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THE SPAWNING BEHAVIOR, FECUNDITY RATES, AND FOOD HABITS OF THE REDBREAST SUNFISH IN SOUTHEASTERN NORTH CAROLINA ¹

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ABSTRACT

Redbreast sunfish *Lepomis auritus* (Linnaeus) were found to spawn during June at water temperatures of 71° to 73°F. Redbreast sunfish redds were almost identical in design and size in the Lumber, Waccamaw, and the South Rivers. Each redd was located in or near a sheltered area such as a log, fallen tree, or stump. The preferred bottom substrate for spawning was sand and small gravel. No redds were observed in silt or detritus.

Age II, III, IV, V, and VI year redbreast sunfish had mean egg counts of 963, 1,000, 3,563, 5,620, and 8,250, respectively, with corresponding standard deviations of 88.4, 435.9, 763.1, 851.9, and 278.4.

The most important food items found in the redbreast sunfish stomachs were aquatic insects, represented by Coleoptera, Odonata, and Ephemeroptera. It appeared that redbreast sunfish were selective and preferred the larger mayfly, dragonfly, and beetle larvae found in the streams. When confined to aquaria, redbreast sunfish preferred live food items such as worms, crickets, grubs, and grasshoppers over artificial foods.

INTRODUCTION

The redbreast sunfish *Lepomis auritus* (Linnaeus) is a highly prized game fish in the inland waters of North Carolina and is a significant game fish in North Carolina's Coastal Plain streams. The redbreast sunfish is found inland along the east coast of North America from New Brunswick to Florida, and inland along the Gulf States to Texas.

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Its geographical distribution in North Carolina encompasses 23 of the 26 major watersheds. Shannon (1966) found the species to inhabit waters at elevations between sea level and 3,500 feet and to inhabit waters having pH ranging from 4.8 to 8.4.

In spite of its stature as a game fish, little was known of the basic biology of the redbreast sunfish. During the past few years, concern was expressed by anglers and outdoor writers over the "sharp decline" in the redbreast sunfish fishery in southeastern North Carolina. Some fishermen suspected that pesticide accumulation and pollution had badly damaged the fishery, whereas others believed that drainage or channelization projects had decreased the redbreast habitat. Because of the varied viewpoints, this study was undertaken to learn more about its life history on which management needs could be based.

METHODS AND PROCEDURES

Spawning data were collected from three rivers in southeastern North Carolina: Waccamaw, Lumber, and South Rivers (Figure 1). Frequent visits were made to these streams during the spawning season of April through June in order to make visual observations of spawning behavior. Physical measurements made at each redd consisted of width, depth, distance from water surface to redd, and water temperature. In addi-

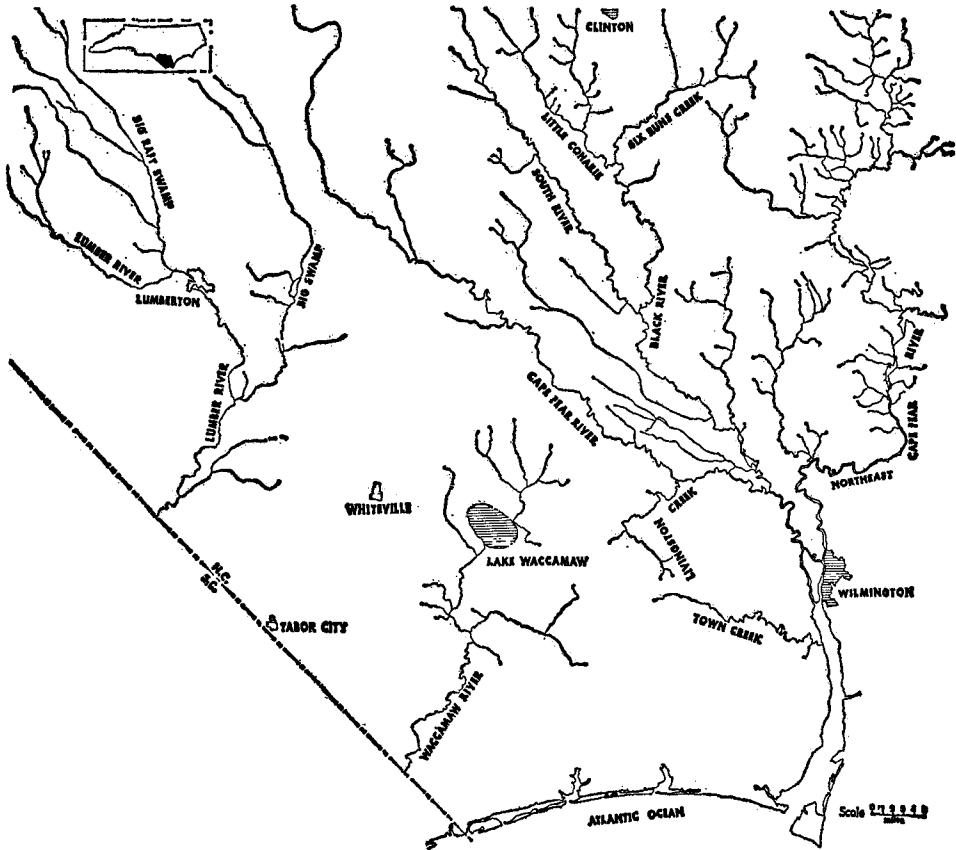


FIGURE 1. Map showing Geographical Location of Streams Sampled

tion, a spawning experiment was conducted in a one-tenth acre pond at the Fayetteville Fish Hatchery. Here, redbreast sunfish were given a choice of sand, gravel, or silt substrate in which to spawn.

Redbreast sunfish were collected for the fecundity study from South River with wire traps, rotenone, and by angling. Each captured specimen was immediately injected with 10 percent formalin, placed in a jar containing 10 percent formalin, and taken to the laboratory where egg counts were made.

Food habits of the redbreast sunfish were determined from preserved stomachs collected from April through August, 1970. Food materials were identified in the laboratory with the aid of a binocular scope at 10X magnification.

RESULT AND DISCUSSION

Fisheries literature pertaining to redbreast sunfish spawning includes a wide range of temperatures, with the reported peak of spawning developing when water temperatures range between 68°F. and 82°F. Breder and Nigrelli (1934) stated that as water temperatures reach 60.8°F., the males seek a shallow shoreline and start nest construction. Breder (1936) found nest building associated with water temperatures between 68°F. and 82°F. in the vicinity of New York City. Fowler (1936) observed spawning near Philadelphia to begin between June 10 and 25. Shannon (1966) concluded that the male redbreast sunfish began nest construction by mid-May when water temperatures ranged between 70°F. and 75°F., and that the peak of spawning activities occurred at water temperatures between 80°F. and 85°F. A four-year study by the Connecticut State Board of Fisheries and Game, reported in 1941 on the life history of redbreast sunfish, indicated that spawning began around June 1, extended through the summer, and tapered off about mid-August.

As water temperatures exceeded 64°F. during April, in the Lumber, Waccamaw, and the South Rivers, the majority of redbreast sunfish collected were males. When water temperatures reached 67°F., female redbreast sunfish began to appear in both the fishermen's creels and the traps. By the first of June, robust females were fairly common. When sexually mature, the stomach color of the females was pale orange and that of the males a deep orange.

The first redbreast redds were located in South River on June 10, 1970, at a water temperature of 71°F. Spawning redbreast were observed on the nest as water temperatures rose from 71° to 78°F. During this period, the Lumber and the Waccamaw Rivers, reputedly good redbreast streams, were checked and in each case the observations concurred with the spawning temperatures found in South River. Redd construction was identical in design in all three watersheds. Those observed averaged 36 inches in diameter and from 6 to 8 inches deep at the center. All redds were found in water depths of 14 to 15 inches. The spawning period of redbreast sunfish in South River extended from June 10 to 20 and thereafter, only a few active redds were located.

One significant observation was that each redd was located in a sheltered area that was partially hidden by logs, fallen trees, or stumps. Invariably, the redds were found in a substrate of sand and fine gravel and none were observed in silt or detritus. Natural physical obstructions in the streams appeared an essential feature of the preferred habitat of the redbreast sunfish.

The observed preference for a sand spawning substrate, exhibited by the redbreast sunfish, was confirmed by experiments conducted in a hatchery pond. Six pairs of mature redbreast were confined in individual cages over a sand and gravel substrate or one of silt. Of the four pairs confined over the former, all chose sand. Of the two pairs confined over silt, only one attempted redd construction and this proved unsuccessful.

Water level discharge data for South River over the past six years were collected from the U. S. Geological Survey gage on South River. Stream discharges generally were quite constant during the late May through early July spawning season of the redbreast sunfish. The average velocities for this period ranged from 0.11 to 1.84 feet per second with a mean of 0.59 feet per second. These data tend to indicate that the redbreast sunfish prefers to spawn under relatively constant water levels with an average velocity approximating 0.59 feet per second.

Ovaries from 17 redbreast sunfish, two to six years of age, were examined to determine the number of eggs produced. The total lengths of these fish ranged between 5.0 and 9.2 inches, with corresponding weights from 49 to 300 grams. Age II fish (5.5 to 5.6 inches total length) had mean egg counts of 963 with a standard deviation of 88.4; age III fish (5.9 to 6.1 inches total length) 1,000 eggs with a standard deviation of 435.9; age IV fish (6.75 to 7.25 inches total length) 3,563 eggs with a standard deviation of 763.1; age V fish (7.25 to 8.0 inches total length) 5,620 eggs with a standard deviation of 851.9; and age VI fish (9.0 to 9.25 inches total length) had mean egg counts of 8,250 with a standard deviation of 278.4.

Ovary lengths ranged from 14 to 58 mm and averaged 37.2 mm. Age II fish (5.5 inches average total length) had ovary lengths averaging 16 mm with a range between 14 and 18 mm; age III fish (6.0 inches average total length) 19.7 mm with a range of 17 to 23 mm; age IV fish (7.0 inches average total length) 37.2 mm with a range of 32 to 40 mm; age V fish (7.9 inches average total length) 49.8 mm with a range of 47 to 54 mm; and age VI fish (9.2 inches average total length) had ovary lengths averaging 55.0 mm with a range of 52 to 58 mm.

Shannon (1966) concluded that redbreast sunfish feed on both bottom and surface dwelling organisms. Phillips (1967) stated that redbreast sunfish were primarily insectivorous and feed mainly upon larval insects rather than the adult forms. Carnes (1966) found that redbreast sunfish confined in a pond would utilize floating pelletized fish food.

The contents of 90 redbreast sunfish stomachs were examined between April and September, 1970. From the types of food material found in the stomachs, it appeared that redbreast sunfish definitely preferred aquatic insects. Plant material, in the form of detritus, was commonly found, but probably ingested incidental to feeding on aquatic insects. Much of the material found in the stomachs was identifiable, whereas that found towards the lower end of the intestine was well digested and could not be identified.

The principal orders of aquatic insects found in redbreast sunfish stomachs were Coleoptera, Odonata, and Ephemeroptera (Table 1). An aquatic insect availability study made with an Ekman dredge in South River during July, 1970 indicated that Diptera larvae was the most common aquatic organism. It appears that redbreast sunfish were selective and preferred the larger mayfly, dragonfly, and beetle larvae. Sand found in the stomachs of redbreast sunfish presumably was derived from caddisfly cases and not the result of bottom feeding. The diet of the redbreast sunfish appeared to be diversified and included all available larger aquatic organisms in the stream. It should be noted that the young fishes found in several redbreast sunfish stomachs resulted from a rotenone sample and were not believed to be a preferred food item (Table 1).

Redbreast sunfish held in both aquaria and an outside pool readily consumed a large variety of food items including worms, crickets, grubs, grasshoppers, and artificial foods such as trout chow and bread.

CONCLUSIONS

It was concluded from the study that:

(1) Redbreast sunfish begin spawning when water temperatures reach 71°F. with the peak being reached before water temperatures exceed 78°F.

TABLE 1. Percent frequency of occurrence of various food items found in the stomach of 90 redbreast sunfish collected April-August, 1970.

Food:	Percent Occurrence	Food:	Percent Occurrence
Unidentifiable insects	77.8	Amphipoda	7.8
Coleoptera	48.9	Hymenoptera	6.7
Odonata	28.9	Hydracarina	5.6
Ephemeroptera	22.2	Pelecypoda	3.3
Gravel	22.2	Decapoda	2.2
Plant materials	20.0	Fish eggs	2.2
Tricoptera	15.6	Lepidoptera	2.2
Nematoda	11.1	Megaloptera	2.2
Fish	8.9	Diptera	1.8
Hemiptera	8.9	Annelida	1.1

(2) Redbreast sunfish prefer to spawn under relatively constant water levels with an average stream velocity approximating 0.59 feet per second.

(3) A sheltered, sand-gravel substrate under 14 to 15 inches of water appears to be the preferred spawning site for the redbreast sunfish.

(4) The mean fecundity rates for II, III, IV, V, and VI year fish were 963, 1,000, 3,563, 5,620, and 8,250, respectively.

(5) Aquatic insects are the mainstay of the redbreast sunfish diet in southeastern North Carolina waters.

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