FISHERIES SESSION

AGE AND GROWTH OF REDEYE BASS IN SHOAL AND LITTLE SHOAL CREEKS, ALABAMA

E. D. CATCHINGS, Alabama Department of Conservation and Natural Resources, Game and Fish Division, Eastaboga, AL 36260

Abstract: The age and growth of redeye bass (*Micropterus coosae*) in Shoal Creek and Little Shoal Creeks, Alabama, were determined. Shoal Creek redeye bass, on the average, grew faster than redeye bass in other studies. Little Shoal Creek redeye bass grew slower during the first 6 years of life than redeye bass in other areas with the exception of redeye bass in Sheed's Creek, TN; however, by age VII Little Shoal Creek redeye bass were slightly larger than Shoal Creek redeye bass. Condition factors (K_n) of Shoal and Little Shoal Creak redeye bass relative to Alabama statewide averages for redeye bass and to redeye bass from other waters were computed. The redeye bass from Shoal and Little Shoal Creeks were in poorer condition relative to the average for Alabama redeye bass and to redeye bass in other waters. The condition of redeye bass in Shoal and Little Shoal Creeks improved as the fish grew relative to redeye bass in other waters.

Proc. Ann. Conf. S.E. Assoc. Fish & Wild. Agencies 32: 380-390

In Alabama the redeye bass occurs above the Fall Line in small (order I) to large streams in the Warrior and Alabama River drainages (Ramsey 1973). Generally, the redeye bass is more abundant in the small, infertile upland streams within these drainages.

Although Alabama has many streams inhabited by the redeye bass, comparatively little research has been conducted on this member of the genus *Micropterus*.

The majority of age and growth data on the redeye bass comes from studies conducted by Parsons (1954), Tatum (1965), Cathey (1973), and Gwinner (1973). Of these four studies, only Parsons' study was conducted on a native redeye bass population. The other three studies were conducted on introduced populations of redeye bass in the Cumberland River Drainage of Tennessee. Parsons' study was conducted on Sheed's Creek which is 1 of 2 streams in Tennessee where the redeye bass is native. The 2 streams are in the Alabama River Drainage.

Based on preliminary collections of redeye bass in Alabama, it appeared that the growth rates of Tennessee redeye bass would not be applicable to the growth of the redeye bass in Alabama. The state record for redeye bass in Tennessee is 340 g, but the redeye bass in Alabama is known to grow considerably larger. I have verified an Alabama redeye bass weighing 679 g and I have collected several specimens weighing more than 454 g.

To my knowledge, age and growth studies have not been conducted on the redeye bass in Alabama. Hurst (1969) investigated the life history of the shoal bass (*Micropterus* sp. cf. *M. coosae*) which at that time was thought to be the Apalachicola race of the redeye bass; however, Ramsey (1973) later recognized the shoal bass to be an undescribed species.

Parsons (1954) recognized the desirability of the redeye bass as a sportfish in spite of its small size and called it the "brook trout of the warmwater gamefish". Due to the potential of the redeye bass to provide a unique stream fishery a life history study was initiated. An objective of this life history study was to investigate the age and growth of the redeye bass to obtain basic growth data. These growth data will be essential in formulating future management plans for the fish should angling pressure intensify on these small streams.

I am indebted to W. Davies, Department of Fisheries and Allied Aquaculture, Auburn University, for his assistance in the design and running of the computer program. Thanks are due B. Smith and F. Harders, Alabama Game and Fish Division, for assistance in scale reading, and collecting samples. W. Shelton, Cooperative Fishery Unit, Auburn University, was most helpful in supplying manpower for taking several samples. Former Conservation Trainees M. Newman, J. Burgess, and J. Sullivan provided assistance in the collection of samples. Former Alabama Fisheries Biologist D. Keller, Enterprise, Alabama was also helpful in collection of fish samples. I would like to thank J. Ramsey and W. Shelton for the use of the Cooperative Fishery Unit's scale reading facilities at Auburn University. The clerical help of E. Wills is also appreciated. Finally, a special thanks is due B. Smith for his critical review of the manuscript and his encouragement. This work was supported in part from funds from the Federal Aid in Fish and Wildlife Restoration Act, Project F-38, Alabama.

MATERIALS AND METHODS

Shoal Creek is located primarily within the Talladega National Forest in Calhoun and Cleburne counties, AL (Fig. 1). It is a tributary of Choccolocco Creek and is in the Coosa River drainage. Shoal Creek is approximately 31.4 km in length and has a watershed area of about 140 km^2. Three impoundments have been constructed on the mainstream of Shoal Creek. A 23.2-ha flood-retarding and recreational impoundment was completed in 1970 at creek km 10.0, and 6.8-ha flood-retarding impoundment was completed in 1971 at creek km 20.2, and a 106-ha multi-purpose impoundment was completed in 1977 at creek km 29.

The once free-flowing creek has lost approximately 5.5 km to the permanent pools of these impoundments. In addition, an 8-ha recreational lake was built in 1964 on a tributary stream near the headwaters of Shoal Creek.

The headwaters of Shoal Creek form at an elevation of 366 m msl and the creek drops to an elevation of 207 m msl at its confluence with Choccolocco Creek. The creek has a gradient of about 4.9 m/km. Shoal Creek is located within the Valley and Ridge Province of the Appalachian Highlands. The topography is characterized by linear northeastward trending ridges of resistant sandstone, and parallel valleys underlain by less resistant shale or carbonate rock.

The study area in which fish samples were collected on Shoal Creek was from approximately 1.6 km upstream from the 23.2-ha impoundment at creek km 8.4 downstream to creek km 28.3 which is now within the 106-ha impoundment. The summer flow varies from .37 m^3/sec at the upper limit of the study area to 2.0m^3/sec at the lower limit of the study area. Stream width ranges from 6.7 to 15.2 m and stream depth varies from 10 to 15 cm over riffles to 1.2 to 1.8 m in the larger pools. The stream bed is composed of an estimated 80% slate gravel and 20% rock. The watershed is completely forested with a mixture of pines and hardwoods of the oak, hickory types. The majority of the stream is well shaded with hardwoods and pines throughout the study area. The visibility in the stream ranges from 1.2 to 1.8 m and turbidity increases only slightly after rainfall due to the forested watershed and the flood-retarding impoundments. The creek has few obstructions throughout its length although there are occasional fallen trees extending partially into the stream.

The Alabama Water Improvement Commission has classified the stream from its source to its mouth for swimming and fish and wildlife. The water is of excellent quality as there are no sources of domestic or industrial pollution in the immediate area of the creek.

Prior to construction of the 6.8-ha impoundment on Shoal Creek, Little Shoal Creek confluenced with Shoal Creek at creek km 20. The reservoir impounded the lower 0.8 km of Little Shoal Creek. The unimpounded stretch of Little Shoal Creek is 4 km in length. Little Shoal's source is at an elevation of 335 m msl and it flows into the 6.8-ha impoundment at an elevation of 265.5 m msl. It has a gradient of approximately 17.3

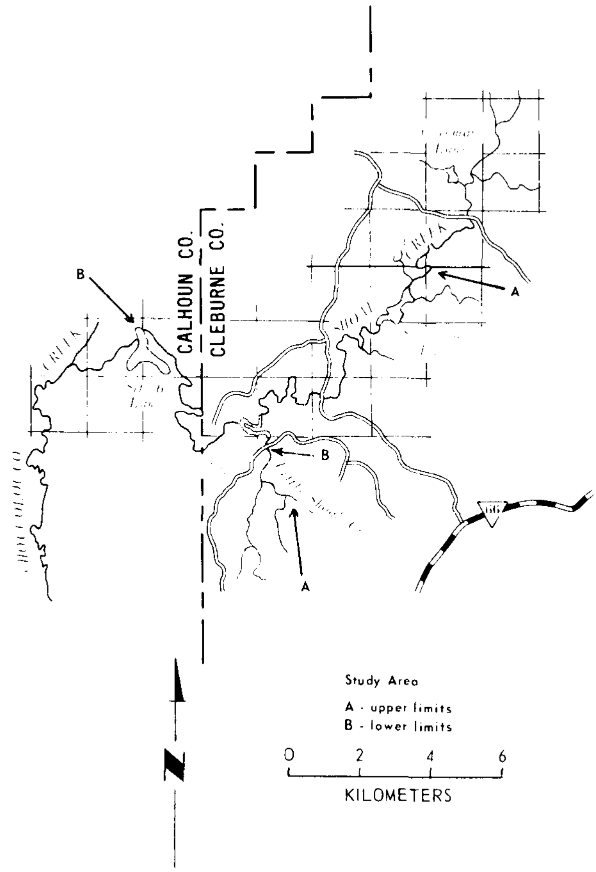

Fig. 1. Map of Shoal and Little Shoal Creeks, AL indicating study area.

m/km. The study area was confined to the lower 1.3 km of Little Shoal Creek and the gradient was 16.3 m/km. The study area averaged 4.6 to 5.5 m in width with a depth ranging from 10 cm over riffles to approximately 1.2 m in some of the larger pools. The average summer flow is about .17 m^3/sec.

Little Shoal Creek lies entirely within the Talladega National Forest. It is similar in all respects to Shoal Creek except for its smaller size. It is well shaded with predominantly hardwoods in the study area. There are more obstructions in Little Shoal than Shoal Creek. These are mainly log jams caused by fallen trees. Visibility is comparable to that in Shoal Creek.

The major sport fish on Shoal and Little Shoal Creeks is the redeye bass; however, largemouth bass (*M. salmoides*) have increased in number in the population samples taken since construction of the impoundments. The spotted bass (*M. punctulatus*) has been observed only rarely in the lower end of the creek below the 6.8-ha impoundment.

Rock bass (*Ambloplites rupestris*), bluegill (*Lepomis macrochirus*), and longear sunfish (*L. megalotis*) are also present in significant numbers.

Fish samples were collected by backpack electrofishing, rotenone, and angling from 9 May 1974 to 30 September 1976. Scale samples were removed from the left side, below the lateral line at the tip of the extended pectoral fin. At least 20 to 40 scales were removed per fish as the incidence of scale regeneration was high. All fish were measured for total length and most fish were also weighed and the sex determined.

Scales were cleaned, prior to making impressions, by soaking them overnight in a concentrated solution of "Spic and Span". Acetate impressions of the scales were made with a Carver Laboratory Press equipped with hot plates. The impressions were read on an Eberbach Scale Projector with 86X magnification. The magnified distances from the focus to each annulus and to the anterior scale margin were measured to the nearest millimeter. The scale radius used was the centermost radius of the anterior field.

Computer analysis was used to determine body length-scale radius relationship equations and to perform back calculations of lengths at each annulus for each age group. The Shoal Creek and Little Shoal Creek scale samples were analyzed separately. Length-weight equations and length-weight tables were also computed.

A third degree polynomial, where total length is a function of the linear, quadratic, and cubic expression of scale radius, was used to back-calculate the length on an individual fish at annulus formation. Sexes were combined to determine body length-scale radius relationship for the populations of each creek. Standard analysis of variance techniques indicated that in both cases the relationship of body length-scale radius is best represented by a curvilinear function. In this respect the addition of the quadratic and cubic terms accounts for a significant proportion of the variation in response.

Back calculations of total lengths at the end of each year of life for individual fish were accomplished by substituting the magnified (86X) scale radius measurements to each annulus into the appropriate body length-scale radius equations. The average length is reported for each age group.

The equation used to calculate the length-weight relationships was $\log W = \log a + b \log L$, where W is the weight in grams and L is the total length in millimeters. These equations can be used to estimate weight when only length of the fish is known.

Relative condition factors (LeCren 1951) were calculated for redeye bass in Shoal and Little Shoal Creeks. Length-weight relationships of Shoal and Little Shoal Creeks redeye bass were compared to redeye bass length-weight relationships from statewide averages (Swingle and Shell 1971). The relative condition factor of LeCren (1951) is expressed as follows: $Kn = \frac{W}{W_l}$ where W equals the weight of a fish of a specific length and W_l is the computed weight for the same length, derived from the equation $W_l = aL^b$ for this species in Alabama river systems. Tables for W_l values are provided in Swingle and Shell (1971).

Length-weight relationships for redeye bass in Shoal Creek were compared to length-weight relationships of redeye bass in Little Shoal Creek to obtain relative condition factors of the populations. LeCren's equation as stated previously is used except that W is the weight of redeye bass of a specific length in Shoal Creek and W_l is the computed weight for the same length redeye bass in Little Shoal Creek.

Relative condition factors for 2 previous redeye bass studies in Spring Creek, TN (Gwinner 1973), and Roaring River, TN (Cathey 1973), were computed. Length-weight relationships of redeye bass in Spring Creek and Roaring River were compared to length-weight relationships of redeye bass in Shoal and Little Shoal Creeks.

RESULTS

Sample totals of 160 redeye bass from Shoal Creek and 52 redeye bass from Little Shoal Creek were analyzed to determine body length-scale radius relationship equations.

The following equations were obtained:

Shoal Creek

$L = 18.278 + 0.881S + 0.00189S^2 - 0.00000675S^3$

Little Shoal Creek

$L = -7.884 + 1.509S - 0.00271S^2 - 0.00000217S^3$

Fig. 2 depicts the body length-scale radius relationship of redeye bass in Shoal Creek and Little Shoal Creek.

Mean calculated total length at annulus formation for redeye bass in Shoal Creek and Little Shoal Creek is presented in Tables 1 and 2 respectively. Table 3 compares the growth of redeye bass in Shoal and Little Shoal Creeks with the growth of redeye bass from other areas.

The length-weight relationship equation for redeye bass in Shoal Creek was $\text{Log } W = -4.92491 + 2.99098 \text{ Log } L$. The length-weight relationship equation for redeye bass in Little Shoal Creek was $\text{Log } W = -5.41778 + 3.21102 \text{ Log } L$. Fig. 3 presents the length-weight relationship for redeye bass in Shoal Creek and Little Shoal Creek.

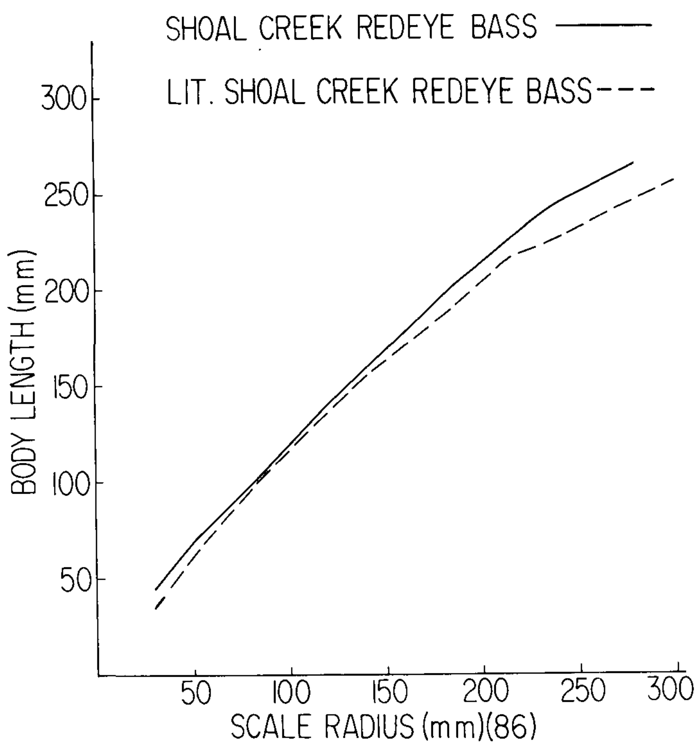

Fig. 2. Body length-scale radius relationships of redeye bass in Shoal and Little Shoal Creeks, AL.

Table 1. Calculated total lengths at annulus formation of redeye bass in Shoal Creek.

Year class	*No. of fish*	*Mean calculated total length (mm) at each annulus*								
		I	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*
1975	4	53								
1974	1	50	82							
1973	14	62	115	149						
1972	26	66	105	141	179					
1971	27	61	98	141	173	196				
1970	30	61	97	139	174	201	214			
1969	32	62	98	137	174	199	201	215		
1968	13	57	94	130	169	200	224			
1967	9	58	93	124	164	195	218	231	233	256
1966	4	55	93	128	161	193	217	229	255	260
Grand wghtd. mean length		61	100	129	173	198	211	219	240	257
Mean annual increment		61	39	29	44	25	13	8	21	17

Table 2. Calculated total lengths at annulus formation of redeye bass in Little Shoal Creek.

Year class	*No. of fish*	*Mean calculated total length (mm) at each annulus*						
		I	*II*	*III*	*IV*	*V*	*VI*	*VII*
1974	1	65						
1973	10	58	96					
1972	7	49	85	120	171			
1971	15	47	91	126	152	180		
1970	12	48	86	121	149	170	189	
1969	5	50	84	125	146	172	193	219
1968	2	54	103	138	157	179	189	221
Grand weighted mean length		51	90	124	154	175	190	220
Mean annual increment		51	39	34	30	21	15	30

Table 3. Comparison of redeye bass growth from various waters.

Location	Mean calculated total length at annulus formation										Reference
	I	II	III	IV	V	VI	VII	VIII	IX	X	
Shoal Creek, AL	61	100	129	173	198	211	219	240	257		Present Study
Little Shoal Creek, AL	51	90	124	154	175	190	220				Present Study
Sheeds Creek, TN	48	84	114	143	169	191	211	215	217	255	Parsons 1954
Spring Creek, TN	62	105	142	174	199	217	243				Tatum 1965
Spring Creek, TN	59	93	120	160	179	221					Gwinner 1973
Roaring River, TN	63	99	131	167	186						Cathey 1973

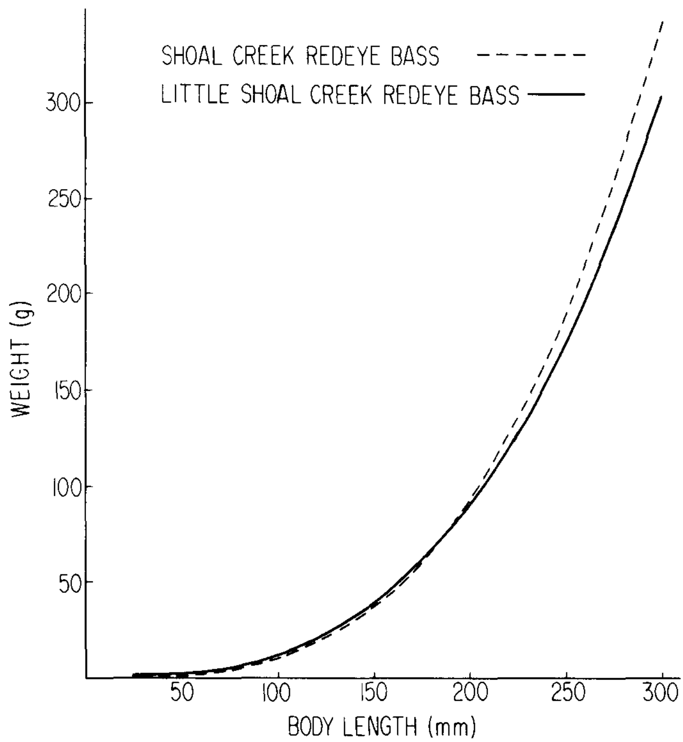

Fig. 3. Length-weight relationships of redeye bass in Shoal and Little Shoal Creeks, AL.

Condition factors of redeye bass in Shoal Creek relative to Little Shoal Creek redeye bass are shown in Table 4. Condition factors for redeye bass in Shoal and Little Shoal Creeks relative to Alabama statewide averages for redeye bass are shown in Table 5. Condition factors for redeye bass in Spring Creek and Roaring River relative to Shoal Creek and Little Shoal Creek redeye bass are presented in Tables 6 and 7 respectively.

Table 4. Condition factors (K_n) for redeye bass in Shoal Creek relative to redeye bass in Little Shoal Creek.

Length (mm)	K_n
50	1.32
100	1.09
150	1.03
200	.97
250	.92
300	.89
Mean K_n	1.04

Table 5. Condition factors (K_n) for redeye bass in Shoal Creek and Little Shoal Creeks relative to redeye bass from Alabama statewide averages.

	Location	
Length (mm)	*Shoal Creek*	*Little Shoal Creek*
50	1.10	.84
100	.96	.88
150	.94	.91
200	.90	.93
250	.88	.95
300	.86	.97
Mean K_n	.94	.91

DISCUSSION

Growth of redeye bass was initially faster in Shoal Creek than in Little Shoal Creek; however, at age VII mean length of Little Shoal Creek redeye bass was slightly more than mean length of Shoal Creek redeye bass (Table 3). Redeye bass in both creeks grew fastest in their first year. Redeye bass in Shoal Creek grew rapidly until age IV at which time growth began to decrease (Table 1). Other than the initial year's growth increment (61 mm), growth was greatest for Shoal Creek redeye bass between the third and fourth years (44 mm), and growth was slowest (8 mm) between the sixth and seventh years. Little Shoal Creek redeye bass growth gradually declined after its first year of growth except for an increase in incremental growth (30 mm) between age VI and VII (Table 2). Other than the initial year's growth increment (51 mm), growth was greatest (39 mm) between the first and second years for Little Shoal Creek redeye bass. Slowest growth (15 mm) for

Table 6. Condition factors (K_n) for redeye bass in Spring Creek[a] and Roaring River relative to Shoal Creek redeye bass.

	Location	
Length (mm)	*Spring Creek*	*Roaring River*
50	1.63	1.39
100	1.61	1.32
150	1.32	1.21
200	1.10	1.17
250	1.19	1.14
300	1.15	1.12
Mean K_n	1.33	1.23

[a]Gwinner (1973).

Table 7. Condition factors (K_n) for redeye bass in Spring Creek and Roaring River relative to Little Shoal Creek redeye bass.

	Location	
Length (mm)	*Spring Creek*	*Roaring River*
50	2.15	1.83
100	1.61	1.32
150	1.36	1.26
200	1.07	1.14
250	1.10	1.06
300	1.02	.99
Mean K_n	1.39	1.27

Little Shoal Creek redeye bass was between their fifth and sixth years. The oldest redeye bass collected from Shoal Creek were 9 years old while the oldest redeye bass collected from Little Shoal Creek were 7 years old (Tables 1 and 2 respectively).

Redeye bass growth in Shoal and Little Shoal Creek was compared with redeye bass growth from other study areas (Table 3). Shoal Creek redeye bass grew faster than redeye bass in Sheeds Creek, TN (Parsons 1954) and Roaring River, TN (Cathey 1973). Shoal Creek redeye bass grew at a slower rate than redeye bass in Spring Creek, TN (Tatum 1965). However, Shoal Creek redeye bass growth was greater than redeye bass growth from the same Spring Creek as documented by Gwinner (1973). Shoal Creek redeye bass lived longer than redeye bass from previous studies with the exception of Sheeds Creek (Parsons 1954).

Growth of redeye bass was not compared with growth of redeye bass from the Chipola River (Parsons and Crittenden 1959), Flint River (Wright 1967) and Halawakee Creek (Hurst 1969) since these populations have been recognized as a newly described species of *Micropterus* (Ramsey 1973).

Little Shoal Creek redeye bass only grew faster, during the first 6 years of life, than redeye bass in Sheeds Creek, Tennessee (Table 3). This slow growth could be related to habitat since Sheed's Creek has a minimum flow of less than $0.03m^3/sec$ while Little Shoal Creek has a flow of about $0.17m^3/sec$. All other studies were on streams with considerably more flow.

If an arbitrary 200-mm harvestable length was assumed, the redeye bass in Shoal Creek would reach this length between the fifth and sixth annulus (Table 1). The redeye bass in Little Shoal Creek would not reach this arbitrary 200-mm harvestable length until between the sixth and seventh annulus (Table 2). It would appear that a stream could easily become "fished out" of harvestable sized redeye bass due to the fish's slow growth and vulnerability to angling. These factors would have direct bearing on management plans for intensively-fished redeye bass streams.

Redeye bass in Shoal and Little Shoal Creeks form annuli during May. Parsons (1954) reported that redeye bass in Sheed's Creek showed evidence of annulus formation in mid May and by early June the annuli were clearly evident.

Condition factors of redeye bass in Shoal Creek relative to redeye bass in Little Shoal Creek revealed that Shoal Creek redeye bass are in better condition up to 150 mm in length (Table 4). At 200 mm and greater lengths the Shoal Creek redeye bass is in poorer condition than the Little Shoal Creek redeye bass.

Redeye bass in Shoal and Little Shoal Creek were found to be in poorer condition than the average Alabama redeye bass at all lengths computed except the 50 mm length for Shoal Creek redeye bass (Table 5). Average relative condition factors for Shoal Creek and Little Shoal Creek redeye bass were 0.94 and 0.91 respectively.

Spring Creek and Roaring River redeye bass length-weight relationships were compared to Shoal Creek and Little Shoal Creek length-weight relationships to obtain relative condition factors of the populations (Tables 6 and 7). These condition factors show that the redeye bass from Shoal and Little Shoal Creeks are in poorer condition than the redeye bass in Spring Creek and Roaring River. A 50-mm redeye bass from Spring Creek would be 1.63 times the weight of a 50-mm redeye bass from Shoal Creek. The relative condition factors of redeye bass in Spring Creek and Roaring River declines as the size of the fish increases. Therefore, the larger redeye bass from Shoal and Little Shoal Creek more closely approximate the weight of a similar length fish from Spring Creek or Roaring River. At a length of 300 mm the Little Shoal Creek redeye bass weigh more than the 300-mm redeye bass in Roaring River (Table 7).

The poorer relative condition factors of Shoal and Little Shoal Creeks redeye bass may be attributed to the infertility of the physiographic region within which they are located. The waters of these creeks have a total hardness of less than 17 ppm. No limestone is in the bedrock of the creeks as it is in both Spring Creek and Roaring River. The total hardness of Spring Creek and Roaring River ranges from 119.7 to 188.1 ppm. This is due to the soluble nature of the limestone bedrocks over which they flow. Waters with high hardness can be more productive than soft waters (Reid 1961).

A possible factor affecting production of the redeye bass in Shoal Creek is competition with largemouth bass and bluegill which are more numerous in the stream since construction of the three mainstream impoundments in 1970, 1971, and 1977. A comparison of preimpoundment and postimpoundment stream population samples revealed noticeable declines in number and weight of redeye bass per hectare of stream (Alabama Department of Conservation and Natural Resources 1976). Largemouth bass were not present in preimpoundment stream samples, but they averaged 5.8% of the weight of postimpoundment stream samples. Bluegill comprised 1.2% and 9.6%, respectively, of pre- and postimpoundment stream samples.

In addition, favorable redeye bass habitat has decreased in the Shoal Creek drainage because of the 5.5 km of creek that were inundated by the permanent pools of these impoundments. Redeye bass are unable to maintain their numbers in a reservoir habitat in competition with other predators nor can they suppress the sunfish population

(Swingle and Smith 1943). Redeye bass are numerous in the creel for the first 2 to 3 years and then their numbers decrease drastically in comparison to the number of largemouth bass creeled.

LITERATURE CITED

Alabama Department of Conservation and Natural Resources. 1976. Annual progress reports on fishery research projects: A life history study of the redeye bass, *Micropterus coosae*, in Ala. waters. (Project No. 2010: Pages 22-39).

Cathey, H. J. 1973. A study of the redeye bass, *Micropterus coosae*, smallmouth bass, *Micropterus dolomieui*, and rock bass, *Ambloplites rupestris* in Roaring River, Tennessee. M.S. Thesis. Tenn. Tech. Univ., Cookeville. 46 pp.

Gwinner, R. G. 1973. A study of the redeye bass, *Micropterus coosae*, smallmouth bass, *Micropterus dolomieui*, and rock bass, *Ambloplites rupestris*, in Spring Creek, Tennessee, M.S. Thesis. Tenn. Tech. Univ., Cookeville. 38 pp.

Hurst, H. N. 1969. Comparative life history of the redeye bass, *Micropterus coosae* Hubbs and Bailey, and the spotted bass, *Micropterus p. punctulatus* (Rafinesque), in Halawakee Creek, Alabama. M.S. Thesis. Auburn Univ., Auburn, AL. 56 pp.

LeCren, E. D. 1951. The length-weight relationship and seasonal cycle in gonad weight and condition in the perch, *Perca fluviatilis*, J. Anim. Ecol. 20: 201-219.

Parsons, J. W. 1954. Growth and habits of the redeye bass. Trans. Am. Fish Soc. 83:202-211.

________________ and E. Crittenden. 1959. Growth of the redeye bass in Chipola River, Florida. Trans. Am. Fish. Soc. 88:191-192.

Ramsey, J. S. 1973. The *Micropterus coosae* complex in southeastern U.S. (Osteichthyes, Centrarchidae). Assoc. Southeast. Biol. Bull. 20:76 (abstract).

Reid, G. K. 1961. Ecology of inland waters and estuaries. Van Nostrand Reinhold Co., New York. 375 pp.

Swingle, W. E., and E. W. Shell. 1971. Tables for computing relative conditions of some common freshwater fishes. Ala. Agri. Exp. Stn. (Auburn Univ.) 55 pp.

Swingle, H. S., and E. V. Smith. 1943. Effect of Management practices on the catch in a 12-acre pond during a 10 year period. Trans. N. Am. Wildl. Nat. Resour. conf. 8:142-155.

Tatum, W. R. 1965. A study of an introduced population of redeye bass, *Micropterus coosae* Hubbs and Bailey, in Spring Creek, Tennessee, M.S. Thesis. Tenn. Tech. Univ., Cookeville. 36 pp.

Wright, S. E. 1967. Life history and taxonomy of the Flint River redeye bass, *Micropterus coosae* Hubbs and Bailey, M.S. Thesis, Univ. Georgia, Athens. 51 pp.