of 1951 a survey of the lake was made, preliminary to the application of rotenone at a later date. Benthic organisms were few in number. The phytoplankton count was slightly over 1500 per liter, with diatoms dominant and desmids next in number. Zoöplankters averaged 1400 per liter with *Difflugia* dominant and the copepods next in order. The pH of the water was 7.7, and the methyl orange alkalinity was 28 p.p.m.

In February, 1952, with a water temperature of 42° F., 20 pounds of derris root (5% rotenone) were applied. The powder was mixed with water to form a thick mash, placed in burlap sacks and towed by motor boats until all the surface area of the lake had been treated, and the powder used up. To ensure a complete kill the 20 pounds of derris root used was over twice the amount customarily used (8.1 pounds) in warmer waters.[2]

Forty-six minutes after the beginning of the rotenone

[1]This work was done by my students, James Connolly, Franklin Bell, Kelly Oliver, Louis Read, Charles Pipkin, Charles McIntire and Byron Wortham. Age-scale determinations were made by Kelly Oliver; age-spine determinations by James Connolly.

[2]The usual amount employed in waters of 70° to 75° F. is 1.5 pounds per acre-foot.

application, the first shiners appeared at the surface, followed soon after by the bluegills; and within 1½ hours after the treatment was started the green sunfish began to appear.

The total kill the first two days after treatment amounted to an estimated 25,800 golden shiners and 10,000 bluegill and green sunfish. The shiners were uniform in size, with an average standard length of 3.75 inches. Most of the bluegills were less than two inches in length. Twelve hundred thirty-one of the shiners totalled 32.75 pounds. Using the weight of these shiners as a basis of calculation, the shiner production was estimated at 327 pounds per surface-acre. A random sampling of 2000 bluegill and green sunfish justified an estimate of 105 pounds per surface-acre. None of the bluegill exceeded 5.5 inches in length. Fourteen of the largest green sunfish varied from 7 to 10 inches in length, and the average weight of this group was 6.9 ounces, with the 10-inch specimen weighing 14 ounces. Stomach analyses of the green sunfish showed its diet to be almost exclusively small bluegills and shiners, with the bluegills in the majority.

This small lake was producing about 432 pounds of shiners, bluegills and green sunfish per surface-acre, and this estimated yield was based strictly upon the fish killed during the first two days after treatment. Many other fish sank into deeper waters and, according to the owner, appeared later at the surface.

In the struggle for survival the fish most seriously affected was the bluegill. Shiners showed no apparent effects from overcrowding, and the predatory green sunfish thrived.

A study of the age of these fish by the scale annuli showed that 4- and 5-year-old bluegill varied from four to five inches in length. Nearly all of the green sunfish were over eight inches in standard length by the fourth year, and varied from this up to ten inches by the fifth year. Age-determination by annuli in the dorsal spine of the green sunfish tended to coincide with scale-annuli determination in this species.

This study shows that rotenone can be effective in water with a temperature as low as 42° F. and will ensure a complete kill of these three species under similar environmental conditions. It also shows that the growth and reproduction of the golden shiner were apparently unaffected, even in overcrowded conditions that had a detrimental effect on normal growth of the bluegill.