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THE BLACK BASSES (*MICROPTERUS*) OF FLORIDA, WITH DESCRIPTION OF A NEW SPECIES[1]

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In OUR revision of the black basses we were unable, because of the paucity of critical material, to arrive at a thorough understanding of the taxonomy and distribution of the forms of *Micropterus* in certain peripheral areas, namely from Texas in the Southwest and from parts of Alabama, Georgia, and all of Florida in the Southeast (Hubbs and Bailey, 1940: 7, 15, 21, 28, Maps 1–2). Since then the accumulation of additional specimens has permitted clarification of the problem of the subspecies of spotted bass (*Micropterus punctulatus*) in Texas. All material from the rivers of eastern Texas has been identified as *Micropterus punctulatus punctulatus* and a distinct subspecies, *M. p. treculii,* has been recognized in the Colorado, Guadalupe, and San Antonio river systems (Hubbs and Bailey, 1942).

New material from the Southeast makes possible a considerable expansion of our knowledge of the systematics of the genus *Micropterus.* In this paper we (1) describe, as a distinct new species, *Micropterus notius,* the Suwannee bass, from

[1] Contributions from the Museum of Zoology of the University of Michigan and the Scripps Institution of Oceanography (New Ser., No. 415).

Ichtucknee Springs, Columbia County, northern Florida; (2) report the occurrence in Florida of the spotted bass, *Micropterus punctulatus* (regarding *M. p.: henshalli* × *punctulatus* as indigenous and *M. p. punctulatus* as presumably introduced); (3) describe and discuss, but do not name, a single large bass from the Chipola River at Marianna, western Florida; (4) discuss the long-debated status of the northern smallmouth bass, *Micropterus dolomieu dolomieu,* as an inhabitant of Florida waters, and conclude that this species has not become established there and that the "smallmouths" of reputed record size were largemouth bass; (5) treat the classification and scientific name of the largemouth bass, regarding *Huro* as 1 of the 2 subgenera of *Micropterus;* and (6) recognize the giant largemouth bass of peninsular Florida as a distinct subspecies, *Micropterus salmoides floridanus* (LeSueur), outline its intergradation with the widespread northern form, *M. s. salmoides* (Lacépède), and treat it as one element in the endemic fish fauna of peninsular Florida.

The bulk of the material on which this report is based is in the Museum of Zoology, but most of the largemouth bass from South Carolina were loaned to us by E. B. Chamberlain and E. Milby Burton from the collections of the Charleston Museum. To them we are grateful. We wish to thank Theodore H. Hubbell for suggestions and for reading the manuscript. We are indebted, also, to E. Ross Allen, Archie F. Carr, Jr., and William M. McLane, who collected many of the specimens here reported.

I

SUWANNEE BASS

Micropterus notius, new species

(Pl. I)

With the exceptions of the spotted bass and Chipola bass discussed below, the only specimens of the subgenus *Micropterus* examined by us from Florida are 6 from Ichtucknee Springs, tributary to Santa Fe River, in the limestone sink area of northern Florida. They represent a strikingly distinct

species. This is believed to be a small species since our largest example, an adult male late in its fourth summer of life, measures only 218.5 mm. in standard length and 269 mm. (10.6 inches) in total length.

Since *M. notius* has scales on the interradial membranes toward the bases of the anal and soft dorsal fins, a shallowly emarginate dorsal fin, and simple pyloric caeca, it is clearly referable to the subgenus *Micropterus,* rather than to *Huro. M. notius* is to be aligned with the *M. punctulatus* section of the subgenus rather than with *M. dolomieu,* because the counts are relatively low for the soft rays of the dorsal, anal, and pectoral fins and for the scale rows along, above, and below the lateral line, and also because the color pattern is more like that of the *M. punctulatus* series than that of *M. dolomieu.*

The lateral-line scale count, which is lower than in any form of the subgenus except *M. p. punctulatus,* is notably less than in *M. d. dolomieu, M. d. velox,* and *M. p. henshalli,* and slightly overlaps the count of *M. coosae,* of *M. p. treculii,* and of *M. p. wichitae.* The ventrolateral longitudinal dark streaks, so characteristic of subadult examples of the *coosae–punctulatus* complex, are very imperfectly developed, and rather regularly aligned only on the caudal peduncle. The shallowly emarginate dorsal fin, the deep body (especially of the young), and the vertical elongation of lateral blotches are reminiscent of these features in *M. coosae* and in *M. d. dolomieu;* the prominent basicaudal spot and the broadened lateral blotches (which are often fused) are suggestive of *M. punctulatus.* The soft dorsal, caudal, and anal fins of the young are more boldly mottled and spotted than in any other form, but the strong caudal band, characteristic of the young of all species except *M. coosae* and *M. salmoides,* is not well formed in the 2 fingerlings of *M. notius.* The bright blue on the lower anterior parts in life seems to be unique for the genus.

TYPES.—The holotype (U.M.M.Z., No. 134628), a fingerling 67.7 mm. in standard length and 84.5 mm. in total length, was collected by Archie F. Carr, Jr., on September 24, 1941, at the head of Ichtucknee Springs, Columbia County, Florida.

Five paratypes: U.M.M.Z., No. 134629 (3), taken with the holotype, and U.M.M.Z., No. 147193 (2), speared by E. Ross Allen and W. M. McLane while goggling in Ichtucknee Springs on April 9–10, 1941.

HABITAT.—Ichtucknee Springs discharge into the Santa Fe River of the Suwannee River system. They lie 5 miles northwest of Fort White, in the northwestern quarter of section 7, Township 6 South, Range 16 East. Cooke (1939: 97, Fig. 49) illustrated the main spring (spelled by him Itchatuchnee) and reported that it issues as a strong boil through the Ocala Limestone. One of the larger springs of Florida, it has a reported flow of more than 400 second feet and a temperature of 74° F.

DESCRIPTION.[2]—The form is robust; greatest depth, 3.2. The caudal peduncle is relatively deep and short, but becomes more attenuate with age; least depth, 8.0; length, 4.9. The body is moderately compressed; greatest width, 6.0. Head large, its length, 2.6; relatively smaller with age. The dorsal fin has a rather shallow emargination, which becomes less marked with age; the ninth and shortest spine is 59.7 per cent of the fourth and longest (1.67 in longest); fourth spine, 9.4. The spinous dorsal becomes progressively lower with age. In the holotype the fifth spine is abnormal, divided to its base. As is usual in the subgenus, the soft dorsal and anal each have small scales on the interradial membranes near their bases. Both fins are smoothly rounded, and each becomes somewhat lower with increased age. The longest soft dorsal ray is usually slightly higher than the longest anal ray, but in the holotype each measures 6.0. The 3 graduated anal spines become relatively shorter with age; the third and longest is 9.9 in standard length. The pectoral fin is short and rounded distally; length, 5.2. The pelvic fin is of moderate length, but becomes relatively shorter with age; length, 5.35.

[2] Measurements of the holotype, as given in the description, were taken with dividers. Fin-ray and scale counts and proportional measurements for each of the 6 specimens are given in Table I. The methods of counting and measuring used in this paper are the same as those employed by Hubbs and Bailey (1940: 9–10).

The caudal fin is very shallowly emarginate, and the lobes are rounded; length from base to tip of longest ray, 4.0; length to tip of median ray, 5.2 (1.27 in caudal length). Tip of snout to origin of dorsal, 2.25; tip of lower jaw to insertion of pelvic, 2.6; thence to origin of anal, 3.5.

Width of head, 2.15 in head length. The predorsal contour, scarcely curved in the smaller specimens, becomes weakly sigmoid in the adult (Pl. I). In the profile of the head and body, except for the weaker emargination of the dorsal fin, *M. notius* bears a very striking resemblance to *M. salmoides.* The snout is relatively shorter than in other species of the subgenus *Micropterus;* length, 4.0. The orbit, as usual, becomes much smaller with age; length, 4.2. The flat interorbital becomes broader with age; least bony width, 5.7. The maxilla extends to below the posterior margin of the pupil (below posterior margin of orbit in adults); length of upper jaw, 2.1. The lower jaw projects slightly; length, 1.7, increasing with age.

Dorsal, X, 12; anal, III, 10; pectoral, 16–15 (16–16 in five paratypes). Scales, 8 or 9—59 to 63—16 to 19; 27 to 29 rows around caudal peduncle and 10 to 15, usually 12 or 13, rows on cheek. Scales are well developed on the opercle, subopercle, and interopercle. Those of the opercle are not much larger than those on the cheek. The few scales on the preopercle are imbedded. In the 1 paratype counted the vertebrae number 14 + 18 = 32.

The bony margins of the lachrymal, suborbitals, preopercle, and the opercular bones are entire. The branchiostegal rays number 6–6 in all 6 specimens. The opercle terminates posteriorly in 2 flat, blunt, rigid projections, of which the lower is much the longer.

The dentaries and premaxillae bear broad bands of depressible villiform teeth. The head of the vomer has a triangular patch, and the palatine has an elongate band of villiform teeth. The ectopterygoid has smaller teeth than the palatine. A subcircular patch of glossohyal teeth is present in each specimen. The gill rakers number 2 + 6 and 2 + 5 in

the holotype; the count is usually 2 + 5, occasionally 1 + 5, 2 + 4, or 2 + 6. In 2 paratypes the pyloric caeca number 10 and 13; all are simple, except for 1 that is branched at its base in 1 specimen and for 1 that is forked about a third of its length from the distal tip in the other.

In coloration, as well as in body form, *M. notius* strongly resembles *M. salmoides*. The body is marked with a series of about 12 lateral blotches. These are vertically elongate, as in *M. dolomieu* and *M. p. treculii,* but anteriorly are much wider than the interspaces and on the caudal peduncle fuse to form a relatively uniform lateral band. They are not light-centered. The basicaudal spot is large. In the smaller specimens it is blackish and is bordered by a light area that is framed by a subtriangular dark mark (Pl. I, Fig. 1). Ventrolateral dark streaks are weakly developed, rather definite only on the caudal peduncle of the 4 largest specimens. In the larger adults the fins are uniformly dusky or show an obscure pattern of mottles, but in the 2 fingerlings the soft dorsal, caudal, and anal are clearly spotted or suffused with dark on a light ground color. In the 2 smaller adults the basal parts of the soft vertical fins are finely mottled and reticulated with light and dark and the caudal fin is darker than in other forms of *Micropterus* at the same size; the basal part is not evidently light, the subterminal dark band across the caudal lobes is less well marked, and the lobes are narrowly edged with light. As usual in the genus there is a black spot on the posterior part of the opercle and 3 brownish oblique lines cross the cheek, backward and downward from the eye.

Striking as the color pattern of preserved specimens may be, the life colors must be even more impressive. One of the collectors of the 2 small adults, William M. McLane, reported that the brilliantly colored nesting fish, taken on April 9 and 10, attracted his attention because the cheeks, breast, and ventral parts of the sides were turquoise blue. These fish were much brighter, he added, than any smallmouths (*M. d. dolomieu*) that he had seen in Lake Erie.

RELATIONSHIPS.—Among the species of the subgenus *Micro-*

pterus, notius presents the closest structural approach to the subgenus *Huro* (*Micropterus salmoides*), as is evidenced in the coloration, in body form, and in the size of the scales (especially on the cheek and along the body). These *salmoides*-like features, in addition to other evidence, suggest strongly that *notius,* more than any other species, retains a generalized position in the genus close to the prototypic *Micropterus.* From some such ancestor as *M. notius* differentiation has proceeded along 2 independent lines. The bifurcate caeca and the deeply incised dorsal fin of *salmoides* are believed to represent specializations along 1 evolutionary line (*Huro*). Progressive differentiation in the other main line, in the subgenus *Micropterus,* has been characterized, among other features, by a reduction in scale size, by pattern evolution, and by modification of body form. A parallel change from the presumably primitive vertebral count, $14 + 18 = 32$, to $15 + 17 = 32$, probably arose independently in each of the 2 principal evolutionary lines, terminated by *salmoides* and *dolomieu,* respectively. Similarly, a trend toward reduction in dentition (especially of the glossohyal) has occurred both in *salmoides* and in *dolomieu.*

We have entertained but rejected the idea that the bass from Ichtucknee Springs may be hybrids between *M. salmoides* and some species of the subgenus *Micropterus.* General appearance favors this concept, but other considerations contradict it. In the first place, no other form of the subgenus *Micropterus* seems to occur in or near Ichtucknee Springs. In the second place, hybridization between the species of *Micropterus* is extremely rare[3] and no hybrid between the sub-

[3] In addition to the 3 hybrid specimens reported previously (Hubbs and Bailey, 1940: 39–40), we have recognized only 1 other (U.M.M.Z., No. 131545), a yearling specimen 106 mm. in standard length. It is identified as *Micropterus dolomieu* (*dolomieu* × *velox*) × *M. punctulatus punctulatus.* It was collected in White River one-half mile northeast of Wyman, Washington County, Arkansas, by J. D. Black and Henry Mills on July 27, 1940. Its main counts are: dorsal, IX, 14; anal, III, 10; pectoral, 15–16; scales, 9—65—15, with 26 rows around the caudal peduncle and 17 rows on the cheek.

TABLE I

PROPORTIONAL MEASUREMENTS AND COUNTS ON 6 TYPES OF *Micropterus notius*, AND ON 1 SPECIMEN OF *Micropterus* SPECIES FROM THE CHIPOLA RIVER, MARIANNA, FLORIDA

The U.M.M.Z. catalogue numbers for the *M. notius* specimens are Nos. 134629 (1 and 2), 147193 (3 and 4), 134629 (5), and 134628 (6, the holotype)

Character	*Micropterus notius*							*Micropterus* Species
	1	2	3	4	5	6	Mean	
Standard length (mm.)	218.5	190.5	181.0	176.5	75.0	67.7	151.5	313
Thousandths of standard length								
Head length	384	378	360	371	388	390	379	342
Greatest depth	336	329	318	312	327	323	324	297
Least depth	130	128	133	125	133	130	130	110
Body width	.....	197	177	159	176	168	175	174
Caudal peduncle length	240	226	227	218	220	210	224	233
Pectoral length	194	202	191	195	207	198	198	172
Pelvic length	176	181	177	171	195	191	182	150
Highest dorsal spine	94	87	84	87	113	106	95	75
Lowest dorsal spine	63	55	56	55	67	64	60	40
Highest dorsal soft ray	167	168	169	161	181	171	170	144
Highest anal spine	89	76	84	83	97	103	89	50
Highest anal soft ray	156	156	156	154	180	171	162	136
Head width	.....	542	519	498	488	458	501	500
Orbit length	193	199	216	213	241	242	217	176
Interorbital width	211	199	199	193	179	182	194	230
Snout length	259	263	262	268	261	261	262	285
Upper jaw length	483	476	486	483	467	462	476	486
Lower jaw length	598	588	597	596	588	576	591	605

TABLE I (*Cont.*)

Character	*Micropterus notius*							*Micropterus* Species
	1	2	3	4	5	6	Mean	
Thousandths of length of highest dorsal spine								
Lowest dorsal spine	665	636	664	634	588	597	631	528
Counts								
Dorsal spines	10	10	10	10	10	10	10.00	10
Dorsal soft rays	12	12	12	12	12	12	12.00	11
Anal soft rays	10	10	10	10	10	10	10.00	10
Pectoral rays*	16–16	16–16	16–16	16–16	16–16	16–15	15.92	16–16
Scales above lateral line*	9–8	8–8	8–8	9–9	–8	8–8	8.27	10
Scales along lateral line*	60–60	63–62	61–59	63–	59–59	62–61	60.82	77
Scales below lateral line*	16–17	17–17	18–17	19–18	17–18	17–18	17.42	20
Scales around caudal peduncle	27	28	29	28	28	27	27.83	31
Scale rows on cheek*	14–12	13–15	13–12	13–12	11–12	11–10	12.33	14

* Counts recorded for both sides, except on the specimen from Chipola River.

genera has been encountered. In the third place, certain characters are inconsistent with the hybridization theory. For example, the notch between the dorsal fins is much shallower than would be expected of a hybrid involving *M.* (*Huro*) *salmoides* as 1 parent. Other characters do not display the intermediacy that one comes to expect in fish hybrids.

We interpret *M. notius* as an endemic species in the sinkhole region of northern Florida and probably as a relict, since it seems to be the most generalized species of the genus. In the same region there is a largely subterranean form of the minnow *Erimystax harperi* (Fowler) and the stream form, *E. h. harperi,* centers here, as do also a genus and species of darter, *Villora edwini* Hubbs and Cannon. A few other fishes seem to find in this region the center of their restricted range. Here also are distinct species of crayfish (Hobbs, 1942) and ferns (St. John, 1936).

The name *notius* is from νότος, "southern."

II

THE SPOTTED BASS, *Micropterus punctulatus,* IN FLORIDA

We have previously shown that *Micropterus punctulatus henshalli* of the upper parts of the Alabama and Tombigbee river basins is represented in southern Alabama, southern Mississippi, and extreme southeastern Louisana by a population intermediate between *M. p. henshalli* and the widespread *M. p. punctulatus* (Hubbs and Bailey, 1940: 16, Map 1, Tables V and VI). The expected extension of the area of intergradation into extreme western Florida is now confirmed.

The following Florida collections of *Micropterus punctulatus: henshalli* × *punctulatus* are in the Museum of Zoology:

No. 134626 (6 specimens, 46.5 to 68.5 mm. in standard length), collected in the Escambia River, west of Jay, Escambia County, October 12, 1941, by A. F. Carr, Jr. The lateral-line scales number 65 in 1 specimen, 66 in 4, and 68 in 1; the scale count around the caudal peduncle is 25 in 3 and 26 in 3.

No. 134601 (1 specimen, 110 mm. in standard length), collected in Perdido Creek, near Pineville, Escambia County, October 12, 1941, by Carr. The lateral-line count is 63, and there are 24 scales around the caudal peduncle.

No. 147187 (3 specimens, 65 to 153 mm. in length), collected in Sweetwater Creek, near Munson, Santa Rosa County, April 11, 1941, by Carl L. Hubbs and Boyd W. Walker. The lateral-line scale counts are 62, 68, and 70 and the caudal peduncle counts are 23, 24, and 24.

The mean values for the 10 specimens are 66.0 for lateral-line scales and 24.8 for scale rows around the caudal peduncle. The 26 intergrades reported previously have values of 66.54 and 25.08. The averages for *M. p. henshalli* have been determined as 72.26 and 27.55, respectively, and for *M. p. punctulatus* as 63.71 and 24.44 (Hubbs and Bailey, 1940: 49–50).

Two specimens of *Micropterus punctulatus,* taken by A. F. Carr, Jr., on October 13, 1941, in the mouth of the Flint River, Apalachicola River system, Gadsden County, Florida, far to the east of other records of the species along the Gulf coast, cannot be identified as intergrades. The 2 specimens have lateral-line scale counts of 62 and 63 and the caudal peduncle rows number 23 and 25. These values are at or near the lower limit of variation for intergrades between *henshalli* and *punctulatus,* but are near the modal counts for the typical subspecies. In view of the absence of other records of the species in the Apalachicola system, and because of the phenotypic agreement of these specimens with the typical subspecies, they are provisionally identified as *M. p. punctulatus.* If this determination is correct, it is highly probable that the population at this locality is the result of stocking. We have no information regarding plantings of this species in Florida, but at least 1 journalist has advocated its wide dissemination in the state.

III

A BASS, *Micropterus* SPECIES, FROM THE CHIPOLA RIVER

In 1940 we reported (Hubbs and Bailey, pp. 6. 28, Map 1),

but did not identify, a large specimen of *Micropterus* (U.M.M.Z., No. 110997) from the Chipola River in the Apalachicola system at Marianna, Jackson County, Florida. On our recommendation, based on preliminary study of this specimen, Carr (1937: 85) had previously included *Micropterus pseudaplites* (= *punctulatus*) in the list of Florida fishes. The specimen was collected by O. C. Van Hyning on January 27, 1933, and there seems to be no reason to question its provenance. A rock bass, *Ambloplites rupestris ariommus*[4] Viosca, taken from its stomach, supports the locality record, since from southern Louisiana to southwestern Georgia that subspecies is strictly coastwise in its distribution.

Since our initial report of this interesting fish, we have collected independently at and near Marianna in a futile effort to secure additional material, and several other collectors have tried to obtain specimens there with no more success. Since high water restricted our field activities, our failure to capture specimens constitutes no proof that the bass is rare at Marianna. Some local residents may well have had this species in mind in speaking of a relatively small-mouthed form known as "shoal bass," which is more active than the largemouth when hooked and more apt to leap in its struggles to escape.

Although we continue to hold in abeyance a determination of the Chipola bass, we strongly suspect that it represents an undescribed form. In this connection it should be recalled that the region of the Chipola River has been found to be one of rather high endemism. For example, Carr and Marchand (1942) described from this stream a distinct species of turtle. The naiad fauna of the Chipola River is marked by high en-

[4] Specimens of *Ambloplites* in the Museum of Zoology from the lowlands of eastern Arkansas and southeastern Missouri are clearly intermediate between *ariommus* and *rupestris; ariommus* is therefore regarded as a subspecies of *rupestris*. Fowler's recent action (1945: 253) in naming a genus *Bartramiolus*, for the sole reception of *Ambloplites ariommus* Viosca is thus seen to be wholly unwarranted. *Bartramiolus* Fowler is herewith relegated to the synonymy of *Ambloplites* Rafinesque; the type species of these nominal genera are conspecific.

demism (van der Schalie, 1940). Two endemic darters, *Doration davisoni* (Hay) and *Poecilichthys okaloosae* (Fowler), inhabit western Florida, along with 5 or more undescribed species of fishes.

On the basis of the low fin-ray counts, the low count of scales above the lateral line, and proportional measurements (Table I, last column), as well as the color pattern, the Chipola bass is clearly allocated to the *punctulatus* section of the subgenus *Micropterus* (also including *coosae* and *notius*), as opposed to the *dolomieu* group. It is sharply differentiated from *notius,* as well as from *M. p. punctulatus, M. p. treculii,* and *M. p. wichitae,* by the small scales, among other characters. The counts for the lateral-line scales (77) and for the rows around the caudal peduncle (31) contrast with the maxima in those forms of 72 and 29, respectively. It is from a geographic locality remote from all of these except *notius* (see record of presumed introduction of *M. p. punctulatus,* p. 11). *M. coosae* and *M. p. henshalli* are the nearest geographical representatives of the genus and have the closest structural similarity. In all scale counts (Hubbs and Bailey, 1940: Tables V and VI), except for the number of rows on the cheek, the Chipola bass equals or slightly exceeds the maxima for these forms. The 31 scales around the caudal peduncle contrast with the mean of 27.55 (maximum, 29) in *M. p. henshalli* and of 28.34 (maximum, 31) in *M. coosae.* Although parallel variations have been noted in *M. coosae* from the Black Warrior River system in Alabama (Hubbs and Bailey, 1940: 28), identification with that form would seem to be precluded by reason of the greater emargination of the dorsal fin in the Chipola bass: the lowest dorsal spine is 52.8 per cent of the highest, as opposed to 70.7 per cent (61.7–77.2) in typical *M. coosae.* Furthermore, there are no glossohyal teeth, whereas these teeth are absent in only 2 of 22 examples of *M. p. henshalli* and in 9 of 42 specimens of *M. coosae* examined. There are 10 pyloric caeca, all unbranched. The large size of the Chipola bass (over-all length, 388 mm., as against 203 mm. and 261 mm., respectively , for the largest *M. p. henshalli* and

M. coosae specimens examined), prevents a comparison at equivalent sizes, but the color pattern is more reminiscent of *M. p. henshalli* than of *M. coosae*. *M. coosae* occurs in the upper and middle Chattahoochee system, but (except for the presumably introduced *M. p. punctulatus*) no representative of *punctulatus* is known from the Chattahoochee–Apalachicola basin. Since the Chipola bass does not seem identifiable with *coosae* as represented in the drainage, the geographic as well as the structural implications suggest alignment with *M. punctulatus,* but in the absence of more material we do not venture a decision as to whether it is a variant *henshalli,* represents an undescribed subspecies of *punctulatus,* or presages recognition of a wholly distinct species. As already stated we lean to the belief that it belongs to an undescribed form.

IV

HAS THE SMALLMOUTH BASS, *Micropterus dolomieu,* BECOME ESTABLISHED IN FLORIDA?

The smallmouth bass has long been regarded by sportsmen and writers on game fishing as an exotic inhabitant of certain lakes in the vicinity of Oakland in central Florida. *Field and Stream* magazine credits Lake Apopka, near Oakland, with the production of the record smallmouth, a 14-pound specimen, 28 inches long and 21¼ inches in girth, caught by Walter Harden on February 9, 1932. This supposed record has been mentioned in several pamphlets and books, for example by LaMonte (1945: 174). Several other fish nearly as large, taken in the same or in near-by lakes, have been accorded considerable publicity. Without having any firsthand evidence, Carr (1937: 85) and Hubbs and Bailey (1938: 29, 52) accepted these accounts as reliable. The Florida Game and Fresh Water Fish Commission included the species in an anonymous account of the game fish of the state (1946: 6–7).

Belief that the smallmouth is established in Florida has apparently been based on the known introductions of northern stock by the United States Bureau of Fisheries (and perhaps

other agencies), and by identifications of large fish taken subsequently. These determinations have been made not only by anglers but by ichthyologists.

For some time we have been sceptical of the reported success of plantings of the northern smallmouth in Florida. Our own collections have not included the species. Neither have those of Archie F. Carr, Jr., and his active associates at the University of Florida. O. Lloyd Meehean, chief of the Division of Game-fish and Hatcheries of the United States Fish and Wildlife Service, who for several years was stationed in Florida, informed us (letter of July 9, 1946) that he has never seen a smallmouth bass from Florida. He wrote:

> I tried to run down two or three reports of smallmouth bass without success. At Winter Haven they reported smallmouth in the city lake and upon investigation I found that these were merely largemouth which were stunted as a result of over-population or possibly lack of food so that the size and shape had been considerably changed, but they were still typical largemouth.

Mr. Herb Mosher, angler and prolific outdoor writer of the *Orlando Morning Sentinel,* has in his column repeatedly raised the question of the occurrence in Florida of the smallmouth. Despite pages of newsprint devoted to the controversy and numerous pleas for specimens, none has been forthcoming. He does not believe that the smallmouth occurs in Florida. Photographs and mounted specimens of several large Florida bass reputed to be smallmouths, including one from Lake Tsala Apopka approximately as large as the accepted world record, have been made available to us, but all of these have proved to be largemouths. In short, despite the unquestioned fact that the species has been planted, we can find no valid evidence that the smallmouth has become established in Florida waters.

Why then have ichthyologists identified record-sized fish as smallmouth? The answer to this question is as simple as it is unexpected. Current descriptions and keys, our own included (Hubbs and Bailey, 1938: 14–15; 1940: 10–13), compare northern smallmouths with northern (not Florida) large-

mouths. It is now evident that the peninsular largemouth parallels the smallmouth in certain characters commonly used for identification, both forms contrasting in these respects with the northern *salmoides*.

The undue reliance placed on scale counts is apparently chiefly responsible for the misidentifications. In *M. d. dolomieu* there are 68 to 81 (usually 72 to 77) lateral-line scales, and in northern *salmoides* 58 to 69, usually 61 to 66. The peninsular largemouth, however, has 65 to 75, usually 69 to 73. Whereas *M. d. dolomieu* has 14 to 18 (usually 15 or 16) rows of scales on the cheek, northern specimens of *salmoides* have 9 to 12, usually 10 or 11. But the largemouth from peninsular Florida has from 10 to 14 (usually 11 to 13).

Mounted specimens in particular are difficult to identify, because of the loss, misrepresentation, or distortion of such important characters as coloration, pyloric caeca, size of mouth, and body form. We believe that the difficulties attending the identification of mounted examples or skins (in contrast to properly preserved museum specimens), along with the small size of the scales in Florida largemouths, adequately account for the incorrect determinations. We conclude that there is no valid evidence that *Micropterus dolomieu* is established in Florida. Characters such as the structure of the pyloric caeca, the relative lengths of shortest and longest dorsal spines, pectoral-ray count, and color pattern (Hubbs and Bailey, 1940: 10–13) should be relied upon for the differentiation of these species.

We therefore recommend the removal of Florida fish from consideration for the title of "world's record" smallmouth bass. We leave to others the decision as to what fish properly deserves the distinction of holding the record, but stress here the importance of accurate identification.

V

THE SCIENTIFIC NAME OF THE LARGEMOUTH BASS

The early history of the changes in the scientific name of the largemouth bass need not be recounted at length. Hen-

shall (1881: 110–32) finally clarified the situation, and except for the unjustified reversion to the specific name *floridana* by certain recent authors, the name *salmoides* has been in general use since that time. Disagreement in nomenclature during recent years has centered largely on the proper generic allocation.

At a time when only 2 species of black bass were recognized, Hubbs (1926: 69, 71) called attention to the many striking differences between them, noting especially the trenchant features of the simple or bifid pyloric caeca, the scaled or scaleless base of the anal and soft dorsal fins, and the shallowly emarginate dorsal as contrasted with the almost separate dorsal fins. The character differences were regarded as worthy of generic separation, and the name *Aplites* was associated with *salmoides.*

Although the sharpness of the distinction was lessened when 4 species and 7 forms of black bass were recognized (Hubbs and Bailey, 1940), the largemouth bass was still accorded generic status. The name *Huro* was adopted for its genus, since, on reconsideration of Rafinesque's names, *Aplites* was interpreted as a strict synonym of *Micropterus.*

Several of the characters that separate *M. salmoides* and *M. dolomieu* break down when the 5 species and 10 forms that we now recognize are critically compared. As noted on page 7, *M. notius* approaches *M.* (*Huro*) *salmoides* more closely in several respects than does any other species of the subgenus *Micropterus.* In the emargination of the dorsal fin *M. punctulatus* is intermediate between *M. salmoides* and *M. dolomieu,* and scales are commonly present on the preopercle (earlier regarded as an exclusive feature of *M. salmoides*). The mouth in several of the newly recognized forms, though smaller than in *salmoides,* is much larger than in *M. dolomieu.* The size of the cheek scales varies among the species so much that this character is of no value in separating the groups. The body form of *M. notius* is strikingly similar to that of *M. salmoides,* and in general features of coloration *M. notius* and *M. punctulatus* bear even closer resemblance to *M. salmoides* than to

M. dolomieu. The presence of scales on the fin bases in *Micropterus, sensu stricto,* usually serves as a clear-cut differentiating feature, but some specimens of *M. salmoides* have a few isolated scales near the bases of the anal and soft dorsal fins. There remains the character of the simple pyloric caeca in *Micropterus,* contrasting with the branched caeca in *Huro.* But, as already noted, some of the caeca are unbranched in *Huro,* and, as now verified by us for *M. notius,* 1 or 2 of the caeca are branched in some specimens of the species of the subgenus *Micropterus.* There seems to be little doubt that *Micropterus* and *Huro* are natural groups and that *salmoides* represents a structural type distinct from *Micropterus.* Whether 1 or 2 genera should be recognized is a matter of opinion.

Since our 1940 revision, several workers, including De Buen (1941), have disagreed with the retention of 2 genera. We now recognize *Huro* as a subgenus of *Micropterus* because of the close resemblance of certain species of *Micropterus* to *Huro,* the gradation from one extreme to the other in most of the characters which have formerly been used for separation, and the difficulty in evaluating the importance of the other characters. The name of the largemouth bass may stand as *Micropterus* (*Huro*) *salmoides* Lacépède.

VI

THE SUBSPECIES OF *Micropterus salmoides*

As already mentioned, we recognize the largemouth bass of peninsular Florida as a distinct subspecies, which intergrades geographically with the northern form. We thus confirm an earlier suggestion (Hubbs and Bailey, 1940: 39) that *M. salmoides* is not a single unit. The Florida subspecies and the intergrades are discussed below.

We tentatively refer all bass from north and west of the range of the intergradation to the typical subspecies, *M. s. salmoides,* although we suspect that one or more additional subspecies may prove recognizable when adequate studies have been made. The largemouths in the southwestern ex-

tremity of the natural range of the species may prove separable on the basis of a high incidence of glossohyal teeth. These teeth are almost invariably absent in *M. s. floridanus* (p. 30), are lacking in 52 out of 58 examples from South Carolina (topotypical *salmoides*), and are seldom developed in northern specimens. If a southwestern subspecies should be recognized, the name *nuecensis* (*Grystes nuecensis* Baird and Girard, 1854) may be available for it.

There are less definite indications that still other forms may exist. Thus, some specimens from the Atlantic coast drainages of Georgia, South Carolina, and North Carolina exhibit in part or to some extent the coloration of *M. s. floridanus,* although they do not have the high scale counts of that form. Some adults from South Carolina disagree with northern largemouths in the size of the mouth. It is the belief of Mr. Percy Viosca, Jr., that a different type of *M. salmoides* occurs in the Ouachita River and its tributaries in north Louisiana (personal communication).

NORTHERN LARGEMOUTH BASS

Micropterus salmoides salmoides Lacépède

The typical subspecies of the largemouth is known to occur in Florida in pure form only in the Pensacola Bay drainage in the western part of the Panhandle. The records by Goode and Bean (1879 : 138), under the name *Micropterus pallidus,* for Pensacola, and of Bollman (1886 : 464), as *Micropterus salmoides,* from near the mouth of the Escambia River, are referable to the typical subspecies. The counts for the Pensacola Bay drainage recorded in Tables II to VII were taken from 2 series, with data as follows : U.M.M.Z., No. 144583, 3 specimens, 51 to 76 mm. long, collected by Reeve M. and Marian K. Bailey on August 21, 1939, in Pond Creek, about 2 miles southwest of Milton, Santa Rosa County, Florida ; U.M.M.Z., No. 88699, 8 fish, 41 to 105 mm. long, seined by Herbert R. Becker and Edwin P. Creaser on September 16, 1929, in a high-water pond of Conecuh River, 8 miles west

of Troy, Pike County, Alabama. Another specimen, 54 mm. long, was collected by Carl L. and Laura C. Hubbs and Boyd W. Walker on April 11, 1941, in Big Escambia Creek, at Flomaton, Escambia County, Alabama.

FLORIDA LARGEMOUTH BASS

Micropterus salmoides floridanus (LeSueur)

Cichla Floridana.—LeSueur, 1822: 219–20 (original description; east Florida).

Micropterus floridanus.—Jordan and Copeland, 1876: 137 (in part; Florida).

Huro floridana.—Jordan, Evermann, and Clark, 1930: 297 (in part; Florida). Schrenkeisen, 1938: 237–40 (in part; Florida).

Micropterus salmoides floridanus.—McLane, 1948: 103–38 (near Welaka; food).

Grystes salmoides (incomplete identification).—Holbrook, 1860: 28–31 (in part; records from Florida).

Micropterus salmoides.—Henshall, 1881: 110–11, 135–74 (in part; Florida records). Goode, 1884: 401–4 (in part: St. John's River; Gainesville;[5] size). Henshall, 1889: 22–29, 41–44, 53 (in part; St. John River; rivers issuing from large clear springs, Hernando County; size). Henshall, 1891: 386 (Myakka and Hillsborough rivers and tributaries, in fresh and brackish water). Bollman, 1891: 577–78 (in part; Florida). Woolman, 1892: 297–98 (localities in Peace and Hillsboro river drainages). Lönnberg, 1894: 125–26 (St. John's River and lakes, including Lake Apopka; color). Jordan and Evermann, 1896: 1012 (in part; Florida). Evermann and Bean, 1898: 243 (Eau Gallie Creek and South Lake, tributaries to Indian River). Evermann and Kendall, 1900: 72 (literature reports; Palatka, Welaka, Match Creek, tributary to Ocklawaha River, and Lake Monroe). Henshall, 1908: 18–20 (in part; size attained in Florida). Fowler, 1915: 249 (West Palm Beach and Lake Kerr). Fowler, 1923: 30 (Bayport, Lake Okeechobee and Caloosahatchie River). Pratt, 1923: 120–21 (in part; Florida). Fowler, 1926: 252 (Lake Trafford). Harkness and Pierce, 1941: 112 (Lake Mize).

Micropterus salmonoides (emended spelling).—Boulenger, 1895: 16–18 (in part; Wekiwachee River).

Aplites salmoides.—Hubbs, 1927: 6 (Florida; characters; *Cichla floridana* regarded as a synonym). Mueller, 1936: 807–8 (host

[5] All definite localities mentioned in this synonymy are in Florida.

of copepod parasites; Myakka River near Sarasota and canals of Lake Okeechobee near Clewiston).

Huro salmoides.—Jordan, 1929: 145–46 (in part; Florida). Pratt, 1935: 114 (in part; Florida). Carr, 1937: 85 (characters). Hubbs and Bailey, 1938: 15, 18–19 (in part; Florida). Bangham, 1939: 265 (parasites; near Englewood, Peace River tributaries, Myakka River, Lake Okeechobee). Hubbs and Bailey, 1940: 13, 37–39 (in part; Florida; partial synonymy). Fowler, 1941: 240–41 (St. John's River; mouth of Blue Springs Run, Volusia County; Lake Okeechobee; Wekiva Springs, near Apopka, Orange County; Lake Apopka; Orange Lake; Fannin and Manatee springs, Levy County [possibly intergrades]; Salt Springs, west of Lake George; Silver Glen Springs, Marion County). Bailey, 1941: 6 (Mill Dam Lake, Marion County). M. H. Carr, 1942: 43–77, Pls. 7–12 (breeding habits and embryology; Bivens Arm, 3 miles south of Gainesville; St. John's River). Meehean, 1942: 184–94 (populations; Clearwater, Buck and Big Prairie lakes and First and Little Deep ponds, Ocala National Forest). Hubbs and Allen, 1944: 125 (Silver Springs; characters; habits). Allen, 1946: 27, fig. (Silver Springs; habits). Fowler, 1945: 298 (Punta Gorda, Alligator River tide ditch; Boggy Creek, Nassau County; Boca Raton, Palm Beach County).

Micropterus pallidus (not of Rafinesque).—Jordan, 1880*a*: 19 (San Sebastian River, tributary to Indian River; no lingual teeth). Jordan, 1880*b*: 22 (St. John's River). Bean, 1880: 96–97 (St. John's River; Jacksonville). Earll, 1887: 529 (St. John's River).

Largemouth black bass.—Meehean, 1944: 220–30, Figs. 1–2 (gain in weight as measure of production; hatchery at Welaka, fed from St. John's River).

There appears to be no doubt as to the applicability of LeSueur's name (*Cichla Floridana*) to the large mouth bass of peninsular Florida. Originally described from east Florida, it may be assumed that the specimens came from the St. Johns River system, in which this subspecies is common.

DIAGNOSIS.—A form which agrees in most characters with *Micropterus* (*Huro*) *salmoides salmoides*, but differs in the smaller scales (Tables II–VIII), in the larger maximum size attained, and in coloration. There are 10 to 14 (usually 11 to 13) rows of scales on the cheek, 7 to 10 (usually 8 or 9) rows above the lateral line, 65 to 75 (usually 69 to 73) scales

along the lateral line, 16 to 18 (usually 17 or 18) rows below the lateral line, and 27 to 32 (usually 28 to 31) rows around the caudal peduncle. A character index for scale size (derived by summing the number of rows of cheek scales, the number of scale rows above and below the lateral line, the number of scales along the lateral line, and the number of rows around the caudal peduncle) gives values of 129 to 145 (usually 135 to 142; 131 or more in 97 per cent of the 72 individuals examined).

According to our scale counts (Tables II–VII) it is possible to set lines that permit separation of most of the specimens of *floridanus* from most of those of *M. s. salmoides,* except in the belt of intergradation. Only for the count of scales above the lateral line does the "per cent identifiable" fall below the 75 per cent level that is customarily recognized as indicative of subspecific differentiation. For the different counts the percentages (Table VIII) are as follows: rows of scales on cheeks, 84 per cent of *M. s. floridanus* separable from 82 to 100 per cent of the several sets of *M. s. salmoides;* scales above lateral line, 55 per cent separable from 87 to 100 per cent; scales along lateral line, 96 per cent from 83 to 93 per cent; scales below lateral line, 78 per cent from 85 to 100 per cent; scales rows around caudal peduncle, 75 per cent from 95 to 100 per cent; meristic index, 97 per cent from 97 to 100 per cent.

The larger size attained by the Florida largemouth, as compared with the northern subspecies, has long been recognized and has stimulated speculation regarding the cause (Hubbs, 1932: 88). Since this form is now shown to be distinguishable morphologically, it seems probable that the large growth potential has in part a genetic basis. Without knowledge of our proposed separation of the subspecies, J. Sanford Hart has informed us that in the physiology of lethal temperatures the largemouth bass of the Tennessee River system (typical *salmoides*) resembles the Lake Erie population more than it does the Florida bass.

TABLE II

SUBSPECIFIC DIFFERENTIATION AND INTERGRADATION OF *Micropterus salmoides* IN NUMBER OF ROWS OF SCALES ON CHEEK

Subspecies and Drainage Basins	Specimens	Total Range	Usual Range	Mean	SD	SE	Percentages	
							9–11	12–14
M. s. salmoides								
Great Lakes and Mississippi River	43	9–13	10–11	10.44	.87	.13	86	14
Mobile River	15	9–12	9–11	10.20	.83	.22	93	7
Big Lake, Ala.	22	9–12	10–11	10.86	.76	.16	82	18
Pensacola Bay	10	9–11	10–11	10.10	.57	.18	100	0
Intergrades								
Choctawhatchee and St. Andrews bays	5	10–14	10–13	12.00	1.23	.55	40	60
Apalachicola River	11	10–12	10–12	11.09	.83	.25	64	36
Ochlockonee River	5	10–14	11–14	12.20	1.64	.73	40	60
Fenholloway River	20	10–13	10–12	11.15	1.00	.22	65	35
Suwannee River	19	9–13	11–13	11.47	1.31	.30	47	53
M. s. floridanus								
Florida peninsula	73	10–14	11–13	12.27	.88	.10	16	84
Intergrades								
Nassau and St. Marys rivers	10	9–12	11–12	11.10	.99	.31	60	40
Satilla River	20	9–12	10–11	10.60	.83	.19	85	15
Altamaha River	7	10–11	10–11	10.43	.56	.21	100	0
Savannah River	11	10–12	10–12	11.09	.83	.25	64	36
M. s. salmoides								
South Carolina north of Savannah River	77	9–12	10–11	10.34	.83	.09	94	6

TABLE III

SUBSPECIFIC DIFFERENTIATION AND INTERGRADATION OF *Micropterus salmoides* IN NUMBER OF SCALES ABOVE LATERAL LINE

Subspecies and Drainage Basins	Specimens	Total Range	Usual Range	Mean	SD	SE	Percentages	
							7–8	9–10
M. s. salmoides								
Great Lakes and Mississippi River	46	7–9	8	7.93	.48	.07	91	9
Mobile River	15	7–9	7–8	7.73	.71	.18	87	13
Big Lake, Ala.	22	7–8	7–8	7.59	.51	.11	100	0
Pensacola Bay	10	7–8	8	7.90	.32	.10	100	0
Intergrades								
Choctawhatchee and St. Andrews bays	4	7–9	7–8	7.75	.97	.48	75	25
Apalachicola River	11	8–9	8–9	8.55	.54	.16	45	55
Ochlockonee River	5	8–9	8–9	8.40	.58	.26	60	40
Fenholloway River	20	7–9	7–8	7.80	.53	.12	95	5
Suwannee River	19	7–9	7–8	7.84	.50	.12	95	5
M. s. floridanus								
Florida peninsula	73	7–10	8–9	8.55	.60	.07	45	55
Intergrades								
Nassau and St. Marys rivers	10	7–9	7–8	7.70	.68	.22	90	10
Satilla River	20	7–8	8	7.90	.31	.07	100	0
Altamaha River	7	7–9	8	8.00	.53	.20	86	14
Savannah River	11	7–9	8	8.00	.58	.17	91	9
M. s. salmoides								
South Carolina north of Savannah River	77	7–9	7–8	7.91	.51	.06	91	9

TABLE IV

SUBSPECIFIC DIFFERENTIATION AND INTERGRADATION OF *Micropterus salmoides* IN NUMBER OF SCALES ALONG LATERAL LINE

Subspecies and Drainage Basins	Specimens	Total Range	Usual Range	Mean	SD	SE	Percentages	
							58–66	67–76
M. s. salmoides								
Great Lakes and Mississippi River	78	59–69	61–65	63.33	2.12	.24	92	8
Mobile River	15	61–67	61–64	63.27	1.68	.43	93	7
Big Lake, Ala.	22	60–68	63–66	64.32	1.99	.42	91	9
Pensacola Bay	10	58–68	59–65	62.60	3.03	.90	90	10
Intergrades								
Choctawhatchee and St. Andrews bays	5	62–73	67–73	67.80	3.96	1.77	20	80
Apalachicola River	11	64–72	65–70	67.73	2.25	.68	27	73
Ochlockonee River	5	63–76	69–76	70.00	2.40	1.07	20	80
Fenholloway River	20	64–72	65–70	68.15	2.41	.54	25	75
Suwannee River	19	61–73	64–69	66.42	2.92	.67	47	53
M. s. floridanus								
Florida peninsula	74	65–75	69–73	70.42	2.14	.25	4	96
Intergrades								
Nassau and St. Marys rivers	10	58–68	61–67	63.70	2.99	.95	80	20
Satilla River	20	62–68	63–67	65.55	1.91	.43	65	35
Altamaha River	7	64–70	65–70	67.29	2.29	.86	43	57
Savannah River	11	63–71	65–69	67.18	2.27	.68	45	55
M. s. salmoides								
South Carolina north of Savannah River	76	59–69	63–67	64.61	1.93	.22	83	17

TABLE V

SUBSPECIFIC DIFFERENTIATION AND INTERGRADATION OF *Micropterus salmoides* IN NUMBER OF SCALES BELOW LATERAL LINE

Subspecies and Drainage Basins	Specimens	Total Range	Usual Range	Mean	SD	SE	Percentages	
							14–16	17–18
M. s. salmoides								
Great Lakes and Mississippi River	46	14–17	15–17	15.52	.90	.13	85	15
Mobile River	15	14–16	14–16	14.73	.89	.23	100	0
Big Lake, Ala.	22	14–17	14–15	15.14	.81	.17	91	9
Pensacola Bay	10	14–16	14–15	14.80	.79	.25	100	0
Intergrades								
Choctawhatchee and St. Andrews bays	4	16–17	17	16.75	.52	.26	25	75
Apalachicola River	11	15–18	16–18	16.55	.95	.29	55	45
Ochlockonee River	5	15–16	15–16	15.60	.58	.26	100	0
Fenholloway River	20	15–17	16–17	16.10	.64	.14	75	25
Suwannee River	19	14–17	15–16	15.58	.67	.16	95	5
M. s. floridanus								
Florida peninsula	73	16–18	17–18	17.01	.67	.08	22	78
Intergrades								
Nassau and St. Marys rivers	10	15–16	16	15.80	.43	.14	100	0
Satilla River	20	14–17	15–16	15.45	.77	.17	90	10
Altamaha River	7	14–16	15–16	15.29	.76	.29	100	0
Savannah River	11	14–16	16	15.73	.69	.21	100	0
M. s. salmoides								
South Carolina north of Savannah River	76	14–17	15–16	15.36	.74	.08	99	1

TABLE VI

SUBSPECIFIC DIFFERENTIATION AND INTERGRADATION OF *Micropterus salmoides* IN NUMBER OF SCALE ROWS AROUND CAUDAL PEDUNCLE

Subspecies and Drainage Basins	Specimens	Total Range	Usual Range	Mean	SD	SE	Percentages	
							24–28	29–32
M. s. salmoides								
Great Lakes and Mississippi River	37	24–30	26–28	27.22	1.25	.21	95	5
Mobile River	15	24–28	26–28	26.33	1.12	.29	100	0
Big Lake, Ala.	22	24–28	26–27	26.14	.97	.21	100	0
Pensacola Bay	10	25–27	26	26.00	.67	.21	100	0
Intergrades								
Choctawhatchee and St. Andrews bays	5	24–28	26–28	26.80	1.83	.82	100	0
Apalachicola River	11	26–30	26–28	27.64	1.18	.35	91	9
Ochlockonee River	5	27–31	27–30	28.80	1.79	.80	40	60
Fenholloway River	20	25–30	28–29	27.95	1.10	.25	75	25
Suwannee River	19	26–29	26–28	27.37	1.02	.23	95	5
M. s. floridanus								
Florida peninsula	72	27–32	28–31	29.71	1.28	.15	25	75
Intergrades								
Nassau and St. Marys rivers	10	24–29	27–28	27.60	1.36	.43	90	10
Satilla River	20	25–29	26–28	27.45	1.06	.24	90	10
Altamaha River	7	26–28	27–28	27.29	.76	.29	100	0
Savannah River	11	26–29	26–28	27.45	1.05	.32	91	9
M. s. salmoides								
South Carolina north of Savannah River	75	24–29	26–28	27.12	.98	.11	99	1

TABLE VII

SUBSPECIFIC DIFFERENTIATION AND INTERGRADATION OF *Micropterus salmoides:* IN MERISTIC INDEX
This meristic index is the sum of the 5 scale rows detailed in Tables II–VI

Subspecies and Drainage Basins	Specimens	Total Range	Usual Range	Mean	SD	SE	Percentages	
							113–130	131–145
M. s. salmoides								
Great Lakes and Mississippi River	34	121–132	122–128	125.00	2.65	.45	97	3
Mobile River	15	116–130	119–125	122.26	3.33	.86	100	0
Big Lake, Ala.	22	118–128	122–127	124.05	2.62	.56	100	0
Pensacola Bay	9	116–127	118–124	121.78	3.30	1.10	100	0
Intergrades								
Choctawhatchee and St. Andrews bays	4	130–139	130–132	133.00	4.08	2.04	25	75
Apalachicola River	11	125–137	128–136	131.55	3.54	1.07	27	73
Ochlockonee River	5	124–145	124–141	135.00	8.57	3.83	40	60
Fenholloway River	20	125–136	126–134	131.15	3.45	.77	40	60
Suwannee River	19	118–134	126–134	128.68	4.39	1.01	58	42
M. s. floridanus								
Florida peninsula	72	129–145	135–142	137.93	3.53	.42	3	97
Intergrades								
Nassau and St. Marys rivers	10	113–132	125–129	125.90	4.99	3.16	90	10
Satilla River	20	121–132	124–129	126.95	2.73	.61	90	10
Altamaha River	7	124–131	125–131	128.29	2.63	.99	86	14
Savannah River	11	122–134	129–134	129.45	3.67	1.11	64	36
M. s. salmoides								
South Carolina north of Savannah River	75	119–131	122–128	126.39	2.69	.31	97	3

TABLE VIII

SUBSPECIFIC DIFFERENTIATION AND INTERGRADATION OF *Micropterus salmoides*
SUMMARY OF PERCENTAGES OF COUNTS ABOVE SELECTED LINE OF SEPARATION
Data from Tables II–VII

Subspecies and Drainage Basins	Rows on Cheek	Above Lateral Line	Along Lateral Line	Below Lateral Line	Caudal Peduncle	Meristic Index
M. s. salmoides						
Great Lakes and Mississippi River	14	9	8	15	5	3
Mobile River	7	13	7	0	0	0
Big Lake, Ala.	18	0	9	9	0	0
Pensacola Bay	0	0	10	0	0	0
Intergrades						
Choctawhatchee and St. Andrews bays	60	25	80	75	0	75
Apalachicola River	36	55	73	45	9	73
Ochlockonee River	60	40	80	0	60	60
Fenholloway River	35	5	75	25	25	60
Suwannee River	53	5	53	5	5	42
M. s. floridanus						
Florida peninsula	84	55	96	78	75	97
Intergrades						
Nassau and St. Marys rivers	40	10	20	0	10	10
Satilla River	15	0	35	10	10	10
Altamaha River	0	14	57	0	0	14
Savannah River	36	9	55	0	9	36
M. s. salmoides						
South Carolina north of Savannah River	6	9	17	1	1	3

In color pattern (Pl. II; see also Allen, 1946: 27, fig.) *M. s. floridanus* differs somewhat from *M. s. salmoides,* but many individuals cannot be properly identified on this basis alone. In *floridanus* the dark blotch at the base of the caudal fin in young and yearlings is more rounded in front, is much larger, and, commonly, is more intense (with age the spot becomes obscure in both subspecies). The lateral dark stripe is usually broader and darker on the caudal peduncle than in specimens of *salmoides* from the northern states, but individuals from bog-stained waters of the southern coastal plain may have an equally dark and broad stripe, as well as a large basicaudal spot. Anteriorly, the lateral stripe is more disrupted in *floridanus,* forming a series of more or less distinct blotches.

Except for the slightly higher mean value for the number of pectoral rays, *floridanus* appears not to differ appreciably from *salmoides* in fin-ray counts: the dorsal spines number 9 in 5 specimens, 10 in 61, and 11 in 2 (mean, 9.95); dorsal soft rays, 12 in 5, 13 in 58, and 14 in 5 (mean, 13.00); anal spines, 3 in 68; anal soft rays, 10 in 5, 11 in 60, and 12 in 3 (mean, 10.97); pectoral rays 14–14 in 9, 14–15 in 4, 14–14 in 2, 15–15 in 41, 15–16 in 3, 16–15 in 4, and 16–16 in 4 (mean for 134 counts, 14.93). The comparable values given by Hubbs and Bailey (1940: Table IV) apply to *M. s. salmoides.*

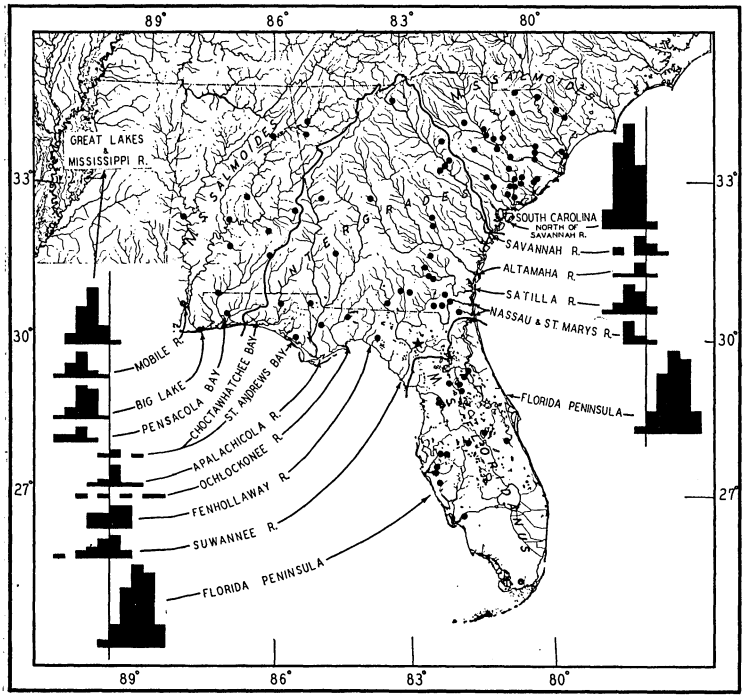
Among 57 specimens of *floridanus* examined for this character only 1 specimen has the tongue toothed, and it has only a single small glossohyal tooth.

RANGE.—*M. s. floridanus* is confined to Florida, where it ranges throughout the peninsula northward in the east to the mouth of the St. Johns River and in the west to, but not including, the Suwannee River system. Farther to the north and to the west it intergrades with *M. s. salmoides,* as is indicated in the following section.

SUBSPECIFIC INTERGRADATION

Although throughout most of peninsular Florida *Micropterus salmoides floridanus* is almost invariably separable from typical *M. s. salmoides* by the meristic index, the 2 forms blend

in a moderately wide band of intergradation (Map 1 and Tables II–VIII). Physiographic barriers in the form of well-drained soils, which extend from the coast to well inland, limit the area of intergradation. One such barrier occurs between the Pensacola Bay and Choctawhatchee Bay drainages,



MAP 1. Florida and adjacent regions, showing the type locality of *Micropterus notius* (star) and the range of *Micropterus salmoides floridanus* and of intergrades between this subspecies and *M. s. salmoides* (circles). Heavy lines separate the ranges of the subspecies from the area of intergradation. Locality records are indicated only for the material used in the present study.

The histograms show for *M. salmoides* the variation in the meristic index by drainage basin or other geographic area; the data are grouped by threes (113–115, 116–118, etc.) and a vertical line indicates the separation between values of 130 and 131. The data from which these histograms were prepared are summarized in Table VII. Map drafted by N. J. Wilimovsky.

and another extends from near the mouth of the Suwannee River north into Georgia and east almost to the St. Johns River (Hobbs, 1942 : Map 2). Gene flow across these areas is probably so slight as to prevent appreciable modification of the characters of the subspecies in their respective ranges. Blending of characters in the area of intergradation may be seen by comparing the ranges, the means, and the percentages of specimens below and above the selected lines of separation. With some exceptions and irregularities for certain counts at certain localities, all the scale counts for series across this belt are intermediate, often about median in average. Thus, *M. s. floridanus* is genetically connected with the main body of *M. s. salmoides,* presumably as the result of gene flow.

Toward the north, that is toward the nomenclatorially typical *M. s. salmoides* of South Carolina, the intergradation is not so clear nor so regular. Populations from the Nassau and St. Marys river systems near the Florida–Georgia border to the Savannah River system of Georgia and South Carolina usually approach *M. s. salmoides* in counts but in some respects show transition: the sample from the Nassau and St. Marys river systems is definitely intermediate in the count of scale rows on the cheek; series from the Satilla and Altamaha river systems are interjacent in the count of scales along the lateral line; the series from the Savannah system is intermediate in the counts for the scales on the cheek and on the lateral line and in the meristic index. Oddly, the three other river-system categories, particularly the two more southern ones, are very close to topotypical *M. s. salmoides* in the meristic index. Though some of their counts are higher than those for South Carolina specimens from north of the Savannah River, other counts are comparatively low. The break between *M. s. floridanus* in the St. Johns system and the intergrades in the Nassau and St. Marys systems (Map 1) is abrupt. This fact, as well as the imperfect and irregular intergradation, suggest to us the possibility that a natural orderly situation has been complicated by the extensive stocking of northern *salmoides.* Much of the collecting in the area where more regular inter-

gradation might be expected has been along U. S. Highway No. 1, which may also have served as the route by which the northern stock was introduced, to modify the genetic composition of the natural populations. An alternative explanation for the abrupt change in characters involves the possibility of the extirpation of intergrading populations in this area during a period of marginal submergence in late Pleistocene, when much of the eastern margin of the peninsula was reduced to a coastal archipelago (Carr, 1940: 6). If this happened, the evidence indicates that subsequent reinvasion of the area north of the St. Johns River was largely from the north.

According to our interpretation the area of intergradation (Map 1) divides the range of *M. s. salmoides* into 2 parts, respectively, east and west of the Appalachian Mountains. It may be assumed that formerly this subspecies was continuously distributed along the coastal plain from South Carolina to Alabama and Mississippi. *M. s. floridanus* probably differentiated on the Florida Peninsula under conditions of partial or complete isolation, most likely during one of the Pleistocene interglacial periods. (See description and maps in Cooke, 1939: 33–61, and Cooke, 1945: 273–311.) Such isolation might have occurred during the Coharie, the Sunderland, or the Wicomico stage, when the land was reduced to islands, with consequent reduction of the fresh water of the area, or it may have taken place during the Penholaway, the Talbot, or the Pamlico stage, when the peninsula existed but was more nearly separated from the mainland than it is at present.

Subsequent to differentiation, when confronted with less effective barriers to migration, *M. s. floridanus* may be assumed to have spread to the north and to the northwest, where it met *M. s. salmoides*. Since the differentiation of *floridanus* from *salmoides* had not reached the specific level, the meeting of the subspecies resulted in amalgamation of the forms in what is now the area of intergradation (Map 1). Thus, according to this hypothesis, intergradation between these subspecies is the result of fusion in an area accessible to both races following partial or complete disappearance of the isolating barrier.

THE FLORIDA LARGEMOUTH BASS AS AN ELEMENT IN THE ENDEMIC PENINSULAR FAUNA

The recognition of *Micropterus salmoides floridanus* adds 1 more element to the list of endemic Florida peninsular fishes. The peninsula has long been noted for endemism of various groups of organisms, such as the ferns (St. John, 1936), crayfishes (Hobbs, 1942), and amphibians and reptiles (Carr, 1940), but very little consideration has been given to the peninsular endemism of the fresh-water and brackish-water fishes. We therefore append a list of fishes that are entirely endemic or chiefly characteristic of the Florida peninsula.

LIST OF FISHES ENDEMIC TO, OR CHIEFLY CHARACTERISTIC OF, THE FLORIDA PENINSULA

(Endemic elements in boldface type)[6]

A. Forms which are strictly endemic to Florida:
Signalosa petenensis **vanhyningi** Weed
Chriopeops goodei (Jordan)
Fundulus **seminolis** Girard
Fundulus confluentus **confluentus** Goode and Bean
Floridichthys carpio **carpio** (Günther)
Jordanella floridae Goode and Bean
Cyprinodon **hubbsi** Carr
Micropterus **notius** Bailey and Hubbs
Micropterus salmoides **floridanus** (LeSueur)

B. Forms which are typically Floridian but which occur also in the Okefenokee Swamp area in southeastern Georgia:
Leptolucania ommata (Jordan)
Mesogonistius chaetodon **elizabethae** Bailey

C. Forms which are characteristically Floridian but which range well to the north along the Atlantic coastal plain (but not beyond North Carolina):
Lepisosteus **platyrhincus** DeKay
Notropis **hypselopterus** (Günther)
Fundulus dispar **lineolatus** (Agassiz)
Labidesthes sicculus **vanhyningi** Bean and Reid
Lepomis punctatus **punctatus** (Valenciennes)
Elassoma **evergladei** Jordan
Hololepis **barratti** (Holbrook)

[6] In addition to the forms named, we have unpublished evidence that at least 5 more forms may eventually be added to the list.

SUMMARY AND CONCLUSIONS

The black bass genus *Micropterus,* long thought to comprise only 2 species, is now shown to encompass 5 full species and a total of 10 forms, subspecies included. In addition, the probable existence of 2 more forms, 1 perhaps a full species, is suggested. The forms that we now add are peripheral in distribution and thus add weight to the theory that most differentiation occurs at the margins of ranges.

Micropterus notius, new species, is known from a single spring in northern Florida. It may be a relict form, as it appears to be the most generalized species of *Micropterus.* Although it closely resembles *Micropterus* (*Huro*) *salmoides* in some respects, this distinct species is referred to the subgenus *Micropterus.* The possibility of its being of hybrid origin is discounted. Hybridization is unknown between *Micropterus* and *Huro,* which are now treated as subgenera. Even interspecific hybrids in the same subgenus are very rare. One additional example, a hybrid between *M. dolomieu* and *M. punctulatus,* is described.

Micropterus species, from the Chipola River in western Florida, is described on the basis of a single specimen, but is left unnamed. It may be either a full species, a subspecies, or a variant of *M. punctulatus* or of *M. coosae.*

Micropterus salmoides floridanus (LeSueur) is recognized as the largemouth bass of peninsular Florida. It is characterized by its small scales, large size, and rather distinctive coloration. Reports of *M. dolomieu* from Florida, including the record-sized "smallmouths," appear to have been based on this subspecies of *M. salmoides. M. s. floridanus* intergrades geographically with *M. s. salmoides.* The intergradation may have resulted from the amalgamation of the subspecies in a region accessible to both, following the disappearance of an isolating barrier. There are indications of the existence of additional subspecies of *M. salmoides,* including a southwestern form with a high incidence of glossohyal teeth.

The 3 forms shift the center of known abundance of the

kinds of black basses to the southeast. In addition, *M. punctulatus* is recorded from Florida.

Each of these 3 forms from Florida (*M. notius, M.* species, and *M. s. floridanus*) is an addition to a region of endemism. Northern Florida, western Florida, and peninsular Florida are centers of endemism for fishes, as well as for other organisms.

Bartramiolus Fowler is shown to be a synonym of *Ambloplites,* since its designated genotype, *Ambloplites ariommus,* intergrades in eastern Arkansas and southeastern Missouri with *Ambloplites rupestris rupestris.*

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PLATE I

Fig. 1. *Micropterus notius*, new species, from the holotype, a fingerling, 68 mm. long.

Fig. 2. *Micropterus notius*, new species, from an adult paratype, 219 mm. long (U.M.M.Z., No. 134629).

Photographs by F. W. Ouradnik.

PLATE I

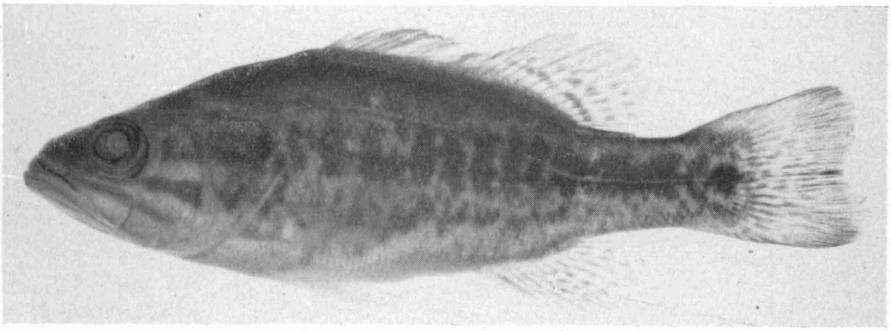


FIG. 1

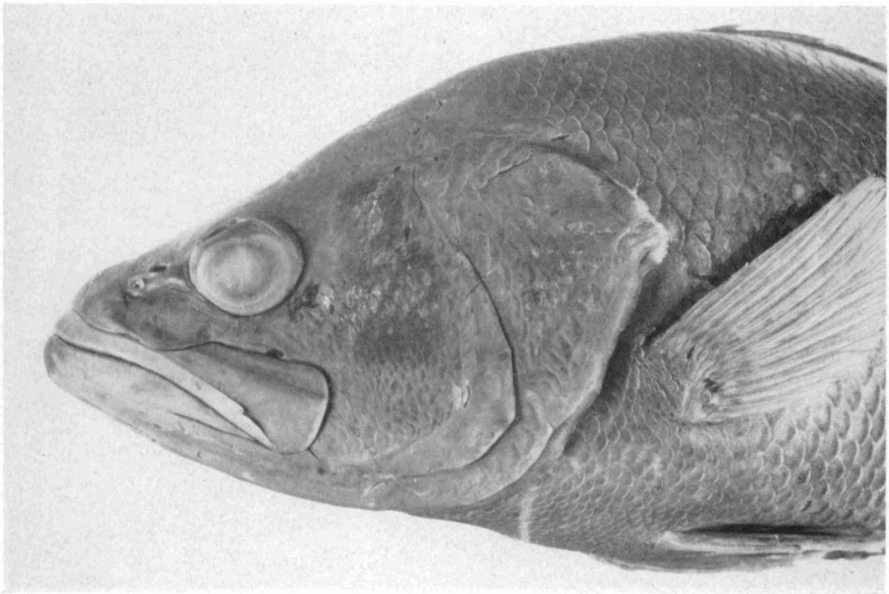


FIG. 2

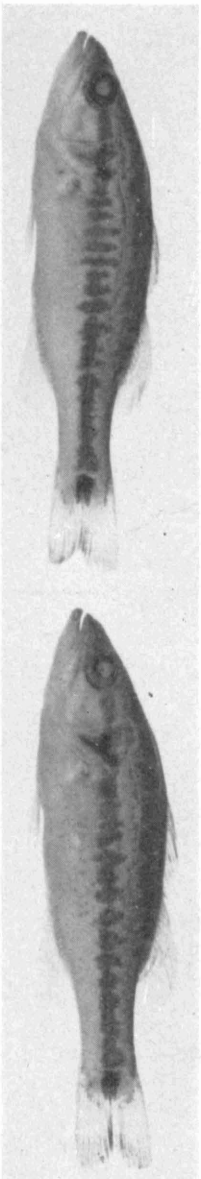
PLATE II

FIGS. 1–2. *Micropterus salmoides floridanus,* young specimens, 63 and 66 mm. in standard length, collected by Reeve M. and Marian K. Bailey on September 1, 1939, in Mill Dam Lake, about 20 miles east of Ocala, Marion County, Florida.

FIG. 3. *Micropterus salmoides floridanus,* a yearling, 142 mm. long, seined by Carl L. Hubbs and party on April 5, 1941, in St. Johns River at Fort Gates Ferry, Putnam County, Florida.

Photographs by F. W. Ouradnik.

PLATE II



FIGS. 1 AND 2

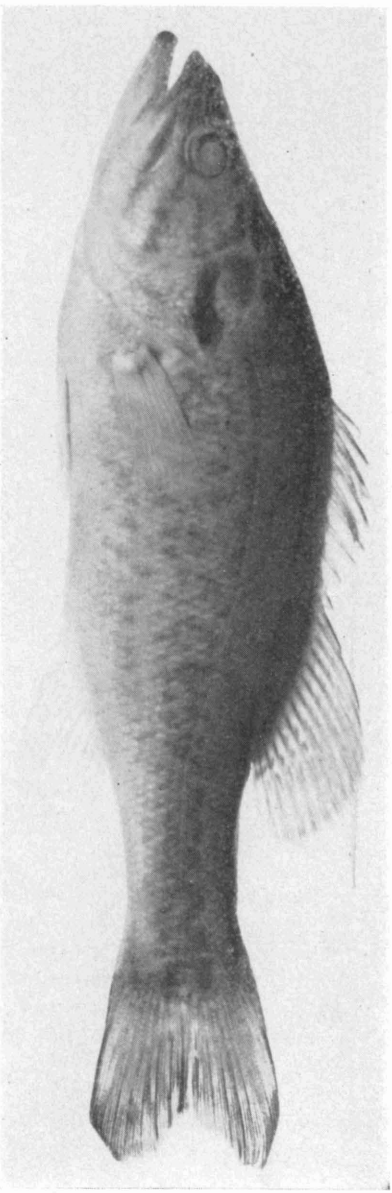


FIG. 3