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Ambloplites constellatus, a New Species of Rock Bass from the Ozark Upland of Arkansas and Missouri with a Review of Western Rock Bass Populations'

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ABSTRACT: A new species of rock bass, Ambloplites constellatus, is described from the upland section of the White River in Arkansas and Missouri. It is compared with the closely related northern rock bass (A. rupestris) from Missouri and Meramec river populations, the southern rock bass (A. ariommus) from the Ouachita and Little river drainages, and with other western rock bass populations of undetermined status. Ambloplites constellatus is distinguished from its congeners by its freckled color pattern and slender body form. Ambloplites constellatus occurs throughout the upper White River. There are two records of the species from the Osage River drainage in Missouri.

INTRODUCTION

In his study of Missouri fishes, Pflieger (1971) noted that rock bass from the upper White River system differed strikingly in color pattern from other Missouri populations. Based on our examination of material from throughout the Ozark Upland province, as well as other western rock bass populations, we describe the upper White River population as a new species, Ambloplites constellatus, the Ozark rock bass. The new form differs from its closest relative, A. rupestris (Rafinesque), the northern rock bass, in color pattern, finer squamation, and higher average number of dorsal and anal fin rays. We can find no evidence of intergradation between the new form and either A. rupestris or A. ariommus Viosca, both of which have close geographically associated populations. Ambloplites ariommus is regarded herein as a full species.

Methods for meristic procedures generally follow Hubbs and Lagler (1947), except for fin elements, which are expressed as a total number, and diagonal scale rows, in which the count includes the number above and below the lateral line row plus the lateral line scale. The breast scale count is made by counting the scale at the lower base of the left pectoral fin insertion, counting downward and forward to the ventral midline and then upward and backward to

[1] This article constitutes contribution Number 7 from Tulane University, Museum of Natural History, Belle Chasse, Louisiana 70037.

the lower insertion of the right pectoral fin. Expressions of meristic data follow Snelson (1972) where in the form (6) 9 or 10 (11), the numbers in parentheses represent the range and the middle figures represent 90% of the observed counts. Procedures of measurement also follow Hubbs and Lagler (1947) . All measurements were made to the nearest 0.05 mm. Intra- and interspecific comparisons were made only between specimens of equivalent size. These data were compared by analysis of variance and covariance.

Ambloplites rupestris Meek, 1891:130 (specimens from James River near Springfield, Missouri, and North Fork of the White River, S of Cabool) ; Branson, 1967:152 (in part: origin of Neosho River rock bass from White River) : Pflieger, 1971:537 (in part: distri-

Ambloplites constellatus, sp. nov.
Ozark rock bass. Figs. 1 and 2

Fig. 1.—Top. Ambloplites consteUatus, n. sp. Holotype, adult male, 186 mm in standard length, from Buffalo River at mouth of Rush Creek, 3.2 km ESE Rush, Marion Co., Arkansas (TU 90909). Bottom. A. rupestris, adult male, 160 mm in standard length, Tennessee River drainage, Cherokee Co., North Carolina (TU 32786)

bution map includes upper White River localities in Missouri) ; Buchanan, 1973; map 138 (in part: distribution map includes upper White River localities in Arkansas).

Ambloplites rupestris rupestris Hubbs and Lagler, 1947:114 (in part: included all of Ozarks in Arkansas and Missouri range).

Holotype.—Tulane University Catalog No. TU 90909, an adult male, 186 mm in standard length from the Buffalo River at mouth of Rush Creek, 3.2 km ESE of town of Rush, 7.7 km ENE of Caney, Marion Co., Arkansas; collected by Robert C. Cashner and Julian M. Humphries, 12 May 1972. Five paratypes, TU 78124, 119-190 mm in standard length were taken with the holotype.

Other paratypes.—Northeast Louisiana State University, NLU 20995 (8), Buffalo River, on Ark. Hwy. 14, 20.9 km SE Yellville, Searcy Co.; University of Florida, UF 14698 (1), Bear Cr., on U.S. Hwy. 65, 5.6 km W Marshall, Searcy Co.; TU 46559 (2), Buffalo River, 1.6 km downstream from U.S. Hwy. 65 bridge, Searcy Co.; TU 43520 (2), TU 44085 (8), White River, 1.6 km downstream from mouth Buffalo River, Baxter Co.; TU 45418 (1), TU 46611 (6), TU 49574 (1), TU 51019 (1), TU 51231 (1), TU 52445 (2), TU 52564 (1), Buffalo River near mouth, Baxter Co.

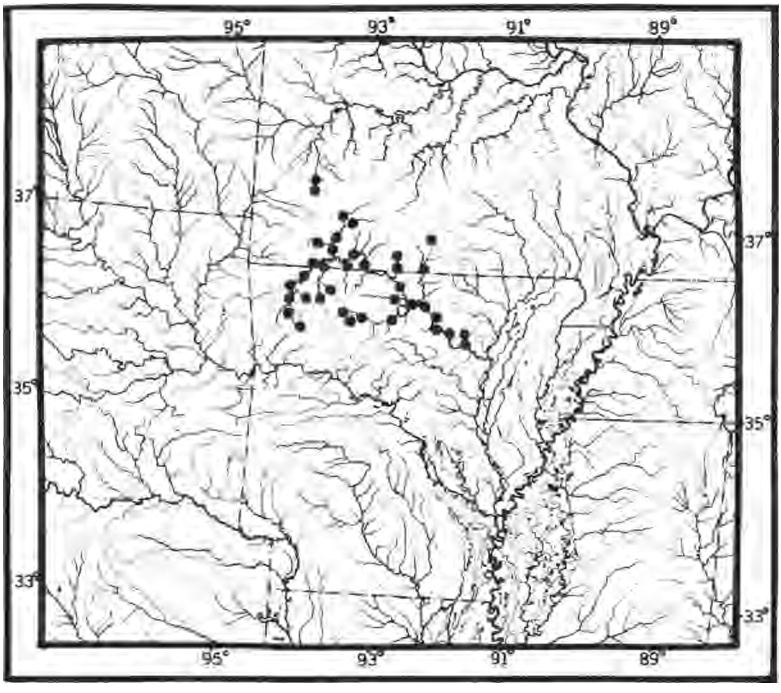


Fig. 2.—Distribution of Ambloplites constellatus. Open circle designates type locality

Other materials. - ARKANSAS: (OZARK SECTION WHITE RIVER DRAINAGE) University of Michigan Museum of Zoology, UMMZ 170908 (9), West Fork White River, on U.S. Hwy. 71, 6.4 km S West Fork, Washington Co.; UMMZ 128297 (1) West Fork White River, 4.8 km N Winslow, Washington Co.; TU 12224 (3), West Fork White River, 9.8 km S Fayetteville, Washington Co.; TU 49995 (1), Mill Cr., 12.9 km E Fayetteville, Washington Co.; TU 46945 (4), Middle Fork White River, 1.6 km SW Sulphur City, Washington Co.; TU 12262 (1), White River at U.S. Hwy. 68 bridge, 13.4 km E Springdale, Washington Co.; NLU 169 (7), White River and tributaries, Washington Co.; UMMZ 123894 (1), Kings River, 1.6 km E Marble, Madison Co.; TU 49603 (1), Kings River at Marble, Madison Co.; TU 49811 (6), War Eagle Cr., 8 km N Hindsville, Madison Co.; TU 48567 (2), White River at St. Paul, Madison Co.; NLU 187 (8), tributaries to Beaver Reservoir, Carroll Co.; TU 45384 (1), Crooked Cr. near mouth, Marion Co.; TU 49482 (1), White River, 1.6 km downstream Cotter, Marion Co.; TU 43104 (1), White River, 4.8 km upstream from mouth of Norfolk River, Baxter Co.; TU 43620 (4), White River at Shipps Ferry Landing, Baxter Co.; TU 43706 (2), TU 49374 (8), Little Buffalo River at Parthenon, Newton Co.; TU 78249 (2), Little Buffalo River at Ark. Hwy. 7 near Jasper, Newton Co.; TU 44171 (5), TU 44719 (2), TU 49199 (1), Texas Museum Natural History TMNH 8142 (1), Buffalo River 1.6 km E Ponca, Newton Co.; TU 44677 (1), White River at Mt. Olive, Izard Co.; TU 44704 (2), TU 49193 (4), TU 43745 (2), White River at Sylamore Ferry, Izard Co.; NLU 13771 (1), White River, 0.8 km NW Guion, Izard Co.; NLU 24554 (1), White River at NLU Biological Camp, Stone Co.; NLU 8684 (1), NLU 10332 (1), NLU 13985 (1), NLU 10381 (1), NLU 10402 (2), Lafferty Cr., Independence Co.; NLU 21684 (1), Spring Cr., 8 km S Cushman, Independence Co.; NLU 14196 (1), White River at Lock and Dam No. 3, Independence Co.

MISSOURI: (OZARK SECTION WHITE RIVER DRAINAGE) UMMZ 142304 (1), UMMZ 151330 (3), Flat Cr., trib. to James River, Barry Co.; William L. Pflieger 66-23 (3), James River, 7.6 km NE Nixa, Christian Co.; UMMZ 142276 (1), UMMZ 151018 (1), Findley Cr., trib. to James River at Ozark, Christian Co.; UMMZ 188418 (4), Norfolk, trib. to White River on county road HH, 16 km S Cabool, Douglas Co.; TU 36583 (10), TU 65744 (6), TU 54687 (3), Norfork, trib. to White River on Mo. Hwy. 14 at Twin Bridges, Douglas Co.; UMMZ 142289 (1), James River, 1.6 km S Galloway on U.S. Hwy. 65, Greene Co.; UMMZ 152100 (1), Norfork, trib. to White River on Mo. Hwy. 30 at Tecumseh, Ozark Co.; TU 79047 (20), Norfork, trib. to White River at Hammond Camp, Ozark Co.; WLP 65-7 (2), Norfork, trib. to White River at Dave Bridge, Ozark Co.; NLU 23885 (1), Norfork, trib. to White River on county road H at Althea (Almartha?) Springs, Ozark Co.; UMMZ 142338 (1), Beaver Cr. at Bradleyville, Taney Co.; TU 38637 (1), Table Rock Lake, Stone-Taney Co. line; UMMZ 142123 (1), Crane Cr., trib. to James River, Stone Co. (OSAGE RIVER DRAINAGE) UMMZ 151720 (1), Limestone Cr., Dade Co.; TU 38038 (1), Turnback Cr., trib. to Sac River, 10.5 km E Hentonville, Lawrence Co.

Diagnosis.-A form close to *Ambloplites rupestris,* distributed primarily in the Ozark Upland section of the White River drainage in Missouri and Arkansas. Differs from all congeners in having a freckled lateral pigment pattern (Fig. 1), and specifically from *rupestris* in its slimmer form and higher average number of dorsal fin elements, 22.80 and anal fin elements, 16.77 (Table 2) ; and lateral line scales, 43.41 (Table 4) .

Description.–A relatively large rock bass with a slender form, the body depth about 40% of the standard length (Figs. 3 and 4). The scales are small, thus counts are comparatively high (Tables 2-4). The eye is large and the iris is red in life. The mouth is large and the lower jaw protrudes.

The cheek region is completely scaled, and the scales are not deeply embedded. The ranges for the body scale counts are: cheek scale rows,

TABLE 1.—Counts and measurements (mm) of holotype and five paratypes of Ambloplites constellatus. All proportions are expressed in thousandths of the standard length in parentheses

	Holotype TU90909	Paratypes TU78124	
Characters	Male	Male	Male
Standard length (mm)	186.0	190.0	162.1
Body depth	72.4 (389)	75.3 (396)	63.4 (391)
Body width	33.9 (182)	32.8 (173)	30.2 (186)
Predorsal length	83.5 (449)	85.0 (447)	73.3 (452)
Head length	72.0 (387)	69.0 (363)	61.0 (376)
Orbit length	17.3 (093)	17.3 (091)	15.4 (095)
Snout length	21.2 (114)	19.8 (104)	17.8 (110)
jaw length	34.6 (186)	30.1 (158)	29.2 (180)
Caudal peduncle length	31.6 (170)	31.9 (168)	29.7 (183)
Caudal peduncle depth	27.3 (147)	27.2 (143)	24.0 (148)
Dorsal fin elements	XI-12 23	XI-11 22	XII-11 23
Anal fin elements	VI-11 17	VI-11 17	V-11 16
Lateral line scales	42	44	43
Cheek scale rows	10	9	9
Scale rows around caudal peduncle	9-2-10	9-2-10	9-2-10
Scale rows above lateral line	8	9	9
Scale rows below lateral line	15	15	16
Diagonal scale rows	24	25	26
Breast scale rows	22	25	25

TABLE 1.–(continued)

Characters	Male	Male	Female
Standard length (mm)	147.9	138.9	119.4
Body depth	60.5 (409)	57.3 (413)	48.6 (407)
Body width	27.6 (187)	26.1 (188)	20.2 (169)
Predorsal length	66.8 (452)	64.1 (461)	55.5 (465)
Head length	56.1 (379)	52.3 (377)	46.3 (388)
Orbit length	14.3 (097)	14.3 (103)	13.1 (110)
Snout length	16.5 (112)	15.0 (108)	13.0 (109)
Jaw length	26.4 (178)	25.0 (180)	22.2 (186)
Caudal peduncle length	25.4 (172)	25.5 (184)	20.1 (168)
Caudal peduncle depth	21.8 (147)	20.1 (145)	18.0 (151)
Dorsal fin elements	XI-12 23	XI-12 23	XI-12 23
Anal fin elements	VI-11 17	VI-11 17	VI-11 17
Lateral line scales	44	41	41
Cheek scale rows	9	9	9
Scale rows around caudal peduncle	10-2-11	9-2-10	9-2-10
Scale rows above lateral line	9	9	9
Scale rows below lateral line	16	16	17
Diagonal scale rows	26	26	27
Breast scale rows	25	24	25

(6) 8-10 (11) ; scale rows above the lateral line, (6) 8 or 9 (10) ; lateral line scales, (38) 40-46 (48) ; scale rows below the lateral line (11) 12 or 13 (14) ; diagonal scale rows (21) 22-24; caudal peduncle scale rows, (17) 19-21; breast scale rows, (20) 21-25 (26) . The ranges for the fin ray counts are: total dorsal rays, (22) 23 (24) ; total anal rays, (15) 17 (18) ; pectoral rays, 14 or 15.

The lachrymal bone is subrectangular in shape and the posterioventral edge bears many fine serrations. The lachrymal extends past the anterior end of the supramaxilla. The supramaxilla is thin and measures less than one-half the length of the upper jaw. The preopercle ranges from strongly serrate to weakly crenate on the posterioventral edge of the lower arm. There are seven bones in the infraorbital series. The teeth on the glossohyal are in a single circular patch. The branchiostegal ray count is 6□6, and the vertebrae number 13 + 18 = 31.

Counts and measurements for the holotype and five paratopotypes are given in Table 1. Frequency distributions are presented in Tables 2-4, and morphometric data are presented in Figures 3 and 4.

Coloration.-Color notes are based on preserved specimens. Amblo-

TABLE 2.-Comparison of fin elements in *Ambloplites constellatus* and populations of *Ambloplites* in Arkansas, Missouri and Oklahoma

	Dorsal fin								
Population	20	21	22	23	24	No.	Mean	SD	SE
A. constellatus									
Upper White			19	72	1	92	22.80	.43	.044
A. *rupestris*									
Meramec and Missouri		1	37	14	1	53	22.28	.53	.073
Ambloplites spp.									
Neosho	1	2	37	10		50	22.12	.56	.079
Black		1	13	6		20	22.25	.55	.120
St. Francis		1	7	2		10	22.10	.57	.180
Whitewater		1	3	2		6	22.17	.75	.310
A. *ariommus*									
Little		..	4	2	1	7	22.71	.76	.290
Ouachita		2	14	7	1	25	22.29	.69	.140

TABLE 2.-(continued)

	Anal fin							
Population	15	16	17	18	No.	Mean	SD	SE
A. *constellatus*								
Upper White	3	19	65	4	91	16.77	.58	.060
A. *rupestris*								
Meramec and Missouri	1	26	26		53	16.47	.54	.074
Ambloplites spp.								
Neosho	4	30	15	1	50	16.26	.63	.088
Black	1	11	7	1	20	16.40	.68	.150
St. Francis		6	4		10	16.40	.52	.160
Whitewater		1	5		6	16.83	.41	.170
A. *ariommus*								
Little			7		7	17.00		
Ouachita	2		15		25	16.52	.65	.130

plites constellatus exhibits little variation in color pattern as compared to the other forms in the genus.

The Ozark rock bass has discernible pigment on each body scale. Close examination reveals that the pigment is located on the epider-

TABLE 3.–Comparison of scale counts in Ambloplites constellatus and populations of Ambloplites in Arkansas, Missouri and Oklahoma

Population	Cheek scale rows 5	6	7	8	9	10	11	No.	Mean	SD	SE
A. constellatus											
Upper White	3	5	20	43	17	1		89	8.78	.97	.10
A. rupestris											
Meramec and Missouri		1	9	18	15	3		49	8.08	1.04	.15
Ambloplites spp.											
Neosho	1	7	26	12	4			50	7.22	.86	.12
Black		1	6	9	4			20	7.80	.83	.19
St. Francis		1	9	....	....			10	6.90	.32	.10
Whitewater		1	4	1	....			6	7.00	.63	.26
A. ariommus											
Little		4	3					7	6.42	.54	.20
Ouachita		7	15	3				25	6.84	.62	.13

TABLE 3.–(continued)

Population	Scale rows above lateral line 6	7	8	9	10	No.	Mean	SD	SE
A. constellatus									
Upper White	4	39	45	1		91	8.43	.70	.073
A. rupestris									
Meramec and Missouri		15	37			52	7.71	.46	.063
Ambloplites spp.									
Neosho	4	42	4			50	7.00	.40	.057
Black		17	3			20	7.15	.37	.082
St. Francis		10	....			10	7.00		
Whitewater		6	....			6	7.00		
A. ariommus									
Little		....	2			2	8.00		
Ouachita	3	21	1			25	6.92	.40	.080

TABLE 4.—Comparison of scale counts in Ambloplites constellatus and populations of Ambloplites in Arkansas, Missouri and Oklahoma

Population	Lateral line scales 35	36	37	38	39	40	41	42	43
A. constellatus									
Upper White				1	....	4	9	11	22
A. rupestris									
Meramec and Missouri		2	3	9	12	14	8	1	2
Ambloplites spp.									
Neosho			1	9	14	9	14	3	
Black		1	2	5	4	3	3	1	1
St. Francis		..	2	1	5	....	2		
Whitewater		1	1	2	1	....	1	....	
A. ariommus									
Little	2	2	1	1	1				
Ouachita		1	2	8	8				

mis covering the anterior margin of the scale, which can be seen through the median posterior margin of the overlying scale. A few to many scales in each row have dark brown spots which stand out from the general pigmentation of lighter brown. This produces an irregularly spotted or freckled pattern (Fig. 1). In any scale row, usually three, but no more than six, scales in succession have dark spots. Fre-

TABLE 4.–(continued)

	Lateral line scales								
Population	44	45	46	47	48	No.	Mean	SD	SE
A. constellatus									
Upper White	23	7	11	[illegible]	1	91	43.41	1.85	.19
A. rupestris									
Meramec and Missouri	2					53	39.57	1.75	.25
Ambloplites spp.									
Neosho					..	50	39.70	1.28	.18
Black					..	20	39.20	1.80	.40
St. Francis					..	10	39.90	1.37	.43
Whitewater						6	38.17	1.70	.70
A. ariommus									
Little						7	36.57	1.52	.57
Ouachita						25	38.88	1.48	.30

TABLE 4.–(continued)

	Breast scale rows								
Population	14	15	16	17	18	19	20	21	22
A. constellatus									
Upper White							3	9	10
A. rupestris									
Meramec and Missouri					2	1	2	12	18
Ambloplites spp.									
Neosho	1	1	6	15	13	7	6		
Black				14	6	..			
St. Francis				3	4	3			
Whitewater				6	....				
A. *ariommus*									
Little				3	4				
Ouachita		1	12	[illegible]	3				

TABLE 4.–(continued)

	Breast scale rows							
Population	23	24	25	26	No.	Mean	SD	SE
A. constellatus								
Upper White	17	21	20	2	82	23.37	1.50	.17
A. rupestris								
Meramec and Missouri	6	3			44	21.66	1.31	.20
Ambloplites spp.								
Neosho					49	17.69	1.37	.20
Black					20	17.30	.47	.11
St. Francis					10	18.00	.82	.26
Whitewater					6	17.00	..	
A. ariommus								
Little					7	17.57	.54	.20
Ouachita					25	16.72	1.17	.24

quently, the dark-spotted scales occur singly and are separated from the next dark-spotted scale in the row by 10-12 scales. In all populations of Ambloplites rupestris examined, almost all the scales bear dark spots and many successive scales in a row are so marked, producing a pattern of parallel lines (Fig. 1) . The freckled vs. the lined patterns of both species are obvious below the lateral line; however, the dark-spotted scales in constellatus do not continue as far down the body as do the longitudinal rows of spots in rupestris. The spotting in constellatus appears to be even more irregular above the lateral line than below, where often the pigment on scales in two parallel rows fuses. In rupestris, the dark spots are smaller and the line produced by successive spots typically runs through every scale in the row. In rupestris, the ground color above the lateral line may be dark green or dark brown, often obscuring the overlying lined pattern. The ground color in constellatus is more uniform above and below the lateral line, and only in very darkly pigmented males are the spots ever obscured. In dorsal view, irregular spots extend over the predorsal region to the nape in constellatus, as opposed to blotches in rupestris. Ambloplites constellatus appears to be unique in having dark spots scattered on the cheek, opercle and preopercle. The characteristic pattern is best seen in individuals over 50 mm.

The ground color of constellatus may be dark olive to tan. Above the lateral line, four or five saddlelike blotches may be visible, but never so dark as to obscure the described freckling or spotted pattern.

The fin pigmentation usually consists of a shade of olive green. Dark spots are prominent on the bases of the dorsal and caudal fins and extend onto the membranes and rays of the fins. The mottled pattern produced is slightly different from that seen in ariommus or rupestris, in that the spots are more intensely pigmented. Unlike males of rupestris, a black marginal band does not develop on the anal fin of constellatus males. The subocular bar is oblique, and the opercular spot is distinct.

Discussion

The status of certain distinctive rock bass populations W of the Mississippi River has received surprisingly little attention from workers engaged in centrarchid systematics or those interested in state faunal lists and distributional patterns. Hubbs and Lagler (1947) reported intergradation between A. r. ariommus x A. r. rupestris in the lowlands of southeastern Missouri and eastern Arkansas. Later, Bailey and Hubbs (1949) also defined the range of the intergrades. Branson (1967) suggested that the rock bass population in the Neosho River drainage of western Missouri and Arkansas and eastern Oklahoma was derived from Arkansas and White river populations. In a very brief account, Eddy (1969) noted that there were several subspecies of rock bass in the S, although he did not specify where. Pflieger (1971) was the first to point out the striking color pattern of rock bass from the upper White River in Missouri, and suggests that this might represent an undescribed subspecies.

During an extended field trip to the Ozark region in the early 1960's the second author was impressed by the differences in pattern in specimens he collected from Spavinaw Creek, Benton Co., Arkansas (Neosho Drainage) and those taken from streams tributary to the upper White River near Fayetteville, Washington Co., Arkansas. Both forms differed markedly from the northern rock bass, A. rupestris.

In this study, we compared constellatus from the upper White River with rupestris from the Missouri and Meramec rivers to the N, with the *ariammus*-like form from the Neosho river in the W, and with reputed "intergrades" from the Whitewater, St. Francis and Black river drainages to the E, and with ariommus from the Ouachita and Little rivers in the SW.

Two scatterplots (Figs. 3 and 4) show a comparison of body depths for Ambloplites constellatus and populations from adjacent rivers and the Ouachita River. The plots serve to illustrate that the Ozark rock bass has a more slender form. The most striking differences in body depth are seen in the comparisons of constellatus with rock bass from contiguous drainages and ariommus from the S (Fig. 4). It is noteworthy that the non-constellatus samples in Figure 4 are in close agreement. Ambloplites ariommus is the deepest-bodied member of the genus. In regard to body depth, "intergrade" populations from the Black River (lower White River), in southeastern Missouri and eastern Arkansas, do not differ significantly from either ariommus from

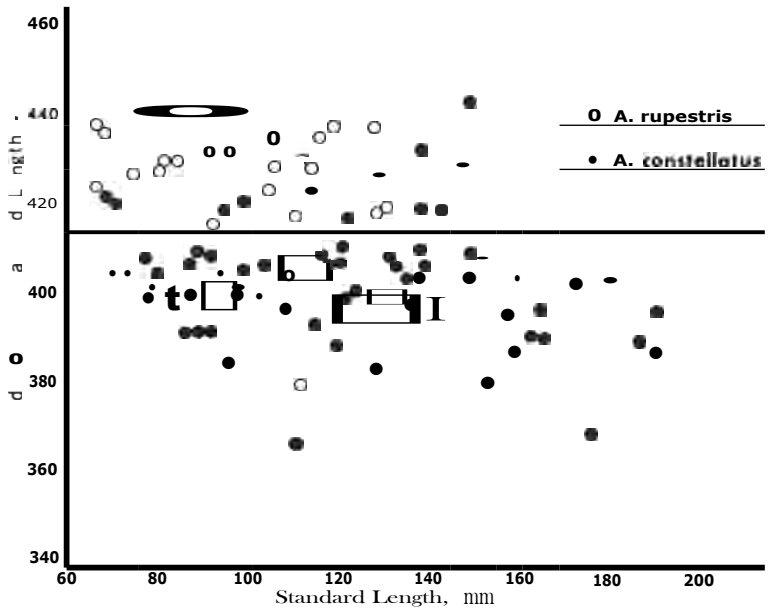
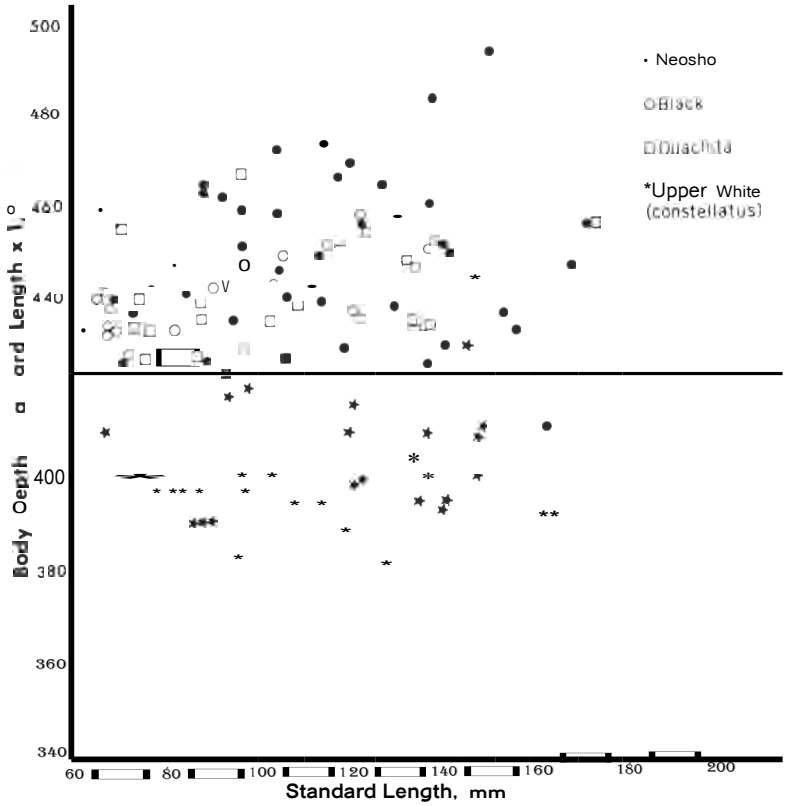


Fig. 3.—Scatterplot showing separation of Ambloplites rupestris and A. constellatus in body depth. Line fitted by eye

the main part of its range along the Gulf Coast or Neosho River rock bass to the W. By this character, 93% of the Ozark rock bass can be separated from the others. The comparison of body depth for samples of rupestris from the Meramec and Missouri river drainages and constellatus does not show as great a separation, about 83% (Fig. 3) . Most of the Ozark rock bass had a ratio of body depth to standard length between .38 and .42. *Ambloplites* rupestris from the Meramec and Missouri rivers were between .42 and .44, and were slightly deeper-bodied than rupestris E of the Mississippi.

Ambloplites constellatus, like A. cavifrons and A. ariommus, tends to have one more soft ray in both dorsal and anal fins than A. rupestris; thus, the counts for total dorsal and anal fin elements are usually 23 and 17, respectively, as compared to 22 and 16 for rupestris (Table 2) . Included in Tables 2-4 are samples of populations from the St. Francis and Whitewater, and Little River (southwestern ariommus). Ozark rock bass differed significantly ($p = < .01$) in the mean num-



F . 4.—S A , O M . L

ber of dorsal fin elements from all the western populations sampled, except from the Little River ariommus. Lowland populations and Neosho rock bass were closer to Meramec and Missouri rupestris and Ouachita ariommus in this character. Rock bass from the Ouachita River are considered to be ariommus, although they do show some modifications in body shape and pattern which is interpreted as reflecting their upland habitat. However, in most characters the southwestern Arkansas populations agree with A. ariommus of the Gulf Coastal Plain drainages. Ouachita River ariommus had an average lower count of dorsal fin elements than most coastal ariommus, but were similar to those populations inhabiting streams tributary to the eastern Mississippi Embayment (Bayou Pierre and Homochitto River).

In regard to anal fin elements, constellatus was closest to populations in southwestern Arkansas. Significant differences ($p = <.01$) between constellatus, rupestris to the N and Neosho rock bass to the W were found.

Ambloplites constellatus is intermediate in squamation between rupestris and cavifrons, and has much higher counts for most scale characters than ariommus (Tables 3-4). The Ozark rock bass has significantly higher ($p = <.01$) means for cheek scale rows, scale rows above the lateral line, lateral line scales and breast scale rows. Meramec and Missouri river rupestris have significantly higher ($p = <.01$) means for all the scale characters, except lateral line scales, than all the non-constellatus populations sampled. "Intergrade" populations from the lowlands are closer to southwestern ariommus in all but the number of cheek scale rows, and Neosho River rock bass approximate ariommus and "intergrade" samples closer than either constellatus or rupestris.

Ambloplites constellatus has a finer squamation than any rock bass from populations in adjacent drainages. However, the Atlantic coastal endemic, A. cavifrons, has higher counts for breast scale rows (30-34) and scale rows above the lateral line (9-11). The Roanoke bass also has an incompletely scaled cheek region and a distinctive color pattern. The lateral pattern of A. cavifrons resembles that of A. rupestris, in that dark spots form longitudinal rows or lines. In live or freshly preserved adult specimens, scattered lighter spots occur above the lateral line, on the nape, cheek and opercle region. These spots range in color from white to yellow. This unusual pigmentation was first reported by Raney (1950) and serves as a useful character in separating A. cavifrons from sympatric A. rupestris. The systematics of the Roanoke bass will be treated in a future paper.

Habitat.—The habitat of the Ozark rock bass is very similar to that of upland populations of the northern rock bass. Ambloplites constellatus prefers small to moderate-size streams, with permanently flowing water, high dissolved oxygen, abundant aquatic vegetation, low turbidity and silt-free substrates. In the Buffalo River in northwestern Arkansas, the Ozark rock bass is very abundant. Most specimens we

collected were taken near the bank, around boulders, logs or tree stumps, in 2-5 ft of water, where the current was not as swift as in the main channel.

Distribution.—The new species is restricted to the Ozark Upland section of the White River drainage in Missouri and Arkansas, and possibly native to the Osage River drainage in Missouri. The state of Arkansas maintains a fish hatchery in Centerton and has taken brood stock from the upper White and introduced fingerling Ozark rock bass in other drainages in the state (Jim Collins, Arkansas Game and Fish Commission, pers. comm.) . In addition, many early efforts to stock rock bass in Missouri streams involved brood stock from the upper White River (A. G. Morris, formerly of Missouri Game and Fish Commission, pers. comm.) .

Ambloplites constellatus ranges throughout the upper White River in northern Arkansas and southern Missouri, almost dropping out completely at the physiographic border between the Ozark Upland and the Gulf Coastal Plain (Fig. 2) . The species that has a distribution pattern most like A. constellatus in the upper White is the yolk darter (Etheostoma juliae). Like the Ozark rock bass, the yolk darter avoids the coastal plain section of the lower White, and does not occur in the upper Black, nor the upland tributaries that flow into the lower Black. Both species are found throughout the uppermost tributaries and the main upper White River in northwestern Arkansas and southwestern Missouri and in the Buffalo River in NW and N-central Arkansas. The yolk darter is more limited in its range, however, and evidently does not extend as far down the upper White as does constellatus. The absence of constellatus from the upper Black River and its tributaries is a pattern paralleled by many Ozark species. Pflieger (1971) noted that the faunas of Ozark Upland stream systems were more highly differentiated than those in other regions of Missouri, perhaps due to their remoteness with respect to avenues of dispersal for fishes. Along the southern and southeastern slopes of the Ozark Uplands are the lowlands of the Mississippi Embayment where the lower reaches of all the principal southward-flowing streams are located today. This lowland area probably now serves as an effective barrier to the dispersal of upland species (Pflieger, 1971) . Thus, in addition to rock bass, the Arkansas saddled darter (E. euzonum), fantail darter (E. flabellare), banded darter (E. zonale) and orangethroat darter (E. spectabile) are represented by phenotypically distinguishable populations in the White and Black river systems. The same degree of differentiation does not occur within the Missouri, Meramec or Neosho systems (Pflieger, 1971).

Buchanan (1973) presented locality records for rock bass in the upland tributaries to the lower Black River in Arkansas. There is one locality in the Strawberry River and several in the Spring River from the upper portion of its confluence with the lower Black. Rock bass have been recorded from a number of sites in the Missouri portion of the Eleven Point River and evidently occurs throughout the Current

River and the Black River, from its upland origin in Missouri to its lowland course as far as its confluence with the Spring River in Arkansas (Funk et al., 1953; Pflieger, 1971; Buchanan, 1973) . The Black and Current rivers in Missouri and Arkansas embrace part of the range of ariommus x rupestris intergrades as delimited by Hubbs and Lagler (1947) and Bailey and Hubbs (1949). These determinations were based on material in the Museum of Zoology, University of Michigan (Bailey and Hubbs, 1949) . After examining that material, we agree that some of these specimens are intermediate between ariommus and rupestris in color pattern, but we would refer most of this material to ariommus based on other characters and knowledge of geographical variation in that form. Material from the Eleven Point River, UMMZ 188647, consists of just two juvenile specimens and cannot be identified with certainty. No material was examined by us from either the Spring or Strawberry rivers in Arkansas. However, the faunal relationships within the Spring River are mixed, as it is a blend of upland and lowland species. Moreover, in cases where two closely related forms are distributed in either the Black River or the White River, the Spring River has affinities clearly with the former. The distribution patterns of Notropis pilsbryi, the dusky shiner, and N. zonatus, the bleeding shiner, serve as an example. The dusky shiner occurs throughout the upper White drainage, but is replaced in the Black River drainage by the bleeding shiner. The Strawberry and Spring rivers both contain N. zonatus. The two subspecies of the Arkansas saddled darter show a similar pattern, with the Black River subspecies, E. euzonum erizonum, present in the Strawberry and Spring. It is certainly possible that Ozark rock bass have been stocked at some time in upland tributaries to the Black River in Arkansas, or that northern rock bass have been introduced in the past by some state or federal agency. However, according to the Arkansas Game and Fish Commission records, which cover the period from 1946-1970, no rock bass have been stocked in the Black River drainage (J. Collins, pers. comm.) .

There are two records (UMMZ 151720 and TU 38038) for Ambloplites constellatus from the Osage River drainage in southwestern Missouri. A total of three specimens from collections made in 1944 and 1965 may represent a natural range extension or more likely are the result of stocking activities. The presence of specimens with the constellatus phenotype and the retention of this identity in a drainage that contains rupestris support the specific validity of the upper White population.

Etymology.—The specific epithet constellatus refers to the clustered arrangement of the dark spots on the side of the body. We would like to thank Dr. Carl L. Hubbs for suggesting the name.

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