Thus, the principal spawning grounds of striped bass in the Tar River apparently occur above Bell's Bridge (Station 1) over about a 25 mile span of river. This stretch of river is characterized by a rocky bottom and a swift current which is very similar to the spawning habitat of striped bass in other rivers such as the Roanoke in North Carolina, the James and Potomac in Virginia and the Hudson in New York (Pearson, 1938).

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MOVEMENTS OF THE REDBREAST SUNFISH IN LITTLE RIVER, NEAR RALEIGH, NORTH CAROLINA[1]

by

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ABSTRACT

Recoveries of 189 redbreast sunfish *(Lepomis auritus)* tagged in Little River, North Carolina, indicated that this species is moderately mobile. Upstream movements predominated among fish recaptured within 60 days after their release in April and May. The extent of movement of males and females was about equal. On the basis of measurements at release and recapture, average annual increase in size was 2.4cm in total length and 48.0g in weight. The estimated annual harvest by sport fishermen was 14.7%.

INTRODUCTION

Some species of sunfishes are more mobile than others. On the basis of degree of movement, Funk (1957) classified stream fishes as mobile, semi-mobile, and sedentary. His work, as well as studies by Ball (1947), Gerking (1959), Gunning (1963), and Moody (1960) indicated that Centrarchidae are sedentary and limited to home range areas. However, white crappies *(Pomoxis annularis)* were found to be mobile (Funk 1957; Siefert 1969) and largemouth bass *(Micropterus salmoides)* semi-mobile (Funk 1957). Berra and Gunning (1972) indicated that longear sunfish *(Lepomis megalotis)* are largely limited to home ranges, but travel short distances in the summer and winter.

In North Carolina redbreast sunfish sometimes reach a length of 20cm and a weight of 450g, and occur in most Piedmont and Coastal Plain streams (Shannon 1966a). In 1966, Shannon (1966b), who released tagged, hatchery reared redbreast sunfish into Bones Creek near Fayetteville, North Carolina, and recaptured them in a counting weir, showed that some moved upstream and others downstream. The upstream movements increased during high water levels in the spring.

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[1] This paper is based on a portion of a thesis submitted to the Graduate Faculty, North Carolina State University at Raleigh, in partial fulfillment of the requirements for the Master of Science degree.

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Hall (1972) noted in New Hope Creek, Orange County, North Carolina, that redbreast sunfish that moved upstream during spring were more numerous and larger than those that moved downstream. Carpenter (1967) reported lengthy upstream movements of redbreast sunfish in the Little River.

The present study was conducted in 1966-68 to further the understanding of redbreast sunfish movements.

MATERIALS AND METHODS

Little River, tributary to the Neuse River, has an average width in our study section of 12m (40 ft) and an average depth of 0.9m (3 ft). Pools, some as deep as 3.4m (11 ft), are interspersed with shallow stretches of sand and pebbled bottom.

The stream section studied was a 26-km (16 mi) segment about 40km (25 mi) east of Raleigh, North Carolina. The upstream boundary was Tarpley's Millpond Dam (Fig. 1) and the downstream boundary was Atkinson's Millpond. The northern 9.7km (6 mi) was measured and markers were placed at 0.16-km (0.1 mi) intervals. The length of the rest of the 26-km section was determined from aerial maps.

With the exception of a few fish captured by hook and line, electrofishing and seining, the sunfish were caught in cylindrical traps (122cm long and 51 to 122cm in diameter), constructed of 2.5cm (1 in) poultry wire. One end was closed, and the other had one or two funnels. The traps were not baited; the mouth usually faced downstream, preventing an accumulation of debris.

Twenty-five to 40 traps were used in most periods of the study, but the number was reduced to 10 in December-January because fish activity was much reduced. Traps were first placed in equal numbers at each station (1-7, not 1A; see Fig. 1). Trapping was soon discontinued at the downstream stations, however, because the catch rate was very low.

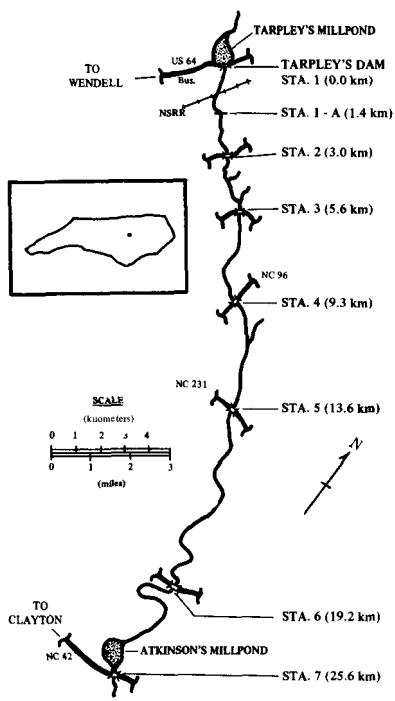

Figure 1. Map of the study area showing trapping station locations (1, 1A, and 2-7) and highway bridges. Distances from Tarpley's Dam are shown in parentheses. Inset shows approximate location of the area in North Carolina.

Each trapped fish was weighed and measured (total length), and sex was determined when possible. A wire dart tag with a plastic pennant, developed by Dr. Alfred Eipper of Cornell University (personal communication), was inserted between the third and fourth pterygiophores about four scale rows below the mid-dorsal line. A shortened (2cm) no. 19 hypodermic needle was used to puncture the skin and facilitate insertion of the wire dart. Each fish was released at the site of capture.

Two population estimates (Schumacher-Eschmeyer 1943) and an exploitation rate were determined from creel census data and trap recaptures.

RESULTS AND DISCUSSION

A total of 481 redbreast sunfish were tagged. During fall 1966, when trapping pressure was equal at stations 1-7, 80% of the 44 fish captured at 6 of the stations (station 4, the dividing point in this comparison, was excluded) were taken at stations 1-3, and only 20% at stations 5-7. 1A was not in use during the early part of the study. Since the downstream stations provided too few fish to justify continued trapping, later trapping was concentrated at the upstream stations.

Activity, as measured by catch per unit of effort, indicated that the fish moved more in May and June and less in January and February than in the other months. This is illustrated by the number of fish tagged each month (Fig. 2).

Recaptures from the 481 fish tagged totaled 189 (39.3%). This sum of all recaptures included 142 individual fish; 111 (78.2% of the total) were recaptured once, 20 twice, 7 three times, 3 four times, and 1 five times.

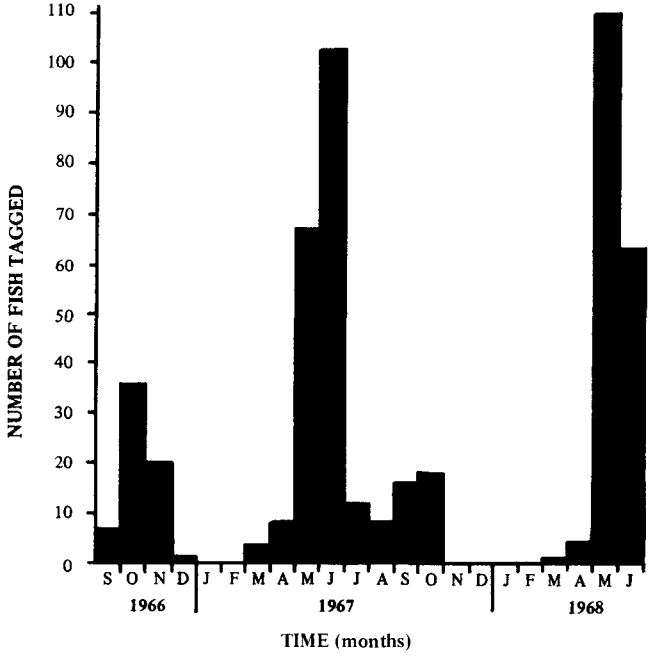

Figure 2. Number of redbreast sunfish tagged during each month, 1966-68. (Since fishing effort was not equal for all months, the catches indicate only approximate relative abundance.)

Of the 189 recaptures, 82 (43.4%) were made 0.16km (0.1 mi) or more from the original tagging site; the rest were recovered at or near the locality of release. To eliminate multiple recaptures from a determination of mobility, we restricted our analysis to the 142 individual fish that were recaptured. About 51 percent (72) of these were recaptured, at least once, 0.16 km or more from their original capture-release site. The rest were never caught more than 0.16km from their original release site. On the basis of Funk's system of classification (1957) this species is semi-mobile in Little River, since about half of the tagged fish moved away from the locality of first capture.

Since fish in the mobile segment of the population left the trapping area they had a reduced chance of being recaptured. This reduction in vulnerability to traps may partly explain why anglers recaptured 57.3% (47) of the fish exhibiting movement, but only 23.4% (25) of those that did not move. (The rest of the fish in both groups were recaught in traps.)

The sex ratio of 334 fish for which sex could be determined at the time of tagging was about two males to one female. Since returns of the sexes were in this same proportion, sex apparently did not affect mobility.

Increased catches by fishermen and traps indicated that redbreast sunfish aggregated at the base of Tarpley's Millpond Dam in the spring. To determine if movements tended to be seasonally directional, we examined data for 25 fish recaptured within a 2-mo or shorter interval after they were tagged at stations 1A-7, or 0.16km downstream from the dam at station 1. (Fish tagged within 0.16km of the dam at station 1 were not considered because the dam prevented them from traveling upstream.) Twenty of 21 fish tagged in April and May and recaptured within 60 days moved upstream; 2 of 4 tagged in June moved downstream and 2 moved upstream (Table 1).

These data indicate a strong tendency toward upstream movement among fish tagged in April and May and recaptured within 60 days. The fish became active earlier in 1968 than in 1967, as illustrated by the peak trapping success (Fig. 2), which was in May 1968 and in June 1967.

The maximum distance traveled by redbreast sunfish in Little River was 6.1km (by each of three fish). Four others were caught a total of 15 times in May and June with movements between captures consisting of eight upstream and downstream 0.16-km movements. Two other fish moved upstream 2.6 and 2.9km to Tarpley's Dam and then were recaptured again 0.2km below the dam; one of these was trapped and retrapped twice during the first 9 days of June 1967.

Table 1. Movements of fish captured from sites 0.16km or more below Tarpley's Dam and recaptured within 60 days.

		Movement				
		Upstream		*Downstream*		
Year and month of tagging	*No. of recaptures*	*No. of fish*	*Summed distance (km)*	*No. of fish*	*Summed distance (km)*	*Average net movements (km)*
1967						
Jan.-Apr.	0	0	. . .	0	. . .	. . .
May	10	9	8.2	1	0.4	+0.8
June	2	2	3.1	0	. . .	+1.6
Jul.-Dec.	0	0	. . .	0	. . .	. . .
1968						
Jan.-Mar.	0	0	. . .	0	. . .	. . .
Apr.	1	1	1.4	0	. . .	+1.4
May	10	10	6.0	0	. . .	+0.6
June	2	0	. . .	2	3.5	−1.7
Jul.-Dec.	0	0	. . .	0	. . .	. . .

The tagged sunfish ranged from 10.0 to 21.5cm in total length (average, 16.2cm or 6.4 in), and from 18 to 259g in weight (average, 100.1g or 3.5 oz).

Growth rates were determined from 31 fish which were at liberty for at least 6-mo before recapture. Of the 31 fish included in the growth study, 22 were free for 10-mo or longer, and represented growth through essentially an annual cycle; 8 were free 7 to 9-mo throughout the fall, winter, and spring; and 1 was free for 9-mo during the summer, fall, and winter. The growth increase for all these fish was expanded to estimate average gain per year. Since growth occurs primarily in the warm months, actual growth of the eight at liberty during fall, winter, and spring was probably greater than indicated by these estimations.

The average estimated annual increase in total length and weight of the 31 fish was 2.4cm (0.95 in) and 48g (1.69 oz). The average gain for fish that moved (2.3cm and 56g per year) was not significantly different from that of fish that did not (2.4cm and 42.3g). The maximum annual growth rate (7.6cm and 182.4g or 3 in and 6.4 oz) was estimated from a 14.5-cm (5.7 in) fish released in June 1967 and recaptured in April 1968.

Inasmuch as small fish were not readily caught in traps, estimates of population size were developed only for those longer than 10.0cm (total length) in the 26-km study area. The Schumacher-Eschmeyer (1943) method was employed for two estimates. The first was based on trap returns after successive lots of about 50 fish were tagged. The second was based on 36 redbreast sunfish caught by fishermen. The first group yielded an estimate of 1226 (sampling variance 0.4177 and standard error ± 92 fish). The second was 1630 (sampling variance 0.2857 and standard error ± 332 fish). Fishing mortality known to have occurred was included in both estimates.

Rate of harvest was calculated from 245 tagged fish which had been free for 1 year or longer, of which 36 were caught by anglers. Annual harvest rate was consequently estimated to be 14.7% for fish longer than 10cm. Projected to the population estimate of 1226 fish, the harvest was 180 during the year. This figure is considered minimal since not all fishermen were contacted.

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