PRELIMINARY EVALUATION OF THREE STRAINS [1] OF LARGEMOUTH BASS, Micropterus Salmoides (LACEPEDE), STOCKED IN PONDS IN SOUTH ALABAMA

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ABSTRACT

Seven ponds in South Alabama were stocked with Florida largemouth bass, *Micropterus salmoides floridanus* (Lesueur), seven with native largemouth bass, *M. s. salmoides* (Lacepede), and seven with F_1 bass. Samples of bass were collected one and two years after stocking to compare growth rates. Major objectives of this study were: to determine which of the three strains of bass grow faster and/or larger in Alabama ponds, to determine if *floridanus* can be successfully introduced into an established fish population of a 1,000 acre lake, and to compare the effectiveness of the three strains of bass in maintaining a balanced fish population.

All three strains of largemouth bass displayed rapid growth in ponds which did not contain a crowded bass population. The fastest growth observed was that of the F_1 bass. However, sufficient data has not been obtained in this study to fully evaluate the growth potential of the three strains of largemouth bass. Further evaluation is planned. The number of pyloric caeca proved to be the best single character for separation of the two subspecies of largemouth bass.

INTRODUCTION

The *floridanus* was introduced into California waters in May 1959 to determine if it would grow as well as reported from Florida waters. The *floridanus* is notable for its large size and rapid growth in the central and southern regions of Florida. Sasaki (1961) concluded, "Results from the available data tend to indicate that Florida largemouth bass do not obtain the spectacular growth and growth rate in Southern California that is attributed to them in Florida waters." Clugston (1964) concluded, "There is very little evidence to indicate that the southern subspecies of largemouth bass is genetically superior to the northern form as far as growth is concerned." Miller (1965) found that the growth rates of the two subspecies did not differ significantly and concluded, "The rapid growth of the southern subspecies, or Florida bass, appears to be related to the favorable environment and growing season in its native range rather than intrinsic factors."

Schlimmer (1969) and Grant (1970) indicated that the *floridanus* has made spectacular growth in California waters several years after their introduction. One objective of this study was to determine if the *floridanus* or F_1 bass will grow faster and/or larger than *salmoides* in ponds in Alabama.

Native *salmoides* are noted for their stunted condition in the Mobile Delta waters. Swingle, Spencer, and Scott (1964) found that the average size of *salmoides* caught by fishermen was 0.65 pound. If the *floridanus* or offspring resulting from natural crossings between the two subspecies exhibited more rapid growth or obtained greater maximum growth, its introduction might improve sport fishing in certain natural waters. Therefore, another objective of this study was to determine if the *floridanus* can be successfully introduced into an established fish population of a 1,000 acre lake.

[1] The native largemouth bass, the Florida largemouth bass, and the Florida largemouth bass X native largemouth bass offspring will be referred to in this paper as salmoides, floridanus, and F_1 bass, respectively.

Native *salmoides* have been exclusively used for hatchery brood stock by the Alabama Department of Conservation for almost 50 years. The *salmoides* were used by Swingle (1950; 1956) while developing the pond analysis technique for determining balance within largemouth bass-bluegill-redear populations. Because of problems encountered in maintaining balanced population conditions in small impoundments, another objective of the study was to compare the effectiveness of the three strains of bass in maintaining a balanced fish population.

METHODS

Brood Pond

Adult *floridanus* and *salmoides* were crossed to obtain F_1 progeny. In March 1969, nine spawning pens were constructed in a 0.5 acre pond at the Spring Hill Fish Hatchery, Mobile, Alabama. The pens measured 15 feet by 15 feet and were constructed of 1-inch mesh chicken wire. Fine gravel provided a substrate on which the adult bass swept nests.

The adult *floridanus* were obtained from the Richloam Fish Hatchery near Lakeland, Florida. Adult *salmoides* were obtained from the Spring Hill Fish Hatchery at Mobile, Alabama. One adult *floridanus* was stocked into each pen and one into the pond (Table 1). One adult *salmoides* was stocked into each pen, No. 1-6, and one adult into the pond. All brood fish were inch-grouped, weighed, and sexed.

TABLE 1. Stocking of *floridanus* and *salmoides* into spawning pens at Spring Hill Fish Hatchery on March 24, 1969.

	Florida Bass		Native Bass [1]		
Pen number	Inch-group	Weight [2]	Inch-group	Weight [2]	Nest present
1	10	0.6	12	1.5	(−)
2	11	0.7	11	1.1	(−)
3	10	0.7	10	0.7	(−)
4	11	1.0	12	1.5	(+)
5	10	0.7	11	1.0	(+)
6	10	0.7	10	0.7	(+)
7	10	0.6	..	..	(+)
8	9	0.5	..	..	(−)
9	9	0.5	..	..	(+)
Pond	10	0.6	12	1.9	(+)

1 All native bass were fin clipped on the caudal fin.
2 Weight is in pounds.

Visual observations were made daily to determine when the bass had spawned. Nests were observed in pens 4, 5, 6, 7, 9, and the pond within one week after stocking. The bass in pens 1, 2, 3, and 8 did not sweep nests. The *floridanus* in pen 5 swept a nest close to the fence, and the *salmoides* in pen 4 appeared to have mated with the *floridanus* in pen 5. On April 1, the *salmoides* in pens 4 and 5 were switched. Since a nest was not swept in pen 1, the *salmoides*, which appeared to be ripe, was removed and restocked into pen 7.

Although observations were made daily, no schools of bass were found in the brood pond during April. On April 29, the brood bass were removed from all pens and the pond was stocked with *Tilapia aurea* brood fish. In July, the two adult bass previously stocked into the pond were removed.

On May 9, a bass school was observed in the brood pond. On May 11, 4,500 F_1 fingerlings estimated to be 4-5 weeks old, were removed from the pond. A second school consisting of 1,900 F_1 fingerlings were removed on May 12. The second school of bass was estimated to be 5-6 weeks old since they were larger.

Experimental Ponds

Twenty-one privately owned ponds were selected for growth studies on the three strains of largemouth bass. All ponds were checked prior-to-stocking and any wild fish present were eliminated with rotenone. Fingerling bass were obtained as follows: (1) *salmoides* from the Spring Hill Fish Hatchery, (2) *floridanus* from the Richloam Fish Hatchery near Lakeland, Florida, and (3) F_1 fingerlings spawned at the Spring Hill Fish Hatchery.

TABLE 2. Size of pond, date stocked, average size of bass stocked, and condition of balance for 1970 and 1971 for all *floridanus* ponds.

Pond no.	Size (acres)	Date stocked Bass	Date stocked Bream	Average size of bass (mm)	Condition of balance [1] 1970	Condition of balance [1] 1971
1	35.0	6- 2-69	2-5-69	48 (39-56)	Balance	Balance
2	9.0	6- 2-69	12-6-68	48 (39-56)	Crowded bream	Balance
3	6.8	6- 2-69	1-31-69	48 (39-56)	Crowded bass	Crowded bass
4	4.0	6- 2-69	2-5-69	48 (39-56)	Terminated in 1969 [2]	
5	2.9	6- 2-69	3-11-69	48 (39-56)	Balance	Balance
6	1.5	6- 2-69	1-31-69	48 (39-56)	Balance	Balance
7	0.5	6- 2-69	2-5-69	48 (39-56)	Terminated in 1970 [3]	

1 Swingle, 1956
2 Pond No. 4 was terminated in 1969 when it was inundated during Hurricane Camille.
3 Pond No. 7 was terminated in 1970 because the dam washed away and the fish population was lost.

TABLE 3. Size of pond, date stocked, average size of bass stocked, and condition of balance for 1970 and 1971 for all *salmoides* ponds.

Pond no.	Size (acres)	Date stocked Bass	Date stocked Bream	Average size of bass (mm)	Condition of balance 1970	Condition of balance 1971
8	34.0	5-10-69	3-11-69	28 (24-41)	Balance	Balance
9	7.0	5-10-69	3-19-69	28 (24-41)	Balance	Crowded bream
10	5.0	5-10-69	12-5-68	28 (24-41)	Balance	Balance
11	3.8	5-10-69	3-11-69	28 (24-41)	Terminated in 1971 [1]	
12	3.0	5-10-69	3-11-69	28 (24-41)	Balance	Crowded bream
13	1.3	5-10-69	3-19-69	28 (24-41)	Terminated in 1969 [2]	
14	0.6	5-10-69	3-19-69	28 (24-41)	Crowded bass	Crowded bass

1 Pond No. 11 was shocked extensively in March 1971, but no bass were collected. A large number of wildfish had gained access to the pond. This pond receives drainage from a soybean field and an insecticide-caused fish kill was suspected.
2 Pond No. 13 was eradicated by insecticides following a heavy rain and runoff from a soybean field.

Fingerling bass of approximately the same age and size were used to stock all ponds. The bass strain stocked into each pond was randomly assigned without the knowledge of the pond owners. All fertilized ponds were stocked with 1,000 bream per acre in the winter of 1968 and 100 bass fingerlings per acre in the spring of 1969. Tables 2, 3, and 4 show the date, size of pond, and species of fishes stocked into each pond.

During the summers of 1970 and 1971, each pond was seined for balance. The pond analysis technique developed by Swingle (1956) was

used for determining the balance of the fish population of each pond. Data pertaining to the management of each pond were obtained from the pond owner. The results of the seining checks are shown in Tables 2, 3, and 4.

TABLE 4. Size of pond, date stocked, average size of bass stocked, and condition of balance for 1970 and 1971 for all F_1 ponds.

Pond no.	Size (acres)	Date stocked		Average size of bass (mm)	Condition of balance	
		Bass	Bream		1970	1971
15	5.0	5-14-69	3-21-69	33 (29-39)	Balance	Balance
16	4.0	5-14-69	3-25-69	33 (29-39)	Balance	Balance
17	3.5	5-14-69	3-11-69	33 (29-39)	Balance	Balance
18	2.0	5-14-69	2-20-69	33 (29-39)	Balance	Balance
19	1.5	5-14-69	3-21-69	33 (29-39)	Crowded bream	Crowded bream
20	1.3	5-14-69	12-5-68	33 (29-39)	Terminated in 1971 [1]	
21	1.2	5-14-69	12-6-68	33 (29-39)	Balance	Crowded bass

[1] Pond No. 20 was inundated by flood waters and no adult fish were caught by hook and line or electrofishing.

During March, August, and September, 1971, samples of bass were collected from the experimental ponds. All collections were made by electrofishing.

All specimens were weighed to the nearest 0.01 pound, the total length measured to the nearest millimeter, and the fish returned to the ponds. Scale samples were taken from selected specimens during March 1971 and from all specimens collected during August and September 1971 to separate the two year classes.

All bass collected which could be aged were utilized for comparing growth. Tables 5, 6, and 7 show the number, mean length, mean weight, and age of the bass collected during 1971.

TABLE 5. Total number, mean length, and mean weight of *floridanus* collected by electrofishing from five ponds during 1971.

Pond no.	Year class	Total no. collected	Mean length (mm)	Mean weight (g)
1	1969 (21 months)	5	337 (303-430)	608 (408-1270)
	1969 (26 months)	5	370 (320-420)	693 (370-1021)
	1970 (age 1)	14[1]	281 (252-320)	309 (200-522)
2	1969 (21 months)	10	391 (355-466)	1196 (617-2204)
	1969 (26 months)	10	431 (396-500)	1356 (857-2549)
	1970 (age 1)	6[1]	315 (288-356)	421 (286-503)
3	1969 (21 months)	10	271 (251-325)	250 (181-458)
	1969 (26 months)	0	... .	... .
	1970 (age 1)	0	... .	... .
5	1969 (21 months)	4	376 (335-421)	823 (588-1383)
	1969 (26 months)	3	359 (304-445)	762 (377-1406)
	1970 (age 1)	8[1]	270 (245-298)	242 (191-354)
6	1969 (21 months)	9	344 (310-475)	606 (381-1678)
	1969 (26 months)	0	... .	... .
	1970 (age 1)	0	... .	... .

[1] All age 1 bass were collected in summer 1971.

TABLE 6. Total number, mean length, and mean weight of *salmoides* collected by electrofishing from five ponds during 1971.

Pond no.	Year class	Total no. collected	Mean length (mm)	Mean weight (g)
8	1969 (22 months)	12	356 (310-427)	733 (426-1501)
	1969 (27 months)	10	390 (359-429)	860 (585-1225)
	1970 (age 1)	15[1]	301 (253-345)	340 (191-563)
9	1969 (22 months)	10	328 (314-356)	477 (417-590)
	1969 (27 months)	0	... .	... .
	1970 (age 1)	0	... .	... .
10	1969 (22 months)	8	397 (320-480)	1095 (449-2132)
	1969 (27 months)	1	420	1252 .....
	1970 (age 1)	8[1]	294 (264-322)	312 (213-426)
12	1969 (22 months)	10	357 (338-399)	679 (540-830)
	1969 (27 months)	0	... .	... .
	1970 (age 1)	0	... .	... .
14	1969 (22 months)	4	285 (271-295)	324 (295-354)
	1969 (27 months)	0	... .	... .
	1970 (age 1)	0	... .	... .

1 All age 1 bass were collected in summer 1971.

TABLE 7. Total number, mean length, and mean weight of F_1 bass collected by electrofishing from five ponds during 1971.

Pond no.	Year class	Total no. collected	Mean length (mm)	Mean weight (g)
15	1969 (22 months)	14	395 (360-439)	968 (635-1229)
	1969 (27 months)	0	... .	... .
	1970 (age 1)[1]	0	... .	... .
16	1969 (22 months)	0	... .	... .
	1969 (27 months)	2	372 (368-375)	767 (762-771)
	1970 (age 1)[1]	0	... .	... .
17	1969 (22 months)	0	... .	... .
	1969 (27 months)	4	430 (380-517)	1554 (794-3420)
	1970 (age 1)[1]	6[2]	321 (300-335)	418 (345-472)
18	1969 (22 months)	12	363 (335-400)	729 (522-998)
	1969 (27 months)	0	... .	... .
	1970 (age 1)[1]	0	... .	... .
21	1969 (22 months)	6	297 (265-321)	316 (195-426)
	1969 (27 months)	2	296 (290-302)	284 (281-286)
	1970 (age 1)[1]	0	... .	... .

1 All age 1 F_2 bass are offspring from F_1 adults.
2 All age 1 F_2 bass were collected during summer 1971.

A total of 94 bass was tagged in August and September 1971. All fish were tagged with a numbered, yellow spaghetti tag measuring 73 millimeters long, with a 10 millimeter nylon T-bar. The tags were inserted with a Floy Tagging Gun, Model FD-67. The tags were inserted between the 3rd and 4th pterygiophore on smaller specimens. They were placed in the flesh on larger specimens. Annual growth rate will be computed from the tagged fish recaptured.

Lake Shelby

Lake Shelby is a 1,000-acre lake in South Baldwin County, Alabama which contains a population of largemouth bass and various forage fish. This isolated lake was chosen to determine if *floridanus* could be successfully introduced into the existing population and how their maximum growth would compare to the native bass.

During 1969 and 1970 prior to the introduction of *floridanus*, native *salmoides* were collected from Lake Shelby for meristic counts. A total of 10,470 *floridanus* (Table 8) was stocked into Lake Shelby during 1970 and 1971.

TABLE 8. Date, number and inch-group of *floridanus* stocked into Lake Shelby, Baldwin County, Alabama.

Date	Number	Inch-group
May 21, 1970	3,500	2 - 3
May 21, 1970	65	4 - 6
August 6, 1970	405	3 - 8
April 30, 1971	6,500	1 - 2

Buchanan (1968) found that the number of pyloric caeca proved to be the best single character for separation of these subspecies (Table 9). Therefore, this characteristic was used in this study.

TABLE 9. Comparison of means of pyloric caeca counts from 58 *salmoides*, 54 *floridanus* and 60 intergrades from California.[1]

Strain	Number examined	Location	Mean number of pyloric caeca
M. s. salmoides	58	Arkansas	23.2
Intergrades	30	California (Sutherland Reservoir)	29.2
Intergrades	30	California (El Capitan Reservoir)	30.0
M. s. floridanus	54	Florida	36.8

[1] This table was taken from a thesis entitled "A Meristic and Morphometric Comparison of Arkansas Largemouth Bass, Micropterus salmoides salmoides (Lacepede), and the Florida Subpecies, Micropterus salmoides floridanus (LeSueur)." Johnny P. Buchanan. 45pp. Table 14, page 38.

Pyloric caeca were removed from the abdominal cavity, the individual caeca separated with a probe and the number recorded. In the case of branching, each tip was counted, regardless of its length (Hubbs and Lagler, 1958).

Twenty *salmoides* collected from Lake Shelby had caecal counts ranging from 18-29 ($x = 22.7$), with the highest frequency being 20 and 21. For 10 *floridanus*, caecal counts ranged from 30-47 ($x = 39.0$), with the highest frequency being 38. The mean caecal counts for F_1 progeny was intermediate between those obtained from *salmoides* and *floridanus*. However, the degree of overlap and variation between the F_1 progeny would make it difficult to separate the three strains of largemouth bass within the same population. For 56 F_1 progeny, the caecal counts ranged from 17-41 ($x = 28.0$), with the highest frequency being 28. The means for the three strains of largemouth bass are compared in Table 10. The effects of stocking *floridanus* into Lake Shelby cannot be determined until recaptures are identified by caecal counts.

TABLE 10. Comparison of means of pyloric caeca counts for three strains of largemouth bass in Alabama.

Strain	Number examined	Location	Mean number of pyloric caeca
M. s. salmoides	20	Lake Shelby	22.7
F_1 progeny	56	Spring Hill Fish Hatchery	28.0
M. s. floridanus	10	Lake Raynagua	39.0

GROWTH

All three strains of largemouth bass displayed rapid growth in the ponds which did not contain a crowded bass population (Table 11). Therefore, bass collected from ponds containing a crowded bass population were not used for comparison. The fastest growth observed was that of the F_1 bass. These bass had a mean weight of 858 grams at 22 months and 1292 grams at 27 months. The largest F_1 bass collected weighed 3420 grams (7.54 pounds) at an age of 27 months. This bass was captured from Pond 17, a 3.5-acre pond containing only bream for forage.

TABLE 11. Total number, mean length, and mean weight of all bass collected from balanced and crowded bream ponds during 1971.

Bass strain	Year class	Total no. collected	Mean length (mm)	Mean weight (g)
Floridanus	1969 (21 months)	28	364 (303-466)	848 (408-2204)
	1969 (26 months)	18	402 (304-500)	1073 (370-2549)
	1970 (age 1)	28	285 (245-356)	314 (191-522)
Salmoides	1969 (22 months)	40	357 (310-480)	728 (417-2132)
	1969 (27 months)	11	393 (359-420)	896 (585-1225)
	1970 (age 1)	23	299 (253-345)	315 (191-563)
F_1 bass [1]	1969 (22 months)	26	373 (335-439)	858 (522 1229)
	1969 (27 months)	6	411 (368-517)	1292 (762-3420)
	1970 (age 1)	6	321 (300-335)	418 (345-472)

[1] The 1970 (age 1) year class are F_2 bass spawned in 1970.

The *floridanus* had a mean weight of 848 grams at 22 months and 1073 grams at 26 months. Although the *floridanus* were larger than the *salmoides* and F_1 at stocking, they were stocked approximately three weeks later. All bass were spawned in April, 1969. The largest *floridanus* observed weighed 2549 grams (5.62 pounds) at an age of 26 months. This bass was collected from Pond 2.

The *salmoides* had an observed growth rate slower than the F_1 bass and *floridanus* at ages 22 and 27 months. They had a mean weight of 728 grams at 22 months and 896 grams at 27 months. The largest *salmoides* observed weighed 2132 grams (4.70 pounds) at 22 months. The age 1 *salmoides* had a mean weight of 315 grams compared to 314 grams for age 1 *floridanus*. There was an observed difference in the mean lengths between age 1 *salmoides* and *floridanus*. Age 1 *salmoides* had a mean length of 299 millimeters compared to 285 for *floridanus;* however, this difference may not be significant.

Factors favoring growth were not always the same in all ponds: (1) fertility varied, (2) wildfish gained access to some ponds, and (3) fishing mortality was not equal in all ponds.

Wildfish were found in several of the experimental ponds. They were either stocked by pond owners, stocked by fishermen, present in pond prior to stocking or migrated upstream over the spillway. The species of wildfish collected were the creek chubsucker, *Erimyzon oblongus*, the warmouth, *Lepomis gulosus*, the golden shiner, *Notemigonus crysoleucas*, the mosquitofish, *Gambusia affinis*, the channel catfish, *Ictalurus punctatus*, the green sunfish, *Lepomis cyanellus*, and the brown bullhead, *Ictalurus nebulosus*. Channel catfish were stocked into Ponds 1, 2, 5, 8, 12, and 18 at 100 per acre by the pond owners. All other species have not been encountered in significant numbers.

DISCUSSION

The large size of *floridanus* and its ability to grow rapidly has generally been attributed to a longer growing season (Bailey and Hubbs, 1949). Early studies in California and Florida have indicated that environment, not genetic differences, was more important in determining growth rate. At present, sufficient data have not been obtained in this study to evaluate the growth potential of the three strains of largemouth bass.

Smith (1971) cited several conclusions from a study on Florida bass in California. The Florida bass was reported to be heavier, hardier, and dominant over the Northern strain.

Smith further reported that a study on marked fish indicated that *floridanus* are harder to catch. "Of 700 of each kind that were marked and released in a reservoir, 43.2% of the Northerns were boated by anglers to 17.1% of the Florida subspecies. That was in 1969. Another check last year showed more of the same. Of 1,000 each of marked Florida and Northern basses, plus 600 intermediates produced when the two crossbred, catch rates were 20%, 53%, and 37%, respectively." This study would indicate that the *floridanus* have a greater average longevity than the Northerns since they are not as easily caught by fishermen. If the *floridanus* has a greater average longevity, then they would be expected to attain a larger maximum size.

Results from this study are too preliminary to conclude if a real difference in growth does exist between the three strains of largemouth bass. However, it appears from the specimens collected that the 1969 year classes of F_1 bass and *floridanus* have grown larger and faster in ponds than the 1969 year class of *salmoides*. There appeared to be little or no difference between the mean weights of the 1970 year classes of age 1 *salmoides* and *floridanus* (Table 11).

Although the data are not conclusive, an improved breed of bass might be developed by selective breeding. A wide range of variation in growth has been observed on the specimens collected. Of the bass which have been observed, the F_1 bass and *floridanus* have shown the greatest degree of variation. A selective breeding study on largemouth bass which will include the *floridanus* will be undertaken by the Fisheries Section, Game and Fish Division, Alabama Department of Conservation and Natural Resources.

Several factors encountered will continue to cause difficulty in determining real differences in growth from this study. They are (1) unequal fishing mortality, (2) varying fertility between ponds, (3) effects of wildfish which are present in certain ponds, (4) difficulties caused by physical features of the ponds which affects sampling, and (5) the inability to drain all ponds concurrently and recover all fish populations for comparison. Certain portions of this study will be amended and redesigned to eliminate as much bias as possible.

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EFFECTS OF A THERMAL EFFLUENT ON AQUATIC LIFE IN AN EAST TEXAS RESERVOIR[1]

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ABSTRACT

Five data collecting stations were designated within Wilkes Reservoir, a 900 surface acre power plant reservoir in Marion County Texas, to gather information relative to the effects of a steam-electric effluent upon aquatic life. Temperature and dissolved oxygen readings were obtained with a YSI model 51A oxygen meter. Readings taken at designated intervals indicated the degree and extent of the heated water. Dissolved oxygen readings indicated no adverse dissolved oxygen concentrations. Twelve species of fish were collected and examined for external and internal parasites. Almost 59% of 161 game fish specimens, and almost 83% of 50 rough fish specimens were parasitized with trematodes, nematodes, cestodes, acanthocephalans, and parasitic copepods. The extent of parasitization in this reservoir indicated optimum or near optimum temperature conditions throughout the year. Parasitic copepods were more evident on bullhead catfish (*Ictalurus sp.*) during February, March, and April. There did not appear to be any seasonal

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