NOTES ON THE LIFE HISTORY OF THE STEELCOLOR SHINER, *NOTROPIS WHIPPLEI* (GIRARD)

WILLIAM M. LEWIS AND GERALD E. GUNNING
Southern Illinois University, Carbondale

The authors became interested in the steel color shiner (Fig. 1) because of its possible value as a commercial bait species. One is led to suspect its suitability for this purpose by: 1) the occurrence of dense populations in pond-like environments; 2) the shiner's tolerance to being handled in warm weather; and 3) its pronounced activity in aquaria.

During six years of collecting in southern Illinois, two well-established populations of the steelcolor shiner have been encountered. One of these occurs in Crab Orchard Lake; the other in the Big Muddy River. Crab Orchard Lake is a 7000-acre artificial impoundment. The Big Muddy River is a sluggish stream approximately 50 miles long with steep mud banks. The river ranges in depth from a riffle and pool stage in dry weather to a continuous stream 15 to 20 feet deep during the rainy season. Both populations are unusually dense. Seining in either of these waters in mid-summer will, on most occasions, produce a sizeable catch of the steelcolor shiner.

On numerous occasions collections of the shiner were transported and held in hot weather. The survival of the fish so handled was excellent.

On the negative side, the populations studied contained individuals that did not attain a size suitable for use as bait for the larger game fishes. Two inches is approximately the maximum size attained in the Illinois populations. Trautman (1957) reports individuals of 4.5 to 5.3 inches from Ohio. It also remains to be demonstrated that this species will prosper under hatchery conditions. Its native habitat suggests, however, that it would.

OBSERVATIONS

Age composition of Crab Orchard Lake population.— In studying the steelcolor shiner the authors concentrated on the age composition of the Crab Orchard Lake population. The most interesting information is that the steelcolor shiner has a life span of no more than two years.

Length-frequency plots of collections over a period of two years, and gonadal studies, indicate that the one-year-olds, which constitute the majority of a steelcolor shiner population, spawn in late August or early September, whereas the few two-year-olds which occur in a population spawn in July. In a collection of large specimens taken July 25, all were spent, but many smaller specimens taken in late August were still heavy with eggs. By October all fish were spent. In the winter following spawning the adults suffer heavy mortality. The young-of-the-year develop rapidly in the late summer or early fall.

The eight graphs of Figure 2 represent length-frequency distributions for particular dates. They give a more detailed analysis of the age

cycle. Figure 2, graph 1, shows two modes at 28 mm. and 42 mm. of standard length. The 28 mm. mode is interpreted as being composed of young-of-the-year. The second mode is of one-year-old fish, or fish spawned during the previous summer.

The distribution shown in graph 2 is essentially the same as that of graph 1. The length at which the first mode occurs is not quite as great as one might anticipate on the basis of the mode of graph 1, but the distribution of the first mode is skewed to the right and some variation is to be expected.

Graph 3 exhibits two modes corresponding to the 1953 and 1954 year classes. A third mode at 26 mm. of length is assumed to indicate spawning by older fish sometime during July, 1955.

Graph 4, based on collections taken in March, 1956, is not continuous with graph 3 inasmuch as the 1955 year class appearing on graph 4 is probably not fully represented on graph 3. Graph 4 may be compared with graph 2 which is based on a spring sample taken in 1955. This comparison is satisfactory with the exception that the 1956 fish appear to have grown faster than did the fish of the 1955 sample in graph 2. Growth data determined by use of the scale method will be presented to show that similar variations in growth rate are to be expected when comparing one year with another.

The length distribution shown in graph 5 is similar to the distributions shown in graphs 2 and 4. The samples shown in graphs 2 and 5 were taken at approximatey the same season but in different years. Graphs 5 and 6 show the same modes.

Graph 7 indicates the appearance of young-of-the-year in late August. These fish result from the early spawning of older fishes. The apparent great reduction in the older fishes in graph 7 is to be expected in a percentage plot, since the younger fish are relatively more abundant. If actual numbers present were compared with the June collection, one might find that the 1955 fish were still abundant.

Graph 8 includes a mode for young-of-the-year at 27 mm. of length and a prominent mode at 37 mm. representing the one-year-olds or the 1955 year class. The situation here is probably similar to that which existed in August, with the exception that the young-of-the-year of the 1956 class have been greatly decimated. Thus the 1955 year class, on a relative basis, again appears abundant.

Age and growth data determined by the scale method (Lagler, 1952: 99-127) for 75 steelcolor shiners taken from Crab Orchard Lake are shown in the upper tier of Table 1. The calculated standard lengths for the first and second annuli are 31 and 53 mm., respectively. This sample was collected in June, and compares favorably with the June sample treated in Figure 2, graph 6.

The middle tier of Table 1 is a compilation of age and growth data derived by the scale method from 17 steelcolor shiners selected from the fish collection of the Department of Zoology, Indiana University. The largest specimens were taken from collections of Dr. Shelby D. Gerking in order that more information might be gained concerning the age of large steelcolor shiners. The

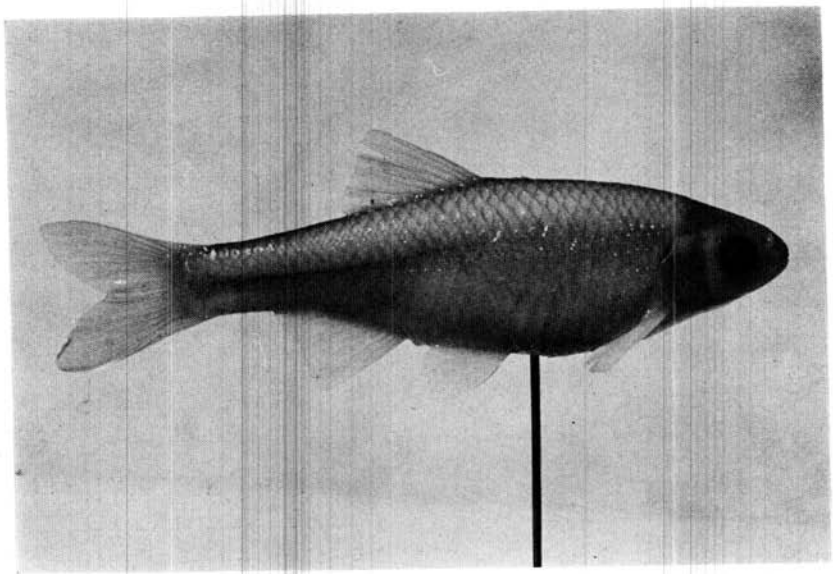

FIG. 1.—The steelcolor shiner, *Notropis whipplei* (Girard).

Indiana localities and numbers of specimens considered are: Eel River, 4; Bean Blossom Creek, 4; Sugar Creek, 4; Branch of Vermillion River, 2; Wabash River, 2; and East Fork of White River, 1. The oldest specimens were two years old. The calculated standard length for the second annulus was 53 mm., which is identical to the calculated length at the second annulus for the Crab Orchard Lake sample discussed above

The lower tier of Table 1 indicates that the growth of these fish was slower than that recorded for the steelcolor shiner, also by the scale method, for specimens taken in 1956 (Table 1).

Analysis of the data on scales leads one to the conclusion derived from a study of the length-frequency data, namely that the steelcolor shiner has a life span of no more than two years.

Parasites.—A well-established infestation of the tapeworm, *Ligula intestinalis* (identified by Dr. George Garoian, Southern Illinois University) appears in the Crab Orchard Lake population of the steelcolor shiner; of 51 specimens examined on July 23, 1955, 8 were found to contain a total of 18 immature tapeworms. Specimens of *Ligula intestinalis* four inches long were taken on a number of occasions.

A parasitic copepod of the genus *Lernea* was the only other parasite found to occur on the specimens collected in the present study. The infestation of *Lernea* was relatively light as compared with the infestation of this organism on associated species of fishes including the bullhead minnow, *Pimephales vigilax perspicuus*. The infestation on the bullhead minnow was some 10 to 15 times as severe as it was on the steelcolor shiner. Whether or not this dif-

TABLE 1.—Calculated and Measured Standard Lengths (in mm.) of Steelcolor Shiners.

Age group	Number specimens	Average calculated length at each annulus		Length at capture
		1	2	
75 specimens, Crab Orchard Lake, Illinois, June 23, 1956				
0	12	..	..	44 (35-55)
I	59	30	..	53 (37-65)
II	4	32	53	63 (55-68)
Mean standard length	..	31	53	.....
Annual increment	..	31	22	.....
17 specimens, various Indiana localities				
I	2	23	..	65 (63-68)
II	15	22	53	74 (67-82)
Mean standard length	..	22	53	.....
Annual increment	..	22	31	.....
654 specimens, Crab Orchard Lake, Illinois, July 28, 1958				
I	584	19	..	37 (29-50)
II	70	19	37	52 (40-66)
Mean standard length	..	19	37	.....
Annual increment	..	19	18	.....

ference in degree of infestation was due to different habits of the fishes or a difference in the physiology or anatomy is, of course, difficult to establish. If the steelcolor shiner is resistant to *Lernea,* it would be in its favor in considering it as a bait species to be produced commercially; *Lernea* frequently constitutes a major problem in minnow hatcheries.

Ovarian counts and egg measurements.—Ovarian counts were made on 10 fish (42-51 mm. standard length) collected in July, 1956, to determine the total number of eggs in the ovaries. The counts varied from 610 to 1,308 eggs per fish. The average count was 1,049 eggs, corresponding to an average fish length of 46 mm. There was a fairly consistent positive correlation between egg count and length of the fish.

Twenty eggs from each of the 10 fish were measured. Average diameters varied from 0.47 to 0.66 mm.

Spawning.—Trautman (1957) observed about 30 steelcolor shiners spawning on the underside of a log raised about a foot from the gravel bottom of a stream. The females deposited their eggs on the underside of the log. In pond culture the steelcolor shiner would thus require a spawning board as do the fathead minnow, *Pimephales promelas,* and bluntnose minnow, *P. notatus.*

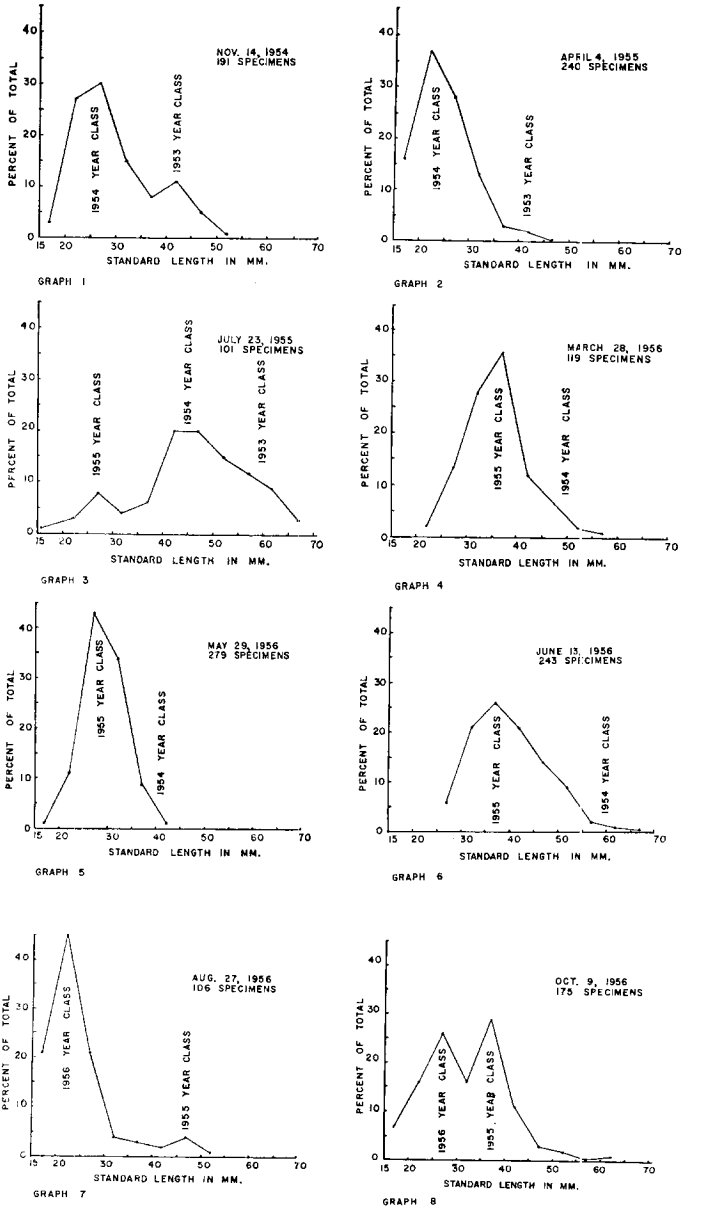

FIG. 2.—Length-frequency distributions for several collections of the steelcolor shiner from Crab Orchard Lake, Illinois.

Food analysis.—To arrive at some idea as to the food of the steelcolor shiner, 10 fish from each of the spring, summer, and fall collections were examined. All fish were adults ranging in size from 40 to 51 mm. of standard length. Among the spring specimens the identifiable material included five occurrences of terrestrial insect remains, one of algae, and one of entomostracans. In the summer specimens terrestrial insect remains were found in four individuals, insect larvae occurred in two and plant remains in two. In the fall collection insect remains occurred in two. From this limited amount of information it appears that the steelcolor shiner is primarily an insectivorous form.

Summary

1. The steelcolor shiner has a life span of no more than two years.
2. The maximum size attained by individuals from Crab Orchard Lake approximates two inches.
3. One-year-old fish spawn in late August or early September, whereas two-year-olds spawn in July.
4. Steelcolor shiner females contained an average of 1,049 eggs.
5. Spawning facilities for culturing the species should include spawning boards.
6. The steelcolor shiner is primarily insectivorous.

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