

# THE BIOLOGY OF THE ROANOKE BASS, *Ambloplites cavifrons* Cope, IN NORTH CAROLINA \*

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## ABSTRACT

This paper summarizes the final report on the investigation of the Roanoke bass in North Carolina. It contains new data on recognition characters, distribution, food studies, sexual maturity, and age-and-growth studies which essentially augments the report "A Preliminary Report on the Biology of the Roanoke Bass, *Ambloplites cavifrons* Cope, in North Carolina," Smith, 1969, presented in the 23rd Southeastern Proceedings, 1969.

## INTRODUCTION

This study concerns the Roanoke bass in North Carolina with particular reference to its basic biology, habitat requirements and limitations, as well as its adaptability to artificial propagation and its potential as a game fish. Many facets of the project were considered in a preliminary report published in 1969 \*\*; consequently, this paper deals only with those aspects not previously described and with the results of experiments terminated since the previous publication. A detailed report of the study can be obtained from the North Carolina Wildlife Resources Commission, Raleigh, North Carolina.

## RECOGNITION CHARACTERISTICS

To substantiate existing recognition characteristics, and to evolve additional ones whereby both the adult and the juvenile stages of Roanoke bass can be differentiated from the rock bass, 37 wild, adult Roanoke bass, 35 wild, adult rock bass, 142 hatchery-reared Roanoke bass, and 46 hatchery-reared rock bass were examined for 17 meristic characters.

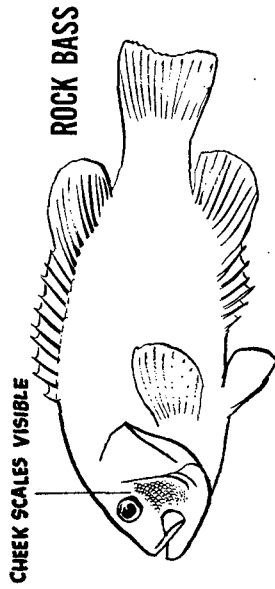
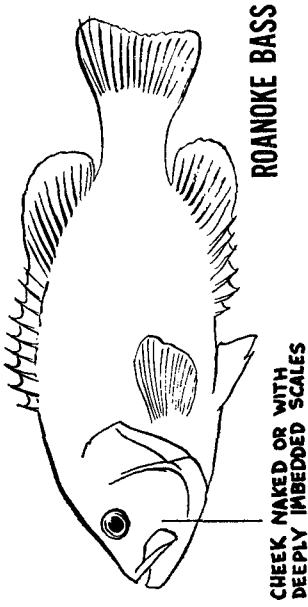
The following seven characters were found valid for distinguishing between the two species:

1. Cheek scalation—all of the Roanoke bass either were devoid of cheek scales or had only a few, deeply imbedded scales whereas the cheeks of all rock bass were completely scaled (Figure 1).
2. Nape curvature—the nape curvature in fingerling Roanoke bass varied in form from a straight line to slightly concave while in the adults, the curvature varied from a straight line to slightly convex; the nape curvature of the rock bass, however, was decidedly convex both in the young and in the adult.
3. Cranium profile—the cranium profile of Roanoke bass, both in the young and in the adult, was slightly concave whereas the cranium profile in young rock bass is almost a straight line, but is very slightly convex in the adult (Figure 1).
4. Number of scale rows above the lateral line — Roanoke bass,  $x = 10.9$ ,  $SE = 0.07$ ; rock bass,  $x = 8.5$ ,  $SE = 0.11$  ( $P_{\Delta} = <0.01$ ).
5. Number of breast scales — measured from the lower insertion of one pectoral fin to the lower insertion of the other: Roanoke bass,  $x = 27$ ,  $SE = 0.3$ ; rock bass,  $x = 20$ ,  $SE = 0.2$  ( $P_{\Delta} = <0.01$ ).
6. Ratio of maxilla length to premaxilla length — Roanoke bass,  $x = 0.68$ ,  $SE = 0.01$ ; rock bass,  $x = 0.47$ ,  $SE = 0.01$  ( $P_{\Delta} = <0.01$ ).
7. Ratio of maxilla width to maxilla length — Roanoke bass,  $x = 0.53$ ,  $SE = 0.01$ ; rock bass,  $x = 0.70$ ,  $SE = 0.01$  ( $P_{\Delta} = <0.01$ ).

\* Contribution from Federal Aid to Fish Restoration Funds under Dingell-Johnson Project F-19-R, State of North Carolina.

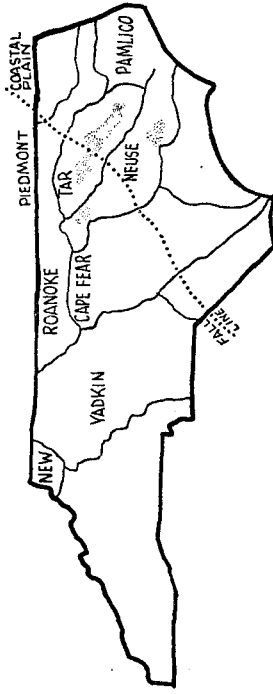
\*\* Smith, William B. 1969. A Preliminary Report of the Biology of the Roanoke Bass, *Ambloplites cavifrons* Cope, in North Carolina. Proceedings of the Twenty-Third Annual Conference, Southeastern Association of Game and Fish Commissioners. Mobile, Alabama.

FIGURE 1.



Meristic Differences of  
Roanoke Bass and Rock Bass

FIGURE 2.



Areas of Roanoke Bass Habitation  
in North Carolina

- Know Locations
- Reported Locations

The remaining ten characteristics were not deemed sufficiently reliable for distinguishing between the two species either because the counts overlapped or because they were identical.

#### DISTRIBUTION IN NORTH CAROLINA

The Roanoke bass in North Carolina, despite the implication of its name, seemingly is confined to the Tar River Watershed and the Neuse River Watershed (Figure 2).

Within the Tar River Watershed, Roanoke bass were collected from 16 locations: Nine on the main stem of Tar River scattered over a 150-mile reach between the headwaters in the Piedmont near Oxford and Greenville in the Coastal Plain; one each from three small Piedmont tributaries; and four locations on a large Coastal Plain tributary and two on a smaller Coastal Plain tributary.

In the Neuse River Watershed, Roanoke bass were collected from five locations—none of which were on the main stem of the Neuse. They were, however, taken from each of the three Piedmont headwater rivers: Flat River, Little River, and Eno River (two locations), whose confluence forms the Neuse River, and from one large Coastal Plain tributary which joins the Neuse downstream some 100 miles east of the headwater locations.

#### FOOD STUDIES

The stomachs of 37 wild and 122 hatchery-reared Roanoke bass were examined for contents.

Fingerling and yearling Roanoke bass, in a hatchery-pond environment, fed almost exclusively on aquatic invertebrates—principally Tendipedidae, Coleoptera, and Notonectidae—fish remains being found only in one stomach in spite of the fact that forage fishes were readily available at all times. The few wild fingerling and the wild yearling Roanoke bass captured all, unfortunately, had empty stomachs consequently no direct comparisons of their feeding habits could be made.

Two-year old hatchery-reared Roanoke bass readily utilized the available forage fishes although they still fed on the larger aquatic invertebrates when available—of the fifteen stomachs containing food, fish remains were present in ten and aquatic invertebrates were present in ten.

Crayfish and fish represented virtually the entire diet found in wild specimens (Table 1).

#### SEXUAL MATURITY

Sexual maturity in Roanoke bass apparently involves an age-size relationship. Based upon the results of three experiments conducted in a hatchery-pond environment and upon the observations of wild fish, Roanoke bass do not attain sexual maturity until reaching Age II and a weight of approximately 100 grams (Table 2).

#### AGE AND GROWTH

##### *Wild Fish*

The age and growth rates of 21 Roanoke bass and 123 redbreast sunfish reported in 1969\* are believed to be in error, consequently those data have been discarded.

Scales from 72 wild Roanoke bass were aged using a Van Oosten-type scale projector, and the length at each annulus was back-calculated. Scales from 119 redbreast sunfish collected from the same streams as the Roanoke bass, and from 40 rock bass, collected only from the mountain streams of North Carolina (36 specimens) and South Carolina (4 specimens) were similarly aged and their lengths back-calculated. The annual growth rates of the three species then were tabulated for comparisons.

Scale data indicate that the redbreast sunfish grow faster during the first year than do either Roanoke bass or rock bass—growth rates of the latter two fishes being almost identical. In the second year, growth rates

\* Smith, *op. cit.*

Number of Stomachs Examined Number Containing Food	HATCHERY-REARED FISH						WILD FISH	
	Fingerling (19mm - 100mm)	Yearling (92mm - 165mm)	2-Year Old (121mm - 192mm)					
	90	14	18					
	23	9	15					
Food Items:	No. of Stomachs Containing	No. of Stomachs Containing	No. of Organi-isms	No. of Stomachs Containing	No. of Organi-isms	No. of Stomachs Containing	No. of Organi-isms	
Fish	1		1			7	7	
Crayfish			7			10	19	
Coeloptera	4		23	2				
Tendipedidae	9		6	141				
Notonectidae	3		1	1		1	1	
Odonata	1		1					
Culicidae	1		1	3				
Trichoptera	1		2					
Copepoda	2		2					
Ephemeroptera								
Unidentified								
Invertebrates	10		12					
Total Number of Food Organisms in Stomachs Containing Food . . . . .			53	147		180	27	
Average Number Per Stomach With Food . . . . .			2.3	16.3		12.0	1.6	
Total Volume (ml.) of Food Organisms in Stomachs Containing Food . . . . .			0.7+	0.8+		48.3	60.8	
Average Volume (ml.) Per Stomach With Food . . . . .			0.09+	0.09+		3.2	3.6	

TABLE 1. Roanoke bass stomach analyses

Experiment Number	Location	Year Class	Age	$\bar{x}_{TL}$ (mm)	$\bar{x}_{wt}$ (gms)	Reproduced Successfully
1	Fayetteville Hatchery	1968	I	149	70	No
			II	219	199	Yes
2	Fayetteville Hatchery	1968	I	86	9	No
			II	152	46	No
3	Table Rock Hatchery	1968	I	111	21	No
			II	189	121	Yes
Smallest wild, gravid female Roanoke bass collected (Tar River) during the study			II	192	142	58 percent mature eggs at capture

TABLE 2. Sexual maturity in Roanoke bass—age-size relationship data

of redbreast sunfish and Roanoke bass are almost identical and both exceed that of the rock bass. In the third year, however, Roanoke bass growth was significantly greater than either redbreast sunfish or rock bass. Only one redbreast sunfish specimen was more than three years old, so further comparisons either were not very reliable or were impossible. Roanoke bass growth continued to be significantly greater than rock bass at least through Age VI. Data for the seventh year was not considered very reliable since only one Roanoke bass specimen was available (Table 3).

Comparative growth rates between male and female Roanoke bass were quite similar. Forty-two specimens—21 of each sex—were aged from scale analyses and the total lengths back-calculated for each year of life. The average growths, by years then were combined for the different age groups. As might be expected, the first year total lengths exhibited the greatest variations between the different age groups (Table 4).

#### *Hatchery-Reared Fish*

Comparative growth studies involving hatchery-reared fish in the same lentic environment were conducted at Fayetteville Hatchery and at Table Rock Hatchery, near Morganton. Fingerling Roanoke bass and fingerling redbreast sunfish were stocked in the same pond at Fayetteville Hatchery and fingerling Roanoke bass and fingerling rock bass were stocked in the same pond at Table Rock Hatchery. All fingerlings were of the 1968 year class.

Growth patterns for the three species, in general, were quite similar to those of their wild-fish counterparts. Individual growths and comparative growths between the Roanoke bass at the two hatcheries, however, evidenced extreme variations.

Both the redbreast sunfish and the rock bass, as fingerlings, outgrew the Roanoke bass in their respective ponds. As yearlings, redbreast sunfish growth continued to exceed that of Roanoke bass in the Fayetteville Hatchery pond but Roanoke bass, in the Table Rock Hatchery pond, were significantly larger than the rock bass. Upon termination of the experiments (following completion of the third growing season but prior to the formation of a third annulus), Roanoke bass were slightly larger than the redbreast sunfish (Figure 3), and they remained significantly larger than the rock bass (Figure 4).

Predation and/or cannibalism by adult Roanoke bass and rock bass in the pond at Table Rock Hatchery apparently was extensive. Fingerling rock bass—spawn of the 1968 fish originally stocked—were numerous in July 1969, rare in August, and absent when the pond was drained in

Species	Years of Age							
	I	II	III	IV	V	VI	VII	VIII
<u>Roanoke Bass</u>								
Total Length in Millimeters	82.7	143.6	191.3	227.2	260.6	287.3	288.0	
Number of Specimens	72	60	51	27	5	3	1	
Percent Attaining Indicated Age	100	83.3	70.8	37.5	6.9	4.2	1.4	
<u>Rock Bass</u>								
Total Length in Millimeters	85.1	128.5	160.9	178.2	195.8	216.5	228.5	258.0
Number of Specimens	40	30	17	9	4	2	2	1
Percent Attaining Indicated Age	100	75	42.5	22.5	10	5	5	2.5
<u>Redbreast Sunfish</u>								
Total Length in Millimeters	93.8	139.5	161.0	188.0				
Number of Specimens	119	81	24	1				
Percent Attaining Indicated Age	100	68.1	20.2	0.8				
<u>Species</u>								
Roanoke Bass	Range of Total Lengths at Capture (mm)			Range of Weights at Capture (gms)				
	126 - 330			35 - 681				
Rock Bass	86 - 272			11 - 455				
Redbreast Sunfish	108 - 198			29 - 154				

TABLE 3. Growth of wild Roanoke bass, Rock bass, and Redbreast sunfish by years of age as determined by Scale analyses

Age Group	Sex	Number of Fish	Total Lengths (mm) At End of Year						
			1	2	3	4	5	6	
I	Male	3	100.6						
	Female	2	75.0						
II	Male	3	88.3	152.3					
	Female	3	86.3	145.7					
III	Male	6	84.3	145.5	206.7				
	Female	10	81.6	141.3	189.3				
IV	Male	8	80.3	139.8	191.8	222.8			
	Female	3	81.0	139.0	197.3	230.7			
V	Male	0							
	Female	2	91.0	144.0	197.5	249.5	268.0		
VI	Male	1	67	120	163	230	277	295	
	Female	1	66	130	181	242	276	296	
Grand Average	Male	21	84.9	142.7	195.8	223.7	277	295	
	Female	21	81.7	141.3	191.3	238.9	270.7	296	
Average of All Specimens		42	83.3	142.0	193.5	229.7	272.3	295.5	

TABLE 4. Calculated total lengths of male Roanoke bass and female Roanoke bass at the end of each year of life and average growth for the combined age groups

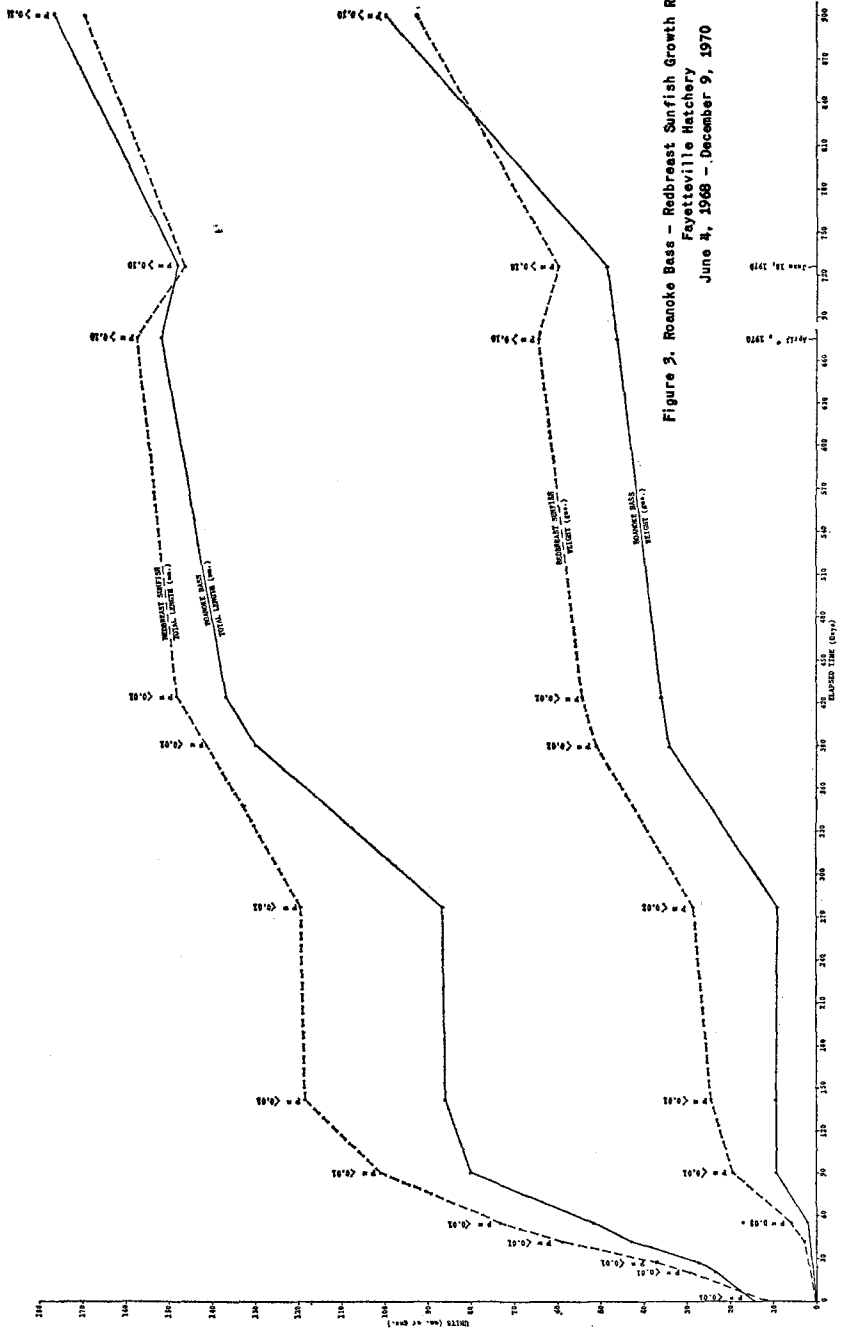


Figure 3. Roanoke Bass - Redbreast Sunfish Growth Rates  
 Fayetteville Hatchery  
 June 4, 1968 - December 9, 1970



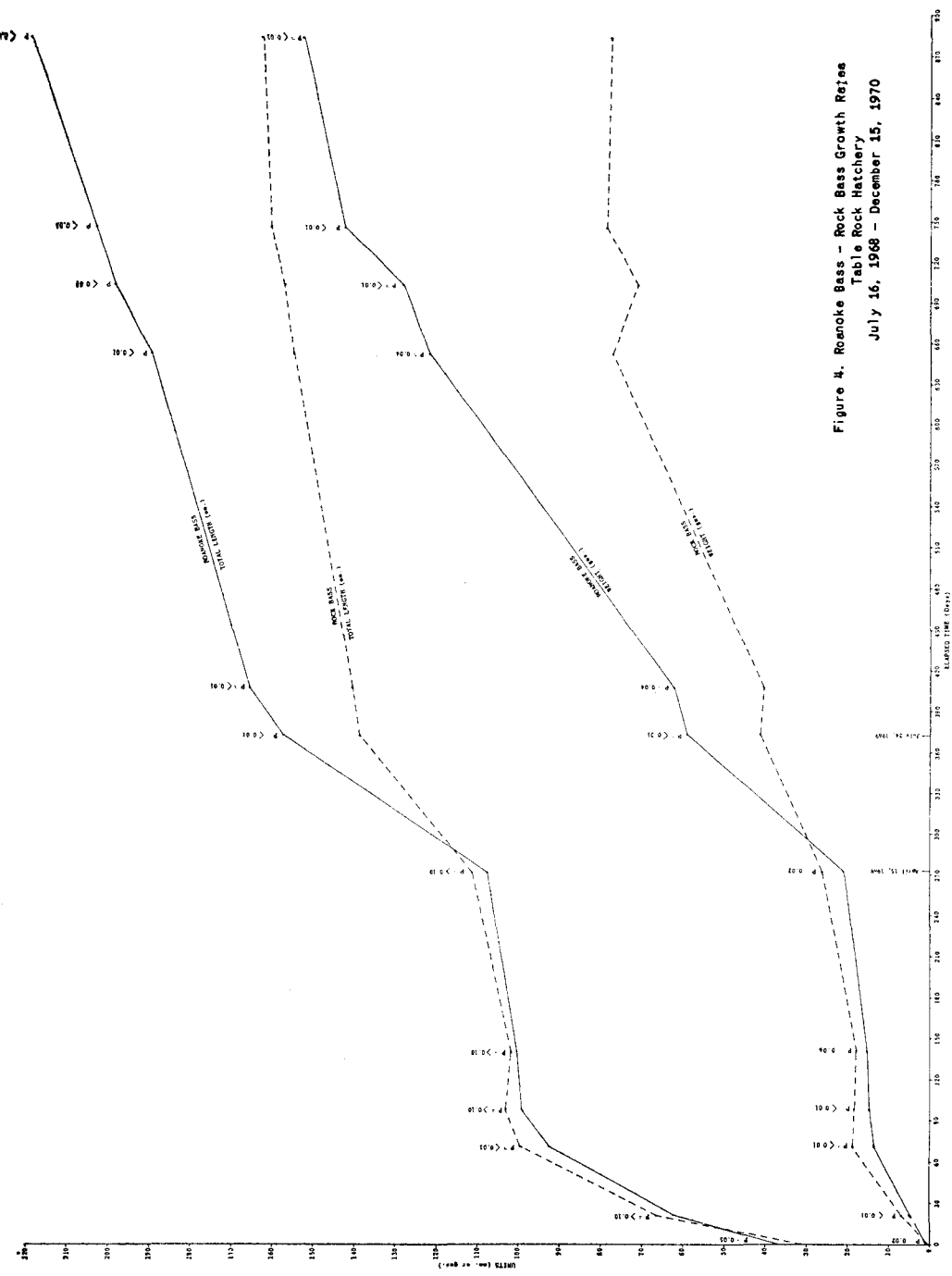


Figure 4. Roanoke Bass - Rock Bass Growth Rates  
 Table Rock Hatchery  
 July 16, 1968 - December 15, 1970

April 1970. In June 1970, fingerling Roanoke bass and fingerling rock bass—again the spawn of the originally stocked fish—were quite abundant, but by the end of July, none could be collected by seining, and when the pond was drained in December 1970, only one rock bass was recovered—Roanoke bass fingerlings being entirely absent from the population.

The fingerling disappearances, both in 1969 and in 1970, occurred despite an abundance of forage-size golden shiners being available in the pond.

#### RELOCATION EXPERIMENTS

Attempts have been initiated to relocate Roanoke bass into three Piedmont streams which seemingly possess ideal habitat for this species although it is not known to be in these watersheds. Relocation experiments also have been initiated in two Piedmont and in one Coastal Plain reservoirs and into one Coastal Plain farm pond.

Results of these introductions, thus far, are not known.

#### SUMMARY

It has been concluded from this study that the Roanoke bass is a highly desirable panfish that is present in moderate numbers in several streams of the Tar River and the Neuse River Watersheds. The Roanoke bass grows both faster and to a larger size than its nearest relative the rock bass, as well as its closest associate, the redbreast sunfish, and does, in fact, attain trophy size for a panfish. It is an extremely game fish when taken on rod-and-reel, and is most delectable when placed upon the table. Further attempts at relocating this species in other suitable waters of the State will be pursued.

### HYDROPHYTIC CHANGES RELATED TO LAKE FLUCTUATION AS MEASURED BY POINT TRANSECTS

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#### ABSTRACT

In the spring of 1970 and 1971, vegetation transects were run on 22,700 acre Lake Tohopekaliga in Osceola County, Florida. The objective of this study was to monitor the response of various plant types to a 7 foot drawdown and compare results with those from a study done in 1956.

As a result of dewatering, littoral vegetation advanced lakeward, expanding from an area of approximately 9,000 acres to 10,500 acres, a 16% increase. The significance of this plant response, relative to standing crop of fish and invertebrate fish-food organisms, is discussed.

Five of 16 dominant plant types occurred most frequently or had widest distribution during a high water period (1970). The remaining 11 occurred most frequently or had widest distribution during low water periods (1956 and 1971).

In the 1956 study it was assumed that water stage duration determined the distribution of annual and perennial plants. Data from the present study indicate distribution of vegetation within Tohopekaliga's basin is determined mainly by prevailing water levels during the growing season. The lakeward limit of perennial emergents is related to historically low water elevations.

#### INTRODUCTION

Tohopekaliga is a 22,700 acre lake located in western Osceola County, Florida. It is one of the larger lakes in the Kissimmee chain of lakes, a major source of water for Lake Okeechobee and southern Florida. The lake currently supports a productive and dynamic sport fishery which