

A PRELIMINARY REPORT  
ON THE  
BIOLOGY OF THE ROANOKE BASS, *Ambloplites cavifrons* Cope,  
IN NORTH CAROLINA



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# A PRELIMINARY REPORT ON THE BIOLOGY OF THE ROANOKE BASS, *Ambloplites cavifrons* COPE, IN NORTH CAROLINA

## ABSTRACT

The Roanoke bass, *Ambloplites cavifrons*, was described by Cope in 1867 seemingly from a single three-inch specimen recovered from the Roanoke River in Montgomery County, Virginia. Subsequent literature indicates the species remained unrecognized in North Carolina until 1963 when encountered in Fishing Creek during a survey and inventory of the Tar River Basin. Inquiry among local anglers and Wildlife Protectors has revealed this fish apparently is taken by rod-and-reel fishing in small-to-moderate numbers from several diverse streams of both the Tar River Basin and the Neuse River Basin. The Roanoke bass—known locally in North Carolina as “Red-eye Bass”, “Red-eye chub”, or “Red perch”—is very popular and, seasonally, is much sought by anglers who know where, and how, to fish for it.

Sixty-nine wild, adult Roanoke bass have been captured since field work was initiated July 1, 1967—47 in wire traps (catfish baskets), 18 by angling, 3 in fyke nets, and 1 with cresol.

Wild, adult Roanoke bass adapted readily to a hatchery-pond environment and spawned successfully in one-tenth acre ponds during May, 1968 and May 1969. Spawning was initiated when the water temperatures reached the low 70's. All nests were constructed at depths of two feet or less and only on gravel substrate.

Fry, because of their proclivity for hiding in and around vegetation, were extremely difficult to collect, however, approximately 1,800 fry were collected from the 1968 spawn. Fry from the 1969 spawn have not been collected as yet.

Redbreast sunfish growth was significantly greater than that of the Roanoke bass in an experimental pond at the Fayetteville Hatchery. There was no significant difference in the lineal growth of the two populations, but Rock bass weights averaged significantly higher than the Roanoke bass weights in an experimental pond at the Table Rock Hatchery.

The examination of scales from 21 wild, adult Roanoke bass and from 123 wild, adult and fingerling, redbreast sunfish taken generally from the same streams indicates that the main advantage of the Roanoke bass over the redbreast sunfish as a game fish is its longevity and consequently, greater size potential.

Crayfish and fish were the only organisms found in the stomachs of ten wild, adult Roanoke bass. Aquatic invertebrates—mainly Tendipedidae, Coleoptera, and Notonectidae—comprised the bulk of the fingerling diet in a hatchery pond. Fish remains were found in only 1 of 96 fingerling stomachs examined.

Data gathered from four gravid female Roanoke bass indicates that the number of eggs produced each year apparently increases with age—at least to seven years—but that the number of eggs per unit of body weight decreases.

The most reliable meristic characters encountered thus far for distinguishing the Roanoke bass from the Rock bass have been the absence of visible cheek scales, the concave curvature of the nape, and the presence of 10 to 12 scale rows above the lateral line of the Roanoke bass versus the completely scaled cheeks, the convex curvature of the nape, and the presence of 8 or 9 scale rows above the lateral line of the Rock bass.

## BACKGROUND

The Roanoke bass (*Ambloplites cavifrons*) was described by Cope in 1867 seemingly from a single three-inch specimen recovered from the Roanoke River in Montgomery County of Virginia.

Several of the diagnostic characters described by Cope have proven a source of confusion to subsequent workers. Two characteristics of this species, however, have been consistently noted by most writers: (1) Cheeks naked, or with a few, deeply imbedded scales; and (2) nape concavely curved. Dr. R. M. Bailey, in his doctoral dissertation, apparently was the first to cite meristic characters differing from those found in the original description. Some of the redefined characters later appeared in a key prepared by Dr. G. A. Moore and published in "Vertebrates of the United States": Data gathered during the current study of the Roanoke bass in North Carolina verified all of the diagnostic characters as altered by Bailey.

A search of the available literature indicated that Roanoke bass "appears to be extinct or so rare as to be seldom collected". The species remained unrecognized in North Carolina waters until found at five locations during a survey of the Tar River in 1963.

## DISCUSSION

The Roanoke bass is far from being "rare", much less extinct, in North Carolina. Since field work was initiated in July of 1967, 53 wild, adult specimens have been captured from the Tar River Watershed and 16 from the Neuse. Forty-seven of these were captured in wire traps (catfish baskets) 18 by angling, 3 in fyke nets, and 1 with cresol. The fish were collected from widely divergent sources—150 river miles apart in the Tar and 100 miles apart in the Neuse. Inquiry among local anglers and Wildlife Protectors revealed this fish to be taken seasonally by rod-and-reel fishing in small-to moderate-numbers from several streams in both watersheds. It is very popular and much sought by the anglers who know where, and how, to fish for it.

The popularity of the Roanoke bass stems from its first-class fighting ability, its size, and its palatability. This fish appears to attain a maximum size greater than any of its associated panfishes. The largest specimen recorded to date measured thirteen inches in total length and weighed 1.7 pounds. Several anglers, however, have reported catches of fish weighing between two and three pounds and one weighing as much as 4¼ pounds.

The Roanoke bass, known locally in North Carolina as "Red-eye bass", "Red-eye chub", and "Red perch", closely resembles—and is frequently confused with—the rock bass, *Ambloplites rupestris* (Rafinesque), or the warmouth, *Chaenobryttus gulosus* (Cuvier). Gross identification is simplified by the three anal spines of the warmouth whereas the other two species possess either five or six; the rock bass then is differentiated by the completely scaled cheeks, and a convex nape whereas the Roanoke bass has no cheek scales (or at most, a few deeply imbedded scales located immediately below the eye) and a concave nape (Plate 1).

The Roanoke bass is described further as having: 10 to 12 scale rows above the lateral line; an elongated body; a large, bass-like mouth with the maxillary extending to—or just behind—the pupil; the spinous portion of the dorsal fin as elongate as the soft portion; and the anal fin considerably shorter than the dorsal. The body color can be various shades of greenish-bronze. A dark spot is present on each scale giving the fish an appearance of having a series of lateral black stripes. There is a small, but distinct, black spot on the operculum.

Specimens were collected only from stream sections with perceptible flow and where the bottom substrate was composed chiefly of rock, gravel, and/or sand. Other stream characteristics generally associated

with Roanoke bass habitat were: Clear water, high dissolved oxygen, neutral pH, maximum summer water temperatures in the 70's, and an adequate supply of macrobenthos (Table 1).

The annual fecundity rates of four gravid female Roanoke bass were computed from the direct count of eggs taken from sections excised from each end of the ovary and weighed to tenth-gram accuracy. Using approximately 15X magnification, the eggs were counted and separated into mature and immature groups, using size and color as criteria. Eggs having diameters between 1.0 and 2.0 mm and a yellow color were considered mature while those with diameters of less than 1.0 mm and a white color were considered immature. Presumably, however, the latter eggs still would mature during the coming spawning season. The resulting data indicated that the number of eggs produced each year increases with advancing age—at least to seven years. The number of eggs produced per gram of body Weight, however, decreases with successive years (Table 2).

While the Roanoke bass is a habitue of flowing streams, it readily adapted to a hatchery-pond environment and spawned successfully in tenth-acre ponds at the Fayetteville Hatchery during May, 1968 and May, 1969. Spawning was initiated when the water temperatures reached the low 70's. All nests were constructed at depths of two feet or less and only on gravel substrate with stone diameters of less than one inch. Similar gravel substrates as well as sand and muck substrates, also were available at various locations in the pond and at depths varying from 0.3 to 4 feet.

When harvesting the fry, their proclivity for hiding in, and around, vegetation—principally spike rush—creates a very real problem. Losses from this source alone can be as high as 50 percent of the hatchery production if the vegetation is abundant. Despite such losses, some 1,800 fry were recovered from the 1968 spawn. Because of a size differential apparent among the fry, it was concluded that at least two successful spawns had occurred in each pond. Fry from the 1969 spawn have not yet been collected.

To test the comparative growth rates of Roanoke bass with redbreast sunfish in the same lentic environment, 525 Roanoke bass fry from the spawn at Fayetteville Hatchery (total lengths averaged 14.5 mm), and an estimated 500 wild, redbreast sunfish fry (total lengths averaged 11.4 mm) collected from Bones Creek—the hatchery water supply—were stocked into the same half-acre pond. Adult fathead minnows, along with suitable spawning facilities for them, were added to the pond.

On March 27, 1969, 267 days following stocking, the pond was drained and all experimental fish counted. A total of 289 Roanoke bass and 685 redbreast sunfish were recovered. The pond then was refilled and restocked with 285 fish of both species. The fathead minnows also were put back in the pond.

A sample of 25 Roanoke bass and 25 redbreast sunfish revealed that the redbreast sunfish had significantly outgrown the Roanoke bass both in total length and in weight at the 95 percent confidence limits: Redbreast sunfish total lengths averaged  $119 \text{ mm} \pm 4.7$ , Roanoke bass total lengths averaged  $86.4 \text{ mm} \pm 4.1$  ( $P < 0.01$ ); Redbreast sunfish weights averaged  $28.4 \text{ grams} \pm 3.9$ , Roanoke bass weights averaged  $8.8 \text{ grams} \pm 1.6$  ( $P < 0.01$ ).

At the Table Rock Hatchery near Morganton, North Carolina, 268 Roanoke bass fingerlings (total lengths averaged 37.5 mm) from the spawn at Fayetteville Hatchery, and 275 rock bass fingerlings (total lengths averaged 31.1 mm) from a hatchery spawn were stocked into the same half-acre pond on July 16, 1968. Fathead minnows also were added to the pond.

On April 15, 1969—274 days following stocking—the pond was drained and all fish counted. A total of 122 Roanoke bass and 125 rock bass

were recovered. The pond was refilled and restocked with 120 fish of each species. Fathead minnows and golden shiners were added for forage.

A sample of 25 Roanoke bass and 25 rock bass revealed that there was no significant difference in the lineal growth of the two populations but that the rock bass weights averaged significantly greater than those of the Roanoke bass at the 95 percent confidence limits: Rock bass total lengths averaged  $111.1 \text{ mm} \pm 3.9$ , Roanoke bass total lengths averaged  $107.44 \text{ mm} \pm 3.0$  ( $P > 0.10$ ); Rock bass weights averaged  $26.2 \text{ grams} \pm 3.5$ , Roanoke bass weights averaged  $20.9 \text{ grams} \pm 2.2$  ( $P = 0.02$ ).

During the spring of 1969, an effort was made to determine whether yearling Roanoke bass would spawn. Observational spawning boxes containing gravel and sand were prepared and placed in the Roanoke bass-redbreast sunfish pond at Fayetteville Hatchery and in the Roanoke bass-rock bass pond at Table Rock Hatchery. Seventy-two Roanoke bass fingerlings showing accelerated growth (total lengths averaged 149.0 mm) were placed in a tenth-acre pond containing prepared spawning facilities.

The observational evidence obtained at the Fayetteville and Table Rock Hatcheries during May, 1969 indicated that, whereas redbreast sunfish and rock bass both spawned as yearlings, the Roanoke bass did not.

The stomach contents of 20 wild, adult—and 96 hatchery-reared, fingerlings—Roanoke bass were examined. Fifty percent of the adults stomachs and 67 percent of the fingerlings stomachs were found empty. In the remaining adults stomachs, only crayfish and fish were found. Aquatic invertebrates—mainly Tendipedidae, Coleoptera, and Notonectidae—comprised the bulk of the fingerling diet. Fish remains were found in only 1 of the 96 fingerlings stomachs.

Scales collected from 21 wild, adult Roanoke bass and from 123 wild, juvenile and adult, redbreast sunfish—generally taken from the same streams—were aged using a Van Oostentype scale projector. Recognizing the probabilities of some inaccuracy because so few specimens are involved, the data indicate that the main advantages of the Roanoke bass over the redbreast sunfish as a game fish are that, whereas the two species grow at essentially the same rate, the Roanoke bass apparently has a greater longevity, and consequently, it possesses a larger ultimate size potential (Table 3).

Twenty wild, adult Roanoke bass, 15 wild, adult rock bass, 123 hatchery-reared, fingerling Roanoke bass, and 35 hatchery-reared rock bass were compared for the following meristic characters: Cheek scalation; nape curvature; the number of scale rows above the lateral line; lateral line scale count; dorsal fin count; anal fin count; ratio of head length to eye diameter; and number of vertebrae.

Data gathered from the above fishes indicate that cheek scalation, nape curvature, and differences in the number of scale rows above the lateral line are the most reliable meristic characters for distinguishing Roanoke bass from rock bass.

The cheeks of the Roanoke bass are naked, or at most have only a few deeply imbedded scales immediately below the eye, while the cheeks of the rock bass are completely scaled.

The nape of the Roanoke bass is concave whereas that of the rock bass is convex.

The Roanoke bass has from 10 to 12 scale rows above the lateral line while the rock bass had either 8 or 9 scale rows above the lateral line.

All of the meristic characters determined thus far are summarized in Table 4.

## LITERATURE CITED

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TABLE 1. Summary of stream data collected near Roanoke Bass capture sites.

(Five Locations in Tar River Watershed, Five Locations in Neuse River Watershed)

Datum	Mean $\pm$ 1.97 (S.D.)
Dissolved Oxygen (ppm)	7.7 $\pm$ 1.0
Free Carbon Dioxide (ppm)	6.3 $\pm$ 4.3
pH	7.1 $\pm$ 0.4
Total Alkalinity (ppm)	30.5 $\pm$ 10.8
Temperature ( $^{\circ}$ F.)	73.5 $\pm$ 6.7
Average Width (ft.)	37.9 $\pm$ 43.1
Average Depth (ft.)	0.9 $\pm$ 1.4
Velocity (ft./sec.)	1.3 $\pm$ 1.4
Volume (cfs)	56.9 $\pm$ 192.7
Secchi (inches)	19.5 $\pm$ 25.0
Macrobenthos—	
Avg. No./sq. ft.	87.0 $\pm$ 180.6
Avg. Vol. (ml)/sq. ft.	1.0 $\pm$ 3.2
Frequency of Bottom Substrate at the Ten Locations	Rock—5 Gravel—6 Sand—9

Plate 1.  
ROANOKE BASS ADULT  
(With Enlarged Cheek Area)

ROANOKE BASS  
(MALE)  
13.0 inches  
1.4 pounds

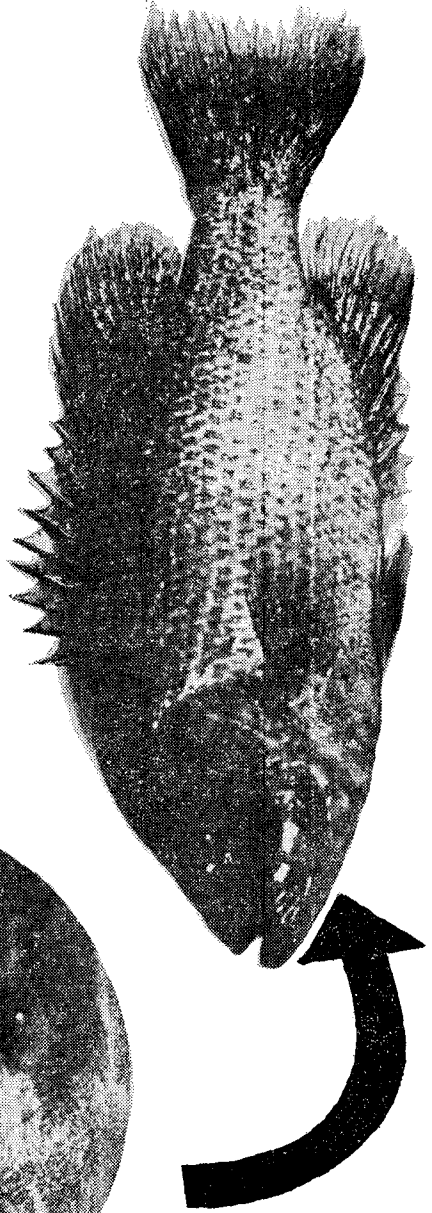


Plate 1.  
ROCK BASS ADULT  
(With Enlarged Cheek Area)

ROCK BASS  
(ADULT)  
340 grams  
10 inches

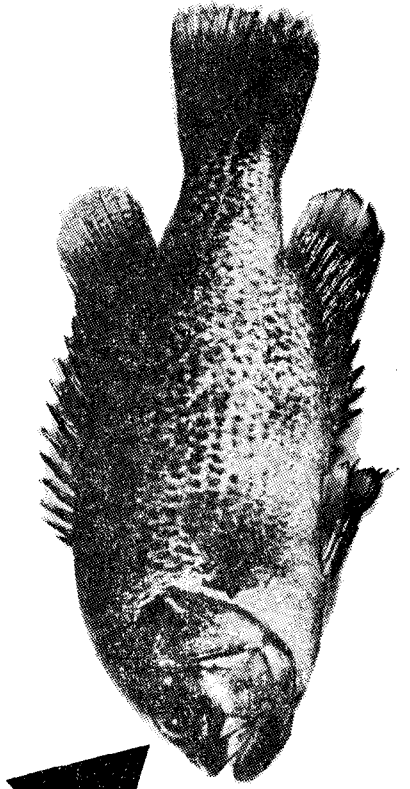




Table 2

## ROANOKE BASS --- ANNUAL FECUNDITY RATES

FISH DATA		EGG DATA			
Age (Years)	Number of Specimens	Range of Mature Egg Diameters (mm)	Calculated Total Number of Eggs Per Female	Number of Eggs Per Gram of Body Weight	Percent of Mature Eggs
4	2	1.3 - 1.8	3,500 - 5,400	25.7 - 29.4	50.9 - 59.7
5	1	1.5 - 1.8	8,200	26.9	54.0
7	1	1.5 - 2.0	9,600	21.7	87.5

Table 3

## GROWTH RATES OF ROANOKE BASS AND REDBREAST SUNFISH BY YEARS OF AGE

	Years of Age							
	I	II	III	IV	V	VI	VII	VIII
<u>Roanoke Bass:</u>								
Total Length in Inches (Mean)	1.81	3.37	4.95	6.38	7.43	8.36	9.86	11.30
Number of Specimens	21	21	21	21	15	10	7	3
Percent Attaining Indicated Age	100	100	100	100	71.5	47.7	33.3	14.3
<u>Redbreast Sunfish:</u>								
Total Length in Inches (Mean)	1.84	3.43	4.83	6.15	6.58	8.30		
Number of Specimens	123	121	104	46	10	1		
Percent Attaining Indicated Age	100	98.4	84.6	37.4	8.1	0.8		

Table 4

## ROCKE BASS -- ROCK BASS MERISTIC CHARACTERS

WILD, ADULT FISH:				ROCKE BASS				ROCKE BASS				HATCHERY-REARED, FINGERLING FISH:			
Meristic Character	Number of Specimens Examined	Meristic Count	Frequency in Sample	Number of Specimens Examined	Meristic Count	Frequency in Sample	Meristic Character	Number of Specimens Examined	Meristic Count	Frequency in Sample	Meristic Character	Number of Specimens Examined	Meristic Count	Frequency in Sample	
Cheek Scales	20	Absent	20	20	Scaléd	15	Cheek Scales	87	Absent	87	Cheek Scales	35	Scaléd	35	
Nepe Curvature	20	Concave	20	15	Convex	15	Nepe Curvature	96	Concave	96	Nepe Curvature	35	Convex	35	
Number of Scale Rows Above Lateral Line	20	10 11 12 13	6 6 7 1	15	8 9	13 2	Number of Scale Rows Above Lateral Line	52	10 11 12	14 34 4	Number of Scale Rows Above Lateral Line	18	8 9	7 11	
Lateral Line Scales	20	44 45 46 47 48	5 6 3 5 1	15	39 40 41 42	5 4 4 2	Lateral Line Scales	56	45 46 47 48 49 50	5 6 13 13 17 2	Lateral Line Scales	18	43 44 45 46 47 48 49	2 1 3 3 6 1 2	
Dorsal Fin	20	XI-12	20	15	X-11 XI-10 XI-11 XI-12	2 4 6 1	Dorsal Fin	95	X-12 X-11 XI-11 XI-12 XI-13 XI-12	2 1 1 85 5 1	Dorsal Fin	35	XI-10 XI-11 XI-12 XI-10 XI-11	1 10 1 2 1	
Anal Fin	20	VI-11	20	15	VI-9 VI-10 VI-11	10 10 1	Anal Fin	95	VI-11 VI-12 VI-10 VI-11 VI-12	8 1 2 72 5	Anal Fin	35	V-9 V-10 VI-10 VI-10 VI-11	1 9 9 17 9	
Head/Eye Ratio	20	4.7	Avg. of 20	15	3.6	Avg. of 15	Head/Eye Ratio	123	3.2	Avg. of 123	Head/Eye Ratio	35	3.5	Avg. of 35	
Number of Vertebrae	8	31 32	7 1	15	31	15	Range of Total Lengths (mm)	9-123			Range of Total Lengths (mm)	23-110			
Range of Total Lengths (mm)	173-317			115-224			Range of Weights (gms)	Trace-29			Range of Weights (gms)	0.3-25			