

PERCINA AUROLINEATA, A NEW PERCID FISH FROM THE ALABAMA
RIVER SYSTEM AND A DISCUSSION OF ECOLOGY, DISTRIBUTION,
AND HYBRIDIZATION OF DARTERS OF THE SUBGENUS
HADROPTERUS

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ABSTRACT

A new species of *Percina* (subgenus *Hadropterus*) from the Alabama River system is described and compared with *nigrofasciata*, *sciera* and *lenticula*. The new species *P. aurolineata* is closest to *P. sciera*, but differs in average number of lateral-line scales and vertebrae and in color pattern. Samples for comparison of the species of the subgenus were obtained from co-inhabiting populations. Range extensions are given for *Percina lenticula* and *P. sciera*. Hybridization between *P. nigrofasciata* and *P. sciera* is described and discussed.

INTRODUCTION

The first specimen of *Percina aurolineata* was taken from the Cahaba River, 2.2 miles north of Centerville, Bibb County, Alabama on 17 March 1957, by R. D. Suttkus, R. J. Miller, H. V. Miller, and J. L. deAbate along with *Percina lenticula* Richards and Knapp,¹ 1964 and *Noturus munitus* Suttkus and Taylor, 1965.

The other 58 specimens were collected during 1962, 1965 and 1966 from the Cahaba and Coosawattee Rivers.

We gratefully acknowledge: assistance in collecting by Dr. C. Robert Shoop, Glenn H. Clemmer, William T. Mason, and the students of the 1965 and 1966 Tulane University Summer Program in Environmental Biology; the loan of material from the University of Alabama (UAIC) by Dr. Herbert

T. Boschung, Jr. and James D. Williams; assistance by Dr. Reeve M. Bailey, University of Michigan Museum of Zoology (UMMZ), in making counts and measurements on a specimen of *Percina lenticula*; permission by Dr. Donald Scott, University of Georgia (UG), to examine 3 specimens of *P. lenticula*; and the aid of collecting and loan of comparative material from Cornell University (CU) by Dr. Edward C. Raney; and loan of material from the United States National Museum (USNM) by Dr. Ernest A. Lachner; photographs are by Dr. Clyde D. Barbour.

We particularly are indebted to Dr. Gerald E. Gunning for assisting the authors in the collection of many of the samples of comparative material from the Pearl River. Nearly all collections were obtained at night and often under severe weather conditions. Assistance in field work and laboratory studies was made through National Institutes of Health grants WP-00082-04, 05 and 3-T1-Es-27-02S1, -03S1, and National Science Foundation NSF G-9026.

Percina aurolineata, new species
Goldline Darter
(Figs. 1-2)

The description is based on 59 specimens, all of which were taken from the Alabama River drainage.

Material. The holotype, Tulane University 39573, an adult male 70.0 mm in standard length, was collected from the

¹ The date given by Richards and Knapp (1964: 695) for RDS field number 2594 should read 17 March 1957 rather than 17 May 1957.

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TABLE 1
Measurements of *Percina aurolineata* and *Percina sciera*
expressed as thousandths of standard length.

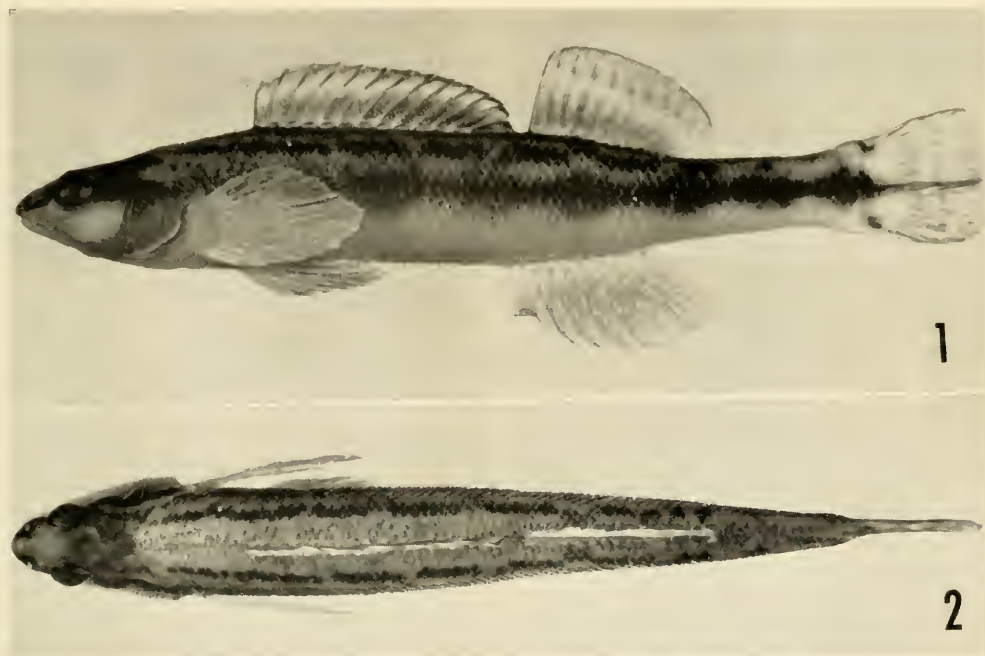
	<i>aurolineata</i> Coosawattee			<i>sciera</i> Tombigbee		
	TU 39573 Holotype	TU 38507	CU 50388 USNM 199733 TU 38320	TU 37584	TU 34603	
Number, sex, standard length (mm)	♂ (70.0)	5 ♂ 5 ♀	Range	5 ♂ 5 ♀	Range	
Body length.....	161	173	163-191	182	162-202	
Body width.....	128	129	118-142	137	125-152	
Caudal peduncle depth.....	81	78	74-81	90	84-98	
Caudal peduncle length.....	250	246	233-255	236	214-259	
Longest D. spine length.....	97	103	95-115	111	104-118	
Longest D. soft ray length.....	127	130	121-136	134	116-145	
First A. spine length.....	61	72	59-77	79	69-85	
Longest A. ray length.....	141	152	136-162	142	126-160	
Longest P ₁ ray length.....	213	215	197-229	215	208-226	
Caudal fin length.....	176	173	167-189	185	168-197	
P ₂ fin length.....	184	193	179-202	197	173-211	
P ₂ fin base length.....	31	31	29-35	37	31-42	
Transpelvic width.....	74	74	65-80	76	69-81	
Head length.....	237	242	236-252	253	247-259	
Head width.....	128	124	119-128	133	119-149	
Head depth.....	128	136	128-145	146	133-159	
Snout length.....	64	60	54-65	60	52-66	
Orbit length.....	53	54	51-60	58	52-64	
Least fleshy interorbital width.....	41	39	36-41	47	43-51	
Upper jaw length.....	60	57	53-60	66	62-73	
Juncture of branchiostegal membranes to tip of lower jaw.....	124	134	124-151	135	119-150	
to P ₂ insertion.....	143	147	138-153	154	146-162	

TABLE 2
Number of lateral line scales for the species of *Percina* (Subgenus *Hadropterus*). Values for holotype in boldface.

Species and Drainage	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	76	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	N	$\bar{x}$						
<i>n. nigrofasciata</i>																																																					
Cahaba R.							1	1	6	4	10	9	9	12	10	9	8	3	1																												83	58.4					
Black Warrior R.	1	1	-	-	3	1	6	8	9	10	3	4	2	-	2	-	1																															51	55.0				
Tombigbee R.			1																																													1					
Leaf R.							2	1	2	2	1	1	1	-	-	-	1																																11	57.3			
Pearl R.							1	-	1	5	3	6	5	5	1	1	1																																28	59.2			
<i>aurolineata</i>																																																					
Coosawattee R.													1	-	-	1	1	4	4	10	5	5	4	1	6	2	1	1																						46	67.3		
Cahaba R.																	1	-	1	2	2	2	3	-	2																									13	67.6		
<i>sciera</i>																																																					
Black Warrior R.													1	-	-	1	1	2	1	1	-	-	-	1	-	-	1																								9	66.1	
Tombigbee R.												2	2	2	3	4	4	2	3	6	2	1	2	-	1																										34	63.7	
Leaf R.											1	1	3	3	4	6	1	6	7	2	4	4																													41	63.4	
Pearl R.											1	4	5	6	14	13	18	24	28	21	16	11	6	1	2	-	-	1																							171	63.3	
<i>lenticula</i>																																																					
Etowah R. ¹																																																		8	86.6		
Coosa R.																																																		1			
Cahaba R.																																																		13	82.1		
Tombigbee R.																																																		3	80.3		
Leaf R.																																																		10	86.8		
Pearl R.																																																		11	82.3		

¹ Data from Richards and Knapp, 1964.





Figures 1 and 2. Lateral and dorsal views, *Percina aurolineata*, sp. nov. Holotype, adult male, 70.0 mm in standard length (TU 39573).

Coosawattee River about 200 yards below the mouth of a small spring tributary 4.2 miles southwest of the center of Ellijay, Gilmer Co., Georgia, 18 June 1966, RDS 3910, by Suttkus and 1966 Environmental Biology class.

Paratypes: Taken with the holotype were 3 paratypes, TU 41049 (2♂, 1♀, 57-70 mm in S.L.). Other paratypes include TU 38507 (6♂, 9♀, 38-59), Cornell University 50388 (2♂, 1♀, 50-65), United States National Museum 199733 (2♂, 1♀, 47-57), all from Ga., Gilmer Co., Coosawattee R. 4.2 mi SW of Ellijay, 22 June 1965, RDS 3707, Suttkus and Environmental Biology class; USNM 199817 (3♂, 3♀, 48-68) Ga., Gilmer Co., Coosawattee R., 3 mi S of Ellijay, 9 September 1965, William Smith-Vaniz and Wilmer A. Rogers; TU 38320 (3♂, 2♀, 41-74) Ga., Gilmer Co., Cartecay River, near the mouth of a tributary 3.1 mi SE of Ellijay, near Ga. Hwy 52, 18 June 1965, RDS 3695, Suttkus and Environmental Biology class; TU 40714 (4♀, 55-65), 15 April 1966, RDS 3881, Suttkus and Glenn H. Clemmer; TU 41053 (3♂, 3♀, 37-64) 17 June 1966, RDS 3909, Suttkus and Environmental Biology class.

Other material, all from Alabama: TU 15284 (♀, 47), Bibb Co., Cahaba R. 2.2 mi N of Centerville, just E of Hwy 5, 17 March 1957, RDS 2594, Suttkus, Miller, Miller and deAbate; TU 29116 (juveniles, 34 and 28), Bibb Co., Cahaba R. 8.5 mi NE of Centerville, Hwy 27, 17-18 July 1962, RDS 3132, Suttkus and Mason; TU 37656 (♀, 49), Shelby Co., Cahaba R., 5.4 mi W of Pelham, Hwy 52, 10 May 1965, RDS 3669, Suttkus and Clemmer; TU 37676 (4♂, 62-70), Bibb Co., Cahaba R., 2.2 mi N of Centerville, just E Hwy 5, 11 May 1965, RDS 3670, Suttkus and Clemmer; UAIC 1611 (♂, 60), Bibb Co., Cahaba R. at Pratt Ferry bridge, 5 June 1965, J. D. Williams et al; TU 38197 (2♀, 47 and 51), Shelby Co., Cahaba R., 5.4 mi W of Pelham, Hwy 52, 24 June 1965, RDS 3709, Suttkus and Environmental Biology class; TU 40800 (2♀, 51 and 54), Bibb Co., Cahaba R., 8.5 mi NE of Centerville, Hwy 27, 19 April 1966, RDS 3887, Suttkus and Clemmer.

Methods of counting and measuring described by Hubbs and Lagler (1958) and Richards and Knapp (1964) were followed.

Diagnosis. A slender species (Table 1) of the subgenus *Hadropterus* with moderate sized scales (lateral line scales 59-74, usually 64-72); moderate number of vertebrae (40-44, usually 41-43); low number of dorsal soft rays (10-13, usually 10 or 11); slender caudal peduncle, depth less than one third of length of peduncle; narrow least fleshy interorbital width; short upper jaw; mid-dorsal saddles absent or indistinct; dorsolateral pigmentation is a continuous or interrupted stripe (bright amber or russet during nuptial condition), straight at the anterior end, not turned dorsad toward the occiput.

Description. *Percina aurolineata* is the most slender of the four species now included in the subgenus *Hadropterus* (Figure 1 and Table 1; also see Table 7, Richards and Knapp, 1964: 698). Measurements and counts are given for the holotype, paratypes, and other material in Tables 1-6. In males the belly is fully scaled with scales in the midventral row enlarged. The nape is completely covered with scales, which are somewhat reduced in size and embedded anteriorly. The opercle, temporal region, and cheek are completely covered with scales. Those on the cheek are usually partially embedded. The entire breast and prepectoral area are covered with embedded scales or a combination of embedded and exposed scales.

Some females have the belly completely covered with scales although the anterior ones are usually embedded. Other females have scattered embedded scales on the belly, leaving small naked areas. The nape, opercle, cheek and breast are covered with scales, but the scales are smaller and more embedded on the nape, cheek and breast than in the males. There are a few small embedded scales on the prepectoral area.

The branchiostegal membranes are somewhat more narrowly conjoined in *P. aurolineata* than in *P. lenticula*, and are more broadly conjoined than in *P. sciera* (Table 1). The values for the ratio of distance from tip of lower jaw to juncture of branchiostegal membranes divided by distance from the juncture to insertion of pelvic fins are: holotype 0.86, ten paratypes 0.84-1.00 ($\bar{x} = 0.91$); *P. lenticula* 0.87-1.05 ($\bar{x} = 0.94$); *P. sciera*, ten specimens from Tombigbee River 0.76-1.00 ($\bar{x} = 0.87$).

The preopercle typically has a serrate margin, and 51 of the 59 specimens have one to three pored scales on the caudal fin base (average for 51 specimens is 1.72).

Coloration in alcohol. The dark lateral band is composed of seven to nine linearly connected black, oval, or quadrate blotches. The dark band continues anteriorly on the upper edges of the opercle and cheek and on the snout to the lateral parts of the frenum and on the adjoining part of the upper lip.

TABLE 3
Number of vertebrae in the species of *Percina* (Subgenus *Hadropterus*).

Species Drainage	39	40	41	42	43	44	N	$\bar{x}$
<i>n. nigrofasciata</i>								
Cahaba R.		22	35	2			59	40.7
Tombigbee R.		1					1	
Leaf R.		15	15	1			31	40.5
Pearl R.		18	19	1			38	40.5
<i>aurolineata</i>								
Coosawatee R.			2	18	14	2	36	42.4
Cahaba R.		2	6	3			11	41.1
<i>sciera</i>								
Black Warrior R.			4	2			6	41.3
Tombigbee R.			18	4			32	40.8
Leaf R.	3	29	47	1			80	40.6
Pearl R.	1	44	75	1			121	40.6
<i>lenticula</i>								
Etowah R. ¹					4	4	8	43.5
Cahaba R.				1	8		9	42.9
Tombigbee R.					2		2	43.0
Leaf R.				1	6	3	10	43.2
Pearl R.					5	5	10	43.5

¹ Data from Richards and Knapp, 1964.

Posteriorly the lateral band is separated slightly from the mid-basal caudal dark spot. The top of the head is dusky except on the anterior portion of the interorbital region and the middle of the frenum which are much lighter. Superimposed on the dusky pigmentation are several scattered brown spots. The lower part of the head below the forward extension of the lateral band is dusky in the males. There is an intensification of the pigmentation below the eye in most males which forms an indistinct suborbital bar. The lower part of the head of the female is much less pigmented than in the male. There are a few melanophores along the posterior part of the upper lip, along the rami of lower jaws, the anterior tip of the lower lip and a few extend posteriorly from the symphysis. An elongate cluster of melanophores forms a poorly developed suborbital bar in the female although the bar is quite noticeable because the surrounding areas of the cheek are devoid of pigment. The ventral part of opercle, cheek, and snout as well as the gular region and the branchiostegal membranes are devoid of pigment in the female. One large female has a few melanophores on the outer part of the left branchiostegal membrane.

Mid-dorsal blotches (saddles) are lacking

or indistinct in both sexes. The two juveniles (TU 29116) are exceptions in that dorsal saddles are distinct. Some specimens have a mid-dorsal stripe with slight intensification of pigment just in front of the first dorsal, at posterior end of first dorsal, another extends from base of fourth to seventh soft dorsal ray, another is found on the caudal peduncle under the posterior part of the extended second dorsal fin, and a posterior intensification occurs on the caudal peduncle at the base of the upper procurent caudal rays. The intensifications are sometimes saddle-like but are not sharply defined as are similar dorsal blotches in *P. sciara*, which, moreover, are separated by light areas. The sharp contrast between dark saddles and light intervening areas in the male of *P. sciara* is masked by the overall darkening at breeding time. The middorsal stripe extends from the anterior base of the first dorsal fin to the occiput in all specimens. Most specimens have a small, well defined, dark-brown spot at the base of the first dorsal spine and at the base of the first dorsal soft ray.

A single brown dorsolateral stripe extends from the lateral aspect of the occiput to the anterior lateral region of the caudal peduncle. In some specimens it continues

TABLE 4
Number of dorsal rays in the species of *Percina* (Subgenus *Hadropterus*);
Values for holotype in boldface.

Species Drainage	Dorsal Spines						Dorsal Soft Rays						
	11	12	13	14	N	$\bar{x}$	10	11	12	13	14	N	$\bar{x}$
<i>n. nigrofasciata</i>													
Cahaba R.	3	69	12		84	12.1	3	53	26	2		84	11.3
Black Warrior R.	15	26	10		51	11.9	2	28	20	1		51	11.4
Tombigbee R.			1		1			1				1	
Leaf R.	3	8			11	11.7	1	7	3			11	11.2
Pearl R.	3	21	4		28	12.0	4	13	11			28	11.2
<i>aurolineata</i>													
Coosawattee R.		6	35	5	46	13.0	16	28	1	1		46	10.7
Cahaba R.		5	7	1	13	12.7	7	5	1			13	10.5
<i>sciara</i>													
Black Warrior R.			7	2	9	13.2	1	4	4			9	11.3
Tombigbee R.		11	18	5	34	12.8	1	18	13	2		34	11.5
Leaf R.	2	14	23	2	41	12.6	2	15	23	1		41	11.6
Pearl R.	4	77	84	6	171	12.5	1	56	106	8		171	11.7
<i>lenticula</i>													
Etowah R.		1	6	1	8	13.0				4	4	8	13.5
Coosa R.		1								1			
Cahaba R. ¹		2	10	1	13	12.9			4	8	1	13	12.8
Tombigbee R.			3		3	13.0				3		3	13.0
Leaf R.			9	1	10	13.1			2	7	1	10	12.9
Pearl R.		3	8		11	12.7			1	5	5	11	13.4

¹ Data from Richards and Knapp, 1964 (in part).

anteriorly on the head to the posterior rim of the orbit. This stripe is usually continuous anteriorly but frequently interrupted posteriorly. In most specimens the stripes are linear but may curve slightly with the dorsal contour of the body. However, in some individuals the stripes undulate, especially posteriorly. The intervening spaces between the dorsolateral stripe and the dorsum and the black lateral band are light in the female and slightly dusky in the male.

The entire ventral region of the male is uniformly dusky. With magnification most males are seen to have dark-edged scales. In contrast the female is nearly immaculate below the dark lateral band. The female has a few small patches of brown or black pigment scattered along the lower side of the body, along base of anal fin, on the ventral side of caudal peduncle, on the prepectoral area, and on the breast. Large females have a dark triangular patch just anterior to the anus.

The first dorsal fin of the male has a moderately wide distal dark band. Proximal to this outer band is a clear band of about the same width which is crossed by pigmented spines. Some large males have brown blotches superimposed on some spines (at the intermediate zone). The proximal

half to two thirds of the first dorsal fin is uniformly black except for a narrow light area at the extreme base.

In the female the first dorsal fin is sparsely pigmented. There is a very narrow incomplete distal dark band with the major part of the pigment on the spines. An intermediate band, scarcely developed in some individuals, and a proximal band are composed almost entirely of pigmentation on the spines with very little on the intervening membranous areas.

In the male the second dorsal fin is dusky except for around the rays at their first branching. These nonpigmented areas form a row of light spots across the fin. There are superimposed brown spots on the anterior edge of the first ray and on the membrane between the two branches of each ray just distal to the nonpigmented part of each ray.

In the female the membranous part of the entire second dorsal is essentially without pigment. A few scattered melanophores are present on the membrane next to the rays just distal to their first branching and, in some individuals, next to the heavily pigmented portions of the rays, and at the extreme basal part of the membranes. The basal third of each ray is heavily pigmented:

TABLE 5
Caudal peduncle scale counts for species of *Percina* (Subgenus *Hadropterus*);
Values for holotype in boldface.

Species	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	N	$\bar{x}$
<i>nigrofasciata</i>																	
Cahaba R.	3	4	19	31	24	2										83	22.9
Black Warrior P.	4	15	14	16	2											51	21.9
Tombigbee R.			1													1	
Leaf R.	1	3	7													11	21.5
Pearl R.	1	8	10	6	3											28	22.1
<i>unilineata</i>																	
Ccosawattee R.	1	7	12	24	1	1										46	22.4
Cahaba R.			2	5	4	1	1									13	23.5
<i>sciera</i>																	
Black Warrior R.			3	4	1	—	1									9	23.1
Tombigbee R.			3	7	15	5	3	—	1							34	24.0
Leaf R.		1	9	9	16	6										41	23.4
Pearl R.		7	31	47	42	32	10	2								171	23.6
<i>lenticula</i>																	
Etowah R. ¹												3	3	2		8	31.9
Cahaba R.											1	—	2	8	2	13	32.8
Tombigbee R.												1	1	1		3	32.0
Leaf R.											2	4	4			10	31.2
Pearl R.												6	4	—	1	11	31.6

¹ Data from Richards and Knapp, 1964 (in part).

next distally is a narrow clear or sparsely pigmented portion which is bordered by another narrow heavily pigmented area. These pigmented parts of each ray extend to the first branching of the rays. The pigmentation at the crotches of the branched rays forms the most pronounced band across the second dorsal fin. In some females the pigment extends along the rays from the first branching to their distal tips but in other specimens there is no pigmentation distal to the branching or only along the anterior rays of the fin.

The caudal fin of both sexes has three basal dark spots. The middle spot is the largest; it is triangular, and only slightly separated from the posterior end of the lateral band. The upper and lower spots are usually distinct; however, in a few individuals the lower basal caudal spot is coalesced with the middle spot. There are upper and lower rounded light areas immediately posterior to the basal caudal spots. The remainder of the caudal fin is dusky except for one or two narrow vertical light areas which appear as wavy vertical bars.

The anal fin of the male is uniformly dusky except at the proximal branching of

the rays where a series of light areas forms an interrupted band across the fin.

In the female the pigmentation of the anal fin is similar to that of its second dorsal. There is little or no pigment on the membranes and the pigment along the soft rays forms three narrow bands or two bands with a narrow one distally and a broad one proximally. Both spinous rays and adjoining membranes are usually clear although a few females have two or three melanophores on the posterior margin of the second spine.

The base and all rays of the pectoral fin of the male are dusky. Some males have a crescentic light area distal to the dusky base. Most of the membranes are clear.

The pectoral fin of the female is lighter than that of the male. Part of the prepectoral region and the base of the pectoral are pigmented.

Both the membranes and the rays of the pelvic fins are uniformly dusky in the male. The anterior edge of the fleshy covering over the spine and the swollen tips of the succeeding soft rays are lightly pigmented or milky.

The pelvic fins of small females are im-

TABLE 6
Number of left pectoral rays and anal soft rays in the species of *Percina*
(Subgenus *Hadropterus*) ; Values for holotype in boldface.

Species Drainage	Left Pectoral Rays						Anal Soft Rays					
	12	13	14	15	N	$\bar{x}$	7	8	9	10	N	$\bar{x}$
<i>n. nigrofasciata</i>												
Cahaba R.		14	68	2	84	13.8		16	62	6	84	8.9
Tombigbee R.		27	20	1	48	13.4		15	27	9	51	8.9
Black Warrior R.			1		1				1		1	
Leaf R.		3	8		11	13.7		1	10		11	8.9
Pearl R.		2	19	7	28	14.2		7	20	1	28	8.8
<i>aurolineata</i>												
Coosawattee R.		2	38	6	46	14.1		15	26	5	46	8.8
Cahaba R.	3	9	1		13	12.8	1	3	9		13	8.6
<i>sciera</i>												
Black Warrior R.		4	4	1	9	13.7	1	3	5		9	8.4
Tombigbee R.		9	21	4	34	13.8	2	24	8		34	8.2
Leaf R.		7	19	5	31	13.9	2	26	13		41	8.3
Pearl R.	3	36	117	15	171	13.8	5	92	73	1	171	8.4
<i>lenticula</i>												
Etowah R. ¹			5	3	8	14.4		6	2		8	9.2
Cahaba R.			8	5	13	14.4		11	2		13	9.1
Tombigbee R.			1	2	3	14.7		2	1		3	9.3
Leaf R.			2	8	10	14.8		6	4		10	9.4
Pearl R.			7	3	10	14.3		6	5		11	9.4

¹ Data from Richards and Knapp, 1964.

TABLE 7

Records of catches of members of the subgenus *Hadropterus* and *Percina palmaris* from areas of known coinhabitation in the Pearl, Pascagoula, Tombigbee and Alabama drainages.

Numbers in parentheses are Tulane University Fish Collection catalogue numbers.

	<i>aurolin- neata</i>	<i>lenti- cula</i>	<i>nigro- fasciata</i>	<i>sciera</i>	<i>palmaris</i>
Pearl R. drainage					
Pearl R.: lower part					
Sept. 10, 1963 (31463, 31452)	—	1	—	4	—
June 11, 1964 (33244, 33250)	—	1	—	21	—
July 9, 1964 (33621, 33625)	—	2	—	4	—
Jan. 16, 1965 (27696, 27697, 27699)	—	1	3	39	—
Mar. 25, 1965 (37316, 37309, 37334)	—	1	3	92	—
Strong R. at rapids 2.3 mi W of Pinola, Miss.					
Apr. 3, 1958 (17733)	—	—	—	11	—
May 3, 1958 (18079)	—	—	—	12	—
July 3, 1958 (18727)	—	—	—	8	—
May 8, 1959 (19787)	—	—	—	33	—
July 4, 1960 (23740, 23737)	—	—	2	7	—
Dec. 29, 1962 (28806, 28805)	—	—	1	51	—
Nov. 6, 1963 (30143, 30148)	—	—	15	153	—
Feb. 1, 1964 (31702, 31700)	—	1	—	17	—
May 17, 1964 (32875, 32867, 32883)	—	3	11	162	—
Dec. 13, 1965 (39459, 39460)	—	—	8	39	—
Pascagoula R. drainage					
Leaf R. at rapids 1 mi W of Moselle, Miss.					
Dec. 29, 1962 (28645, 28624)	—	—	5	58	—
Nov. 2, 1963 (30074, 30053, 30057)	—	10	11	31	—
Dec. 12, 1965 (39407, 39408)	—	—	4	3	—
Tombigbee R. drainage					
0.5 mi above and below Hwy 50 bridge, 10 mi NW of Columbus, Miss.					
Sept. 9, 1964 (34603)	—	—	—	21	—
May 6, 1965 (37580, 37590, 37584)	—	1	1	11	—
June 26, 1965 (38543, 38546)	—	1	—	3	—
Dec. 12, 1965 (39429)	—	—	—	7	—
Alabama R. drainage					
Cahaba R.					
Mar. 17, 1957 (15284, 15291, 15286)	1	7	17	—	—
July 17-18, 1962 (29116, 29133)	2	—	2	—	—
May 10, 1965 (37656, 37665)	1	—	36	—	—
May 11, 1965 (37676, 37679)	4	—	19	—	—
June 24, 1965 (38197, 38196)	2	—	16	—	—
Apr. 19, 1966 (40800, 40790)	2	—	15	—	—
Coosawattee R.					
June 22, 1965 (38507*, 38508)	21	—	—	—	114
June 18, 1966 (41049 + 39573, 41044)	4	—	—	—	23
Cartecay R.					
June 18, 1965 (38320, 38321)	5	—	—	—	51
Apr. 15, 1966 (40714, 40713)	4	—	—	—	45
June 17, 1966 (41053, 41055)	6	—	—	—	39
Talking Rock Cr.					
June 19, 1965 (38351, 38350)	—	—	74	—	5
Apr. 15, 1966 (40726, 40728)	—	—	53	—	26

* Plus Cornell Univ. 50388 and U.S. National Museum 199733.

maculate. Large females have scattered dusky spots along the rays.

Color in Life. Color notes were recorded for the four male specimens (TU 37676) obtained from the Cahaba River on 11 May 1965 soon after they were collected. Each had three or four bright amber or russet spots on the dorsal part of the snout and four or five similar spots on the top of the head between the interorbital region and the occiput. Yellowish blotches were present in the intervening areas and the rim of the orbit was yellowish. The iris appeared to be a mixture of amber and orange. The dorsolateral stripe on either side of the body was bright amber. Each spine in the anterior half of the first dorsal fin had an elongate bright amber blotch in the submarginal band. This submarginal band which was described as a nonpigmented (membranous areas) intermediate band in the alcoholic specimens was bright canary yellow in life. The marginal band and the basal zone were dusky. The second dorsal fin was mostly dusky but the light areas (as described for alcoholic specimens) at the branching of the rays were bright yellow in life. The basal part of each interradial membrane was bright yellow. A small bright russet spot was present at the anterior base of the second dorsal fin.

The dorsolateral area above and below the amber dorsolateral stripe was bright yellow. This bright yellow shaded to olive at the superior margin of the lateral band. An elongate suborbital patch, an elongate area below the preorbital band on the snout, and the upper part of the upper lips were yellow. The base of the caudal fin and the area around the basal caudal spots were bright yellow. The one or two wavy vertical areas on the caudal fin were bright yellow. The anal fin was bluish-gray with yellowish on some rays; the distal margin had a narrow milky white edging. The pectoral fins were yellowish, especially the crescentic area distal to the dusky base. The pelvics were bluish-gray with a milky white edging on the distal margin.

Below the lateral dark band the body was pale with a bluish-olive hue. The ventral surface of the lower jaw, the interopercular surface and the ventral surface of the cheek were iridescent blue.

Color notes for a paratype series (RDS 3707, taken 22 June 1965) were recorded by the junior author on July 17, 1965. Some fading had occurred, but the males were yellow to yellow-olivaceous above, and a pale yellow submarginal band was present on the first dorsal fin. The other fins were colored as follows: second dorsal and caudal yellowish; pelvics dusky, with some with yellow on anterior half; anal dusky and pectorals yellowish, especially near the base. The lips were yellow and the ventral part of the body was pale with dusky overlay.

Females were more yellow above the lateral line. The cheeks and lips were yellow. The first dorsal fin lacked a submarginal yellow band. The ventral part of the body was white with scattered patches of dark-edged scales. The caudal was yellow, as in the males, but the anal and pelvics were clear. These fins were clear except for scattered dark patches, mainly on the rays.

Specimens collected from the Cartecay River on 15 April 1966 were somewhat emaciated and did not exhibit any yellow, golden or amber coloration. Obviously these specimens were in winter condition and had not started to develop nuptial coloration.

Variation. Geographic variation is apparent between Cahaba and Coosawatee populations. The Coosawatee specimens have a higher average number of vertebrae, dorsal spines, dorsal soft rays, pectoral rays, and anal soft rays, but average fewer rows of scales around the caudal peduncle (Tables 2-6). A parallel pattern of variation is shown for *P. lenticula* in data presented by Richards and Knapp, 1964. Specimens of *lenticula* from the Etowah River (higher elevation) differ from Cahaba River specimens also in having higher meristic counts. An exception is noted in the caudal peduncle scale row count, which is lower in the upstream population of *lenticula*.

Relationships. Richard and Knapp (1964: 690) indicated the Pearl River drainage as the eastern limit of the range of *Percina sciera* along the Gulf Coast. They gave comparative information and suggested relationships (1964: 698, 699) for the three

species which they included in the subgenus *Hadropterus*.

Meristic characters, proportional measurements, and color patterns support the view that *aurolineata* and *sciera* are closely related, and furthermore that *sciera* is probably more closely related to *aurolineata* than to *lenticula*. Both *lenticula* and *aurolineata* occur together in the Cahaba River and may occur together in other parts of the Alabama system. Specimens of *sciera* from the Tombigbee, Leaf and Pearl rivers were selected for comparison because they were taken with *lenticula* at the same sites. Thus Table 7 summarizes coinhabitation by geographical areas; *sciera*, *lenticula*, and *nigrofasciata* are coinhabitants in the Pearl, Leaf, and Tombigbee rivers; *sciera* and *nigrofasciata* in the Black Warrior River (it is likely *lenticula* will be collected there eventually); and *aurolineata*, *lenticula* and *nigrofasciata* in the Cahaba River. Perhaps future collections will reveal coinhabiting populations of *aurolineata* and *lenticula* in the upper part of the Alabama River drainage.

In some characters (e.g. in number of lateral line scales and number of vertebrae) *aurolineata* is intermediate between *lenticula* and *sciera*. *Percina aurolineata* is closer to *sciera* and *nigrofasciata* than to *lenticula* in most meristic characters. *Percina lenticula* has the highest values for most meristic characters. Of the meristic characters considered, the number of lateral line scales (Table 2) shows the greatest divergence among the four species. *Percina nigrofasciata* has the lowest average number of scales and *lenticula* has the highest. *Percina sciera* is nearly intermediate between *aurolineata* and *nigrofasciata* in this character. On the basis of many meristic characters, *sciera*, *aurolineata*, and *nigrofasciata* form a close group distinct from *lenticula*.

In body proportions (Table 1) and color pattern, *aurolineata* seems to be more closely related to *sciera* than to either *nigrofasciata* or *lenticula*.

The complementary distribution of *aurolineata* and *sciera* suggests that *aurolineata* represents an eastern isolate of *sciera* stock and that *sciera* has not redispersed into *aurolineata* range. The reverse movement seems less likely because *aurolineata* apparently has a lower maximum temperature

tolerance than *sciera*. *Percina aurolineata* has been encountered only above the Fall Line, and thus may represent a population derived from a former *sciera* stock which invaded the upper Alabama system from the Tennessee drainage when they were connected in the past. (Hayes and Campbell, 1900: 131-33; Simpson, 1900: 133-136).

Comparisons. *Percina aurolineata* and *sciera* differ primarily in coloration. The dorsal saddles are lacking or indistinct in *aurolineata*, while *sciera* invariably has well defined median dorsal saddles which are visible even on darkened nuptial males. *P. aurolineata* has a single linear, continuous or interrupted stripe on the dorso-lateral area whereas *sciera* has oval or quadrate blotches or if narrow spots are present, they are not arranged in a linear fashion, but instead undulate between the lateral margins of the dorsal saddles and dorsal margins of lateral blotches. In *aurolineata* it continues anteriorly to the lateral aspect of the occiput, and in some specimens is continuous with the postorbital bar, whereas in *sciera* it typically curves toward the middorsal part of the occiput, and frequently joins with that on the opposite side to form a V-shaped pattern at the occiput.

All (faint in some specimens such as the holotype) *aurolineata* specimens have a mid-dorsal stripe which extends from the origin of dorsal fin to the occiput. Although some specimens have a predorsal blotch, it is not encircled anteriorly by a light area. *Percina sciera* has a dorsal saddle just in front of the first dorsal fin and this saddle is separated from the convergent dorsolateral stripes by a lightly pigmented area. The bright yellow, amber or russet coloration of *aurolineata* is not seen in *sciera*. Nuptial males of *sciera* are generally dark over the entire body. Sometimes the females of *sciera* are yellowish on the dorsolateral area, but lack the bright amber or russet.

P. sciera from the Tombigbee River has more of the belly, breast, and prepectoral area naked than does *aurolineata* from any part of its range. Also more of the scales of *sciera* are small and embedded.

Average differences are shown in several proportional measurements between *aurolineata* and *sciera* (Table 1). However, there is no overlap in range of variation in

depth of caudal peduncle, least fleshy inter-orbital width, and upper-jaw length.

Ecology and distribution. *P. aurolineata* is an inhabitant of the main channels of rivers, as is *P. lenticula*. The rivers at collection sites ranged from 50 to 200 feet in width. All localities were "white water" rapids four inches to three feet deep with small to extensive bottom areas of bedrock, boulder, rubble and gravel. River weed, *Podostemum*, grew at all localities, and was particularly luxuriant at the Cartecay and Coosawattee sites. In addition to *Podostemum* there were extensive beds of water willow, *Justicia*, at the three Cahaba River sites. Although there may be a general association of *aurolineata* with plants, none was observed in the clumps of *Podostemum* or *Justicia*. *Percina aurolineata* was observed on the sand between the *Podostemum*-covered boulders at the Cartecay River locality, over gravel between *Podostemum*-covered boulders at the type locality, and over gravel next to beds of *Justicia* at the lower Cahaba River locality.

Water temperatures ranged from 12.5 to 25°C: 18°C at the Cartecay River site at 1330 hrs on 18 June 1965, 12.5°C at 1250 hrs on 15 April 1966; 20°C at Coosawattee River at 1730 hrs on 22 June 1965; 23°C at two localities on the Cahaba River at 2330 hrs on 10 May 1965 and at 1030 hrs on 11 May 1965; and 25°C at upper Cahaba River locality at 1430 hrs on 24 June 1965.

The known occurrences of *Percina aurolineata* and *P. lenticula* (Fig. 3) are such as to suggest the probability that both species occurred throughout the upper Alabama drainage in the past, and that they may be present in a few localities in this area at the present time. However, pollution and extensive impoundment probably have eliminated these species from much of the area.

Toward achieving a more detailed analysis of distributional interrelations, we have tabulated (Table 7) the catch statistics of all collections of *aurolineata* and *lenticula* made by us, along with statistics for other species of the subgenus *Hadropterus* taken with *aurolineata* and *lenticula*. Additional statistics for *sciara* and *nigrofasciata* are presented for comparison. Catch records

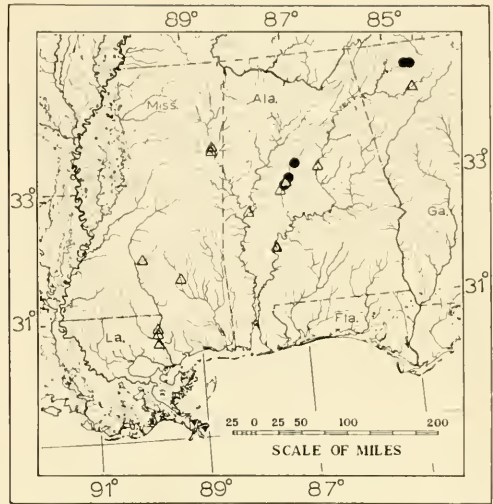


Figure 3. Distribution of collections of *Percina aurolineata* (solid circles) and *Percina lenticula* (open triangles).

for *Percina palmaris* (Bailey) are presented along with data for *aurolineata* because *palmaris* was the only other species of *Percina* taken at the Cartecay and Coosawattee localities, which drain the region above Coosawattee Falls. Talking Rock Creek is a small tributary entering the Coosawattee below the falls. Perhaps the indicated switch in dominance, based on number of individuals caught by seine, is coincidental or a reflection of biased sampling, but the figures may indicate a relationship of dominance through competition in the two kinds of habitats, river (*palmaris* vs. *aurolineata*) and creek (*nigrofasciata* vs. *palmaris*) or the specific relationship between each species and the particular habitat. During the April 15, 1966 collection from Talking Rock Creek the water was 15°C and there was an obvious difference in number of the two species in the different habitats. *Percina palmaris* was common in the riffles and rare along the banks in still water. However *nigrofasciata* was common in the latter area which apparently is its wintering habitat.

Associated fish species taken with *Percina aurolineata* at the type locality were *Hypentelium etowanum*, *Campostoma anomalum*, *Nocomis micropogon*, *Notropis callistius*, *Notropis stilbins*, *Notropis trichostius*, *Notropis zonistius*, *Micropterus coosae*, *Micropterus punctulatus benshalli*,

Etheostoma jordani, *Percina palmaris* and *Cottus carolinae zopherus*. Associates at the Cartecay locality were *Icthyomyzon gagei*, *Hypentelium etowanum*, *Moxostoma duquesnei*, *Camptostoma anomalum*, *Nocomis micropogon*, *Notropis callistius*, *Notropis stilbius*, *Notropis trichroistius*, *Notropis zonistius*, *Semotilus atromaculatus*, *Lepomis auritus*, *Micropterus coosae*, *Percina palmaris* and *Cottus carolinae zopherus*. Fish species taken with *aurolineata* at the three Cahaba River localities were as follows: *Alosa alabamae*, *Alosa chrysocloris*, *Dorosoma cepedianum*, *Hypentelium etowanum*, *Moxostoma duquesnei*, *Camptostoma anomalum*, *Ericymba buccata*, *Hybopsis aestivalis*, *Hybopsis amblops winchelli*, *Hybopsis storeiana*, *Notropis caeruleus*, *Notropis callistius*, *Notropis chrysocephalus isolepis*, *Notropis stilbius*, *Notropis uranoscopus*, *Notropis venustus stigmaturus*, *Notropis volucellus*, *Phenacobius catostomus*, *Pimephales vigilax perspicuus*, *Noturus leptacanthus*, *Noturus munitus*, *Anguilla rostrata*, *Fundulus olivaceus*, *Ambloplites rupestris ariommus*, *Lepomis cyanellus*, *Lepomis macrochirus*, *Lepomis m. megalotis*, *Micropterus coosae*, *Micropterus punctulatus henshalli*, *Ammocrypta beani*, *Ammocrypta vivax*, *Etheostoma jordani*, *Etheostoma rupestre*, *Etheostoma stigmaceum*, *Percina caprodes carbonaria*, *Percina copelandi*, *Percina lenticula*, *Percina n. nigrofasciata*, *Percina shumardi*, *Cottus carolinae zopherus*.

Ecology and relationships of *lenticula*, *nigrofasciata* and *sciera* outside of range of *aurolineata*. *Percina sciera* seems to be tolerant of a greater range of habitat with regard to size of stream than either *aurolineata* or *lenticula*. *Percina sciera* is a common inhabitant of small rivers and large tributaries as well as of large rivers in the Tombigbee, Pascagoula, and Pearl river drainages. Outside of the central Gulf Coastal area, that is west of the Mississippi River and north in the Mississippi basin area, *sciera* lives in small streams as well as rivers. *Percina nigrofasciata* is abundant along the eastern Gulf and southern Atlantic Coastal Plain, primarily in small streams. It occurs in the small streams in the Piedmont region above the fall line in the Alabama, Apalachicola, Savannah, and Edisto systems (Crawford, 1956: 17). Often *nigrofasciata*

is associated with a gravel bottom or with emergent or submerged aquatic vegetation or debris (snags) in the small-stream habitat. Invariably, when living in a river habitat, *nigrofasciata* is associated with bed-rock, boulders, rubble, or gravel bottom where *Podostemum* or *Justicia* usually grows. *Percina sciera* seems to be more tolerant of other types of bottom (sand, silt-covered sand, or gravel) where aquatic plants are absent. Perhaps there is considerable interspecific competition between the two species in the river habitats and *sciera* is more successful in the deep, swift waters and non-vegetated areas.

Thirty-seven monthly night collections for the period April 1963 through April 1966 from a sand bar along the Pearl River, 1.4 miles east of Bogalusa, Louisiana, did not produce any *nigrofasciata*. However, *sciera* (26 specimens) was taken in ten collections. Thirty-seven concurrent night collections, plus nine additional collections (during March and April, 1965 and February, March and April, 1966), were made immediately below a low dam four miles south of Bogalusa. The bottom at this part of the Pearl River was composed of gravel with a very sparse growth of *Podostemum*. In the parts sampled the current was more swift than at the sand bar locality. In the 46 samples, *nigrofasciata* was taken 11 times (28 specimens), *sciera* 29 times (789 specimens) and hybrids four times (11 specimens). *Percina sciera* was present in greater number in every collection which also yielded *nigrofasciata*. Most specimens of both species were collected during the cooler months. Very few were taken from the shallows during the summer when water temperature exceeded 25°C.

Based on the tabulation in Table 7, *Percina sciera* appears to be more successful in the river habitats than is *nigrofasciata*. The periodicity and duration of the monthly sampling period for the lower Pearl River localities eliminates the possibility of missing a peak in abundance of *nigrofasciata* because several samples were obtained during the peak of spawning. Moreover, *nigrofasciata* is found more often in the shallow parts of the riffles and rapids than is *sciera* and so any sampling bias would have favored *nigrofasciata*.

A comparison of catch records from the

Strong River area with those from the lower Pearl River at the dam south of Bogalusa shows that frequency of occurrence and number of specimens of *nigrofasciata* were higher at the former locality. The Strong River rapids had a thick carpet of *Podostemum*, and usually there were more extensive shallow areas than present at the dam locality. Thus the Strong River area seemed to be a better habitat for *nigrofasciata* but even there *sciera* dominated.

Percina lenticula adults typically inhabit the deepest and fastest parts of rapids, and this is the likely reason so few specimens have been collected. The November 2, 1963 collection from Leaf River came from the fastest (10 feet per second) and deepest (2.5 feet) part of the rapids. During the December 12, 1965 visit, high water prevented collecting in midstream and collecting was limited to the edge; this probably accounted for the lack of *lenticula* and for the predominance of *nigrofasciata* over *sciera* in the collection.

An interesting species association was noticed during the November 1963 collecting from the Leaf River. The bedrock in the rapids area was very uneven, with numerous potholes. We assumed (not being able to see the bottom because of turbulence and turbidity) that most of the fishes caught in the seine were chased out of the holes by our kicking. In more than half of the nine or ten sets in which we obtained *lenticula* we also captured one or two specimens of *Etheostoma histrio* and *Anguilla rostrata*.

Hybridization. Swain (1884: 252) stated in his description of *Hadropterus scierus* that *scierus* and *nigrofasciatus* are evidently closely related. Hubbs and Black (1954: 202) noted Swain's observation about the relationship between the two species and stated that both species sometimes occur together in the central part of the Gulf lowland, that their morphological and ecological relationships had not been determined, and that no indication of intergradation between them had been observed. Neither Hubbs and Black (1954), nor Hubbs (1954) in his description of a new subspecies of *scierus* specifically mentioned or used specimens from the Pearl, Pascagoula or Tombigbee rivers in their tabulations of meristic characters. Crawford (1956: 27,

33) mentioned coinhabiting populations of *sciera* and *nigrofasciata* in the Pearl River and in drainages flowing into Lake Pontchartrain. He compared the two species (op. cit.: 27, 29) and (:33) stated that there is no evidence of intergradation and that the respective forms seem to be relatively unsuccessful in invading each others range. He suggested that this is further evidence for the close relationship between the two forms.

Intensive studies of the fishes of the Pearl River at Pools Bluff Sill, Washington Parish, Louisiana, have revealed the presence of hybrids between *Percina nigrofasciata* and *Percina sciera*.

The fast flowing, turbulent waters over the extensive gravel beds below the low dam support an abundance of fishes and seventy-three species have been recorded.

During January through April high water condition is typical for the Pearl River at Pools Bluff Sill. Although some darters do not move into temporary flooded areas behind the curtains of the dam, both *nigrofasciata* and *sciera* do and apparently spawn over sand bottom and gravel. Because of the turbidity and turbulence, direct observations on behavior usually are impossible. Both species spawn from the middle of February to about the middle of April at the Pools Bluff locality. The following observations were made in 1965: January 16, both *nigrofasciata* and *sciera* were collected, no ripe individuals of either species, water temperature 13°C at 1:48 AM; March 18, *sciera* males ripe, water 15°C at 8:00 PM; March 25, *sciera* males ripe, females not ripe, water 17°C at 10:20 PM; April 8, *sciera* male nearly spent, water 20°C at 9:15 PM. During the spring of 1966 the following data were recorded: February 18, *sciera* female ripe, water 11°C at 12:00 midnight; February 24, *nigrofasciata* female ripe, *sciera* males ripe, water 10°C at 12:15 AM; March 4, *nigrofasciata* male ripe, *sciera* males and females ripe, water 12°C at 1:30 AM; March 10, *sciera* males and females ripe, water 12°C at 5:30 PM.

Physical and biological conditions at Pools Bluff that appear to be conducive to hybridization between *nigrofasciata* and *sciera* are: (1) a barrier (dam); (2) restricted preferred spawning areas; (3) presumably a mar-

ginal habitat for *nigrofasciata*: (4) overlap in spawning time, and (5) extremes in relative abundance (*nigrofasciata* relatively scarce and *sciera* common).

The *Percina nigrofasciata* x *Percina sciera* hybrids (Figs. 7-9) exhibit an intermediacy especially in number, shape, and size of lateral blotches (Figs. 4-12, Table 8). The lateral and vertical dimensions of the major lateral blotches were determined for 10 specimens of *nigrofasciata* (TU 27697, 2 specimens; TU 37309, 2; TU 39550, 1; TU 39681, 1; TU 39725, 4); for 10 hybrids (TU 39380, 2; TU 39726, 4; TU 40000, 2; TU 40887.1; TU 40888.1) for 10 specimens of *sciera* (TU 39724). The basicaudal blotch, although not measured, was considered as the first blotch, the penultimate as the second and so on forward. The average ratios (lateral dimension of blotch, as measured along lateral line, divided by vertical dimension) are consistently intermediate in the hybrids (Table 8). The number of lateral blotches is also intermediate for the hybrids.

The hybrids are also intermediate in number of scales (Table 9). In number of vertebrae and fin rays the parental species are too similar to provide a satisfactory test for hybrid intermediacy (Table 10).

Supplementary material. The material examined in this study for comparison of

meristic characters is listed in abbreviated form.

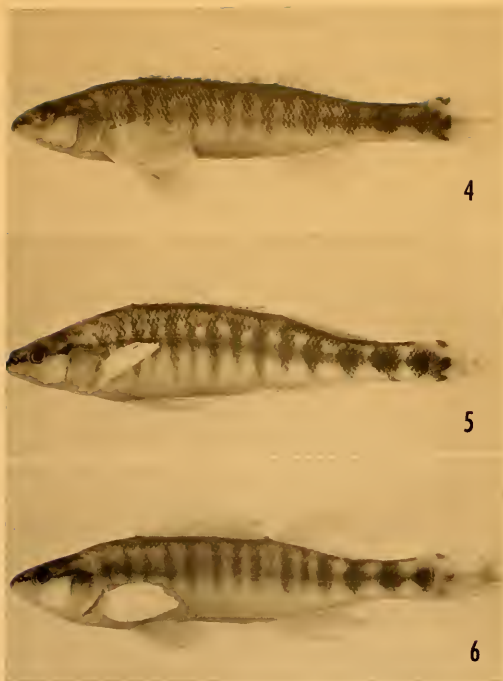
Percina lenticula. *Pearl River drainage:* TU 31463 (1, 72 mm S.L.) La., St. Tammany Parish, Wilson Slough at West Pearl River, 3.5 mi E Talisheek, RDS 3329, 10 Sep. 1963. TU 27696 (1, 73) La., Washington Par., Pearl R. just below dam at Pools Bluff, 4 mi S Bogalusa, RDS 3623, 16 Jan. 1965. TU 33621 (2, 48 and 49) La., Washington Par., Pearl River just above dam at Pools Bluff, 4 mi S Bogalusa, RDS 3526, 9 July 1964. TU 37316 (1, 100) La., Washington Par., Pearl River just below dam at Pools Bluff, 4 mi S Bogalusa, RDS 3644, 25 Mar. 1965. TU 33244 (1, 38) La., Washington Par., Pearl River at River Mile 54, 2.3 mi SE Bogalusa, RDS 3479, 11 June 1964. UMMZ 173953 (1, 154) Miss., Strong R., 1954. TU 31702 (1, 106) Miss., Simpson Co., Strong R., 2.3 mi W Pinola, Hwy 28 (formerly Hwy 20) RDS 3376, 1 Feb. 1964. TU 32875 (3, 98-117) Miss., Simpson Co., Strong R. 2.3 mi W of Pinola, Hwy 28, RDS 3431, 17 May 1964. TU 41970 (1, 74)¹ La., St. Tammany Par., Pearl R. at River Mile 52, 11.5 mi below Pools Bluff Sill, RDS 4024, 18 October 1966. TU 41990 (1, 76)¹ La., St. Tammany Par., Pearl R. at River Mile 51.5, 12 mi below Pools Bluff Sill, RDS 4025, 18 October 1966. *Pascagoula River*

¹ Specimen was not used in comparison but collection site is represented on map.

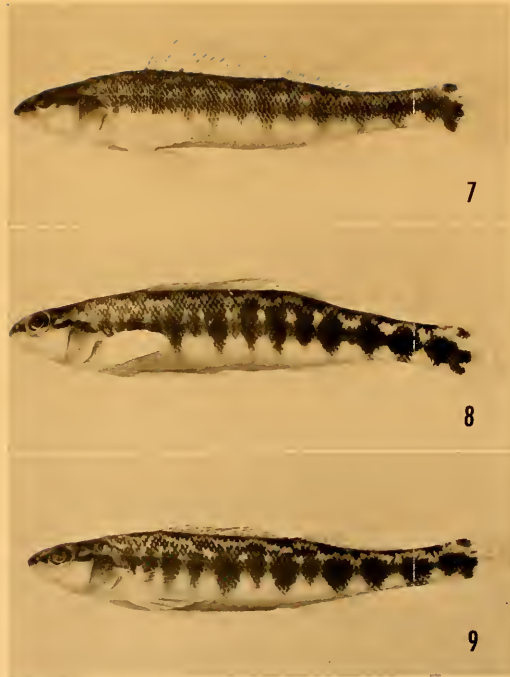
TABLE 8
Ratios of lateral dimension divided by vertical dimension of lateral blotches in ten each of *Percina nigrofasciata*, hybrids, and *Percina sciera* from the Pearl River.
Lateral Blotches

	12th	11th	10th	9th	8th	7th	6th	5th	4th	3rd	<i>Penulti- mate</i> ¹
<i>Percina sciera</i>											
Number of specimens				3	7	10	10	10	10	10	10
Average				0.34	0.39	0.59	0.83	0.99	1.10	0.99	1.18
<i>P. sciera</i> × <i>P. nigrofasciata</i>											
Number of specimens			2	8	10	10	10	10	10	10	10
Average			0.25	0.30	0.29	0.37	0.33	0.39	0.50	0.58	0.70
<i>P. nigrofasciata</i>											
Number of specimens		5	9	10	10	10	10	10	10	10	10
Average		0.17	0.17	0.16	0.16	0.17	0.17	0.21	0.26	0.37	0.56

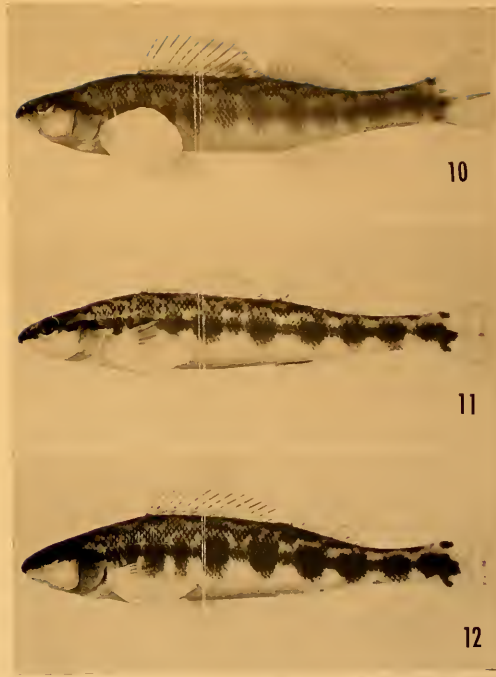
¹ Lies just ahead of the central basicaudal spot.



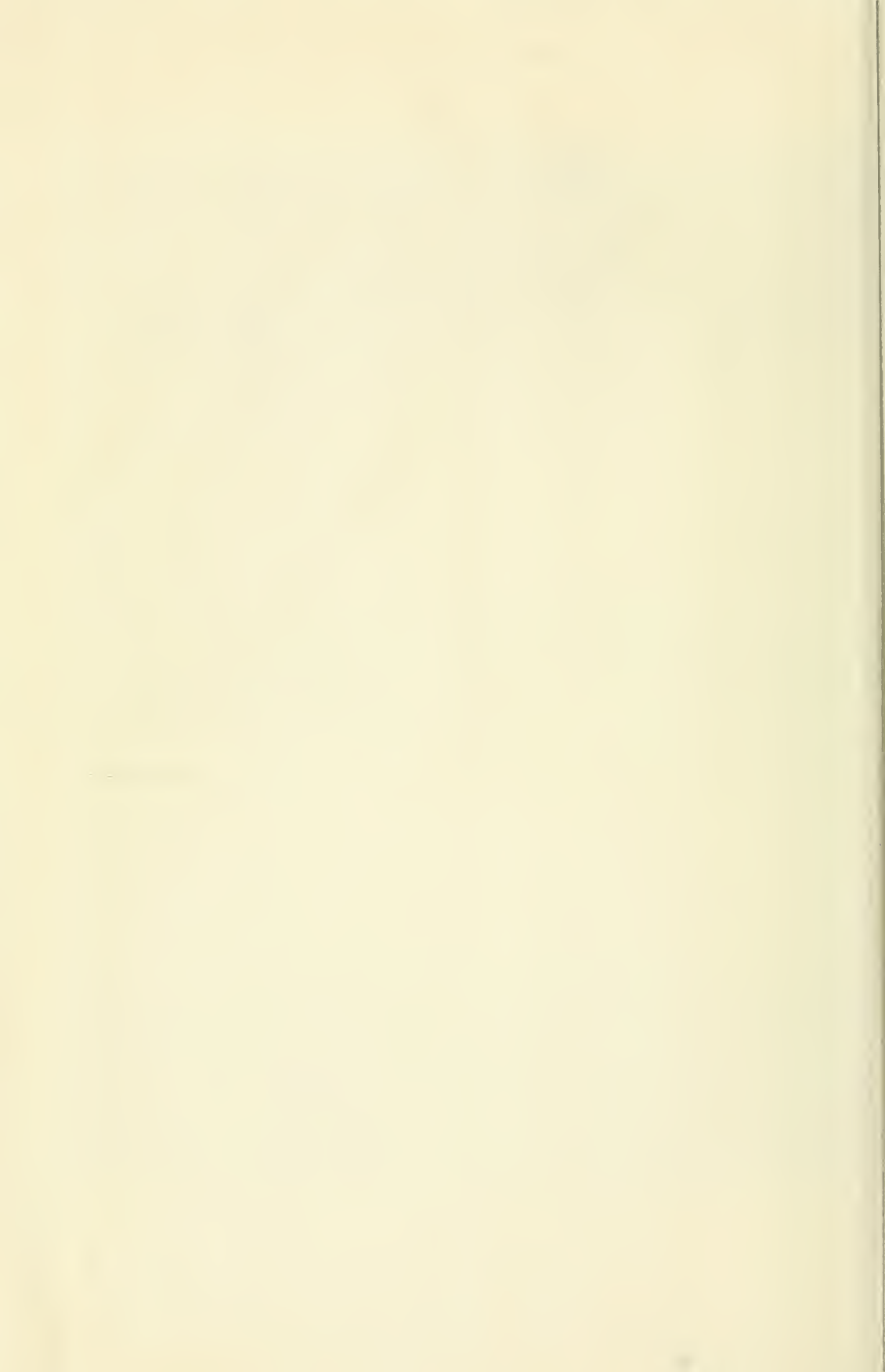
Figures 4-6. *Percina nigrofasciata*. 4. TU 39806 5. TU 39725 6. TU 27697.



Figures 7-9. *Percina nigrofasciata* X *Percina sciera*. 7. TU 40000 8. TU 39380 9. TU 39380.



Figures 10-12. *Percina sciera*. 10. TU 39801 11. TU 39801 12. TU 39801.



River drainage: UG 140 CR-3 (1, 48), Ala., Shelby Co., Coosa R., 30 Aug. 1949. UAIG 2036 (3, 24-28) Ala., Bibb Co., Cahaba River 2.5 mi SE of Harrisburg, 4 June 1966. TU 40939 (1, 37¹): Ala., Wilcox Co., Alabama R. at Tait Bar, River Mile 122.4, RDS 3920, 28 June 1966. In addition, all material listed by Richards and Knapp (1964) from Cahaba River and up-

¹ Specimen was not used in comparison but collection site is represented on map.

	Lateral Line Scales														
	54	55	56	57	58	59	60	61	62	63	64	65	66	67	
<i>Percina nigrofasciata</i>	1	1	—	1	3	—	3	1							
<i>Percina nigrofasciata</i> ×															
<i>Percina sciera</i>					2	2	1	1	1	—	2	1			
<i>Percina sciera</i>						1	1	—	2	2	1	1	—	2	
Transverse Scales (From origin of anal upward to base of first dorsal fin)															
	18	19	20	21	22	23	24	25	26		Mean				
<i>Percina nigrofasciata</i>	2	1	5	2							19.7				
<i>Percina nigrofasciata</i> ×															
<i>Percina sciera</i>			2	4	2	—	2				21.4				
<i>Percina sciera</i>			1	1	2	2	—	3	1		23.1				
Caudal Peduncle Scales															
	21	22	23	24	25		Mean								
<i>Percina nigrofasciata</i>	3	3	4				22.1								
<i>Percina nigrofasciata</i> ×															
<i>Percina sciera</i>	2	—	5	3			22.9								
<i>Percina sciera</i>		5	1	1	3		23.1								

	Dorsal Rays									
	Spines					Soft Rays				
	11	12	13	14	Mean	10	11	12	13	Mean
<i>P. nigrofasciata</i>	1	6	3		12.2	1	6	3		11.2
<i>P. nigrofasciata</i> × <i>P. sciera</i>			4	5	12.7		2	8		11.8
<i>P. sciera</i>			4	6	12.2		4	5	1	11.7
	Anal Soft Rays									
	Anal Soft Rays					Vertebrae				
	8	9	10		Mean	40	41	42		Mean
<i>P. nigrofasciata</i>	3	7			8.7	7	4	2		40.6
<i>P. nigrofasciata</i> × <i>P. sciera</i>		4	6		8.2		5	7	1	40.7
<i>P. sciera</i>		7	2	1	8.4		4	12	2	40.8
	Left Pectoral Soft Rays									
	13	14	15		Mean					
<i>P. nigrofasciata</i>	1	8	1		14.0					
<i>P. nigrofasciata</i> × <i>P. sciera</i>		1	8	1	14.0					
<i>P. sciera</i>		2	8		13.8					

per Alabama River drainage was used in this paper.

Percina n. nigrofasciata. *Pearl River drainage*: The following material was collected from La., Washington Par., Pearl R. just below dam at Pools Bluff, 4 mi S of Bogalusa: TU 27630 (1, 56) RDS 3617, 18 Dec. 1964; TU 27697 (2, 60 and 79) RDS 3623, 16 Jan. 1965; TU 27837 (2, 63 and 67) RDS 3629, 12-13 Feb. 1965; TU 37309 (2, 70 and 81) RDS 3644, 25 Mar. 1965; TU 37377 (4, 58-77) RDS 3645, 3 Apr. 1965; TU 39550 (2, 49-66) RDS 3830, 21 January 1966; TU 39681 (1, 70) RDS 3832, 18 February 1966 and TU 39725 (4, 62-80) RDS 3833, 24-25 February 1966. The following material was collected from Miss., Simpson Co., Strong R. 2.3 mi W Pinola, Hwy 28: TU 23740 (2, 34 and 34) RDS 2917, 4 July 1960; TU 28806 (1, 34) RDS 3193 29 Dec. 1962; TU 30143 (15, 38-94) RDS 3357, 6 Nov. 1963; TU 32867 (10, 44-59) RDS 3431, 17 May 1964, and TU 39459 (8, 38-68) RDS 3825, 13 Dec. 1965. *Pascagoula River drainage*. TU 28581 (5, 30-68) Miss., Covington Co., Leaf R. 1 mi upstream from US Hwy 84, 10 mi ENE Collins, RDS 3185, 23 Nov. 1962. TU 28601 (10, 28-69) Miss., Covington Co., Leaf R. 0.75 mi upstream from US Hwy 84, 10 mi ENE Collins, RDS 3186, 23 Nov. 1962. TU 28654 (5, 35-54) Miss., Jones Co., Leaf R. 1 mi W Moselle, RDS 3192, 29 Dec. 1962. TU 30053 (11, 33-74) Miss., Jones Co., Leaf R. 1 mi W Moselle, RDS 3354, 2 Nov. 1963. TU 39407 (4, 43-70) Miss., Jones Co., Leaf R. 1 mi W Moselle, RDS 3822, 12 Dec. 1965. *Tombigbee River drainage*. TU 37590 (1, 58) Miss., Lowndes Co., Tombigbee R. 9 mi NW Columbus, 0.5 mi upstream from Hwy 50 bridge, RDS 3663, 6 May 1965. *Black Warrior River drainage*. UAIC 1060 (38, 32-57) Ala., Tuscaloosa Co., Black Warrior River below Oliver Dam at Tuscaloosa, 28 October 1963. UAIC 1594 (6, 32-62) Ala., Tuscaloosa Co., Black Warrior River below Oliver Dam at Tuscaloosa, 7 May 1965. UAIC 1766 (4, 34-44) Ala., Tuscaloosa Co., Black Warrior River below Oliver Dam at Tuscaloosa, 29 September 1965. *Cahaba River drainage*. TU 15286 (17, 42-73) Ala., Bibb Co., Cahaba R., 2.2 mi N Centerville, RDS 2594, 17 Mar. 1957. TU 35091 (3, 40-68) Ala.,

Bibb Co., Cahaba R. 2.2 mi N Centerville, RDS 3504, 26 June 1964. TU 37679 (19, 37-76) Ala., Bibb Co., Cahaba R. 2.2 mi N of Centerville, RDS 3670, 11 May 1965. TU 29133 (2, 31 and 35) Ala., Bibb Co., Cahaba R. 7 mi NE Centerville, Hwy 27, RDS 3132, 17-18 July 1962. TU 32721 (10, 50-72) Ala., Shelby Co., Cahaba R. 5.4 mi W Pelham or 3.2 mi SW Helena, Hwy 52, RDS 3461, 31 May 1964. TU 37665 (36, 45-80) Ala., Shelby Co., Cahaba R. 5.4 mi W. Pelham, Hwy 52, RDS 3669, 10 May 1965. TU 38196 (16, 25-70) Ala., Shelby Co., Cahaba R. 5.4 mi W Pelham, Hwy 52, RDS 3709, 24 June 1965.

Percina nigrofasciata × *Percina sciera*. The following were collected from La., Washington Par. Pearl R. just below dam at Pools Bluff, 4 mi S Bogalusa: TU 39380 (2, 64 and 69), RDS 3821, 10 Dec. 1965; TU 39726 (6, 59-82), RDS 3833, 24-25 February 1966; TU 40000 (2, 63 and 68), RDS 3837, 10 March 1966; TU 40887 (1, 68), RDS 3623, 16 January 1965 and TU 40888 (1, 71), RDS 3644, 25 March 1965.

Percina sciera. *Pearl River drainage*. TU 27849 (32, 53-86) La., Washington Par., Pearl R. just below dam at Pools Bluff, 4 mi S Bogalusa, RDS 3629, 12-13 Feb. 1965. TU 27911 (23, 48-80) La., Washington Par., Pearl R. just below dam at Pools Bluff, 4 mi S Bogalusa, RDS 3640, 4 Mar. 1965. TU 37337 (24, 51-89) La., Washington Par., Pearl R. just below dam at Pools Bluff, 4 mi S Bogalusa, RDS 3641, 18 Mar. 1965. TU 39724 (131, 49-89) La., Washington Par., Pearl R. just below sill at Pools Bluff, 4 mi S Bogalusa, RDS 3833, 24-25 February 1966. TU 30148 (153, 33-88) Miss., Simpson Co., Strong R. 2.3 mi W Pinola, Hwy 28, RDS 3357, 6 Nov. 1963. TU 32883 (162, 39-75) Miss., Simpson Co., Strong R. 2.3 mi W Pinola, Hwy 28, RDS 3431, 17 May 1963. *Pascagoula River drainage*. TU 28624 (58, 36-77) Miss., Jones Co., Leaf R. 1 mi W Moselle, RDS 3192, 29 Dec. 1962. TU 30057 (31, 45-84) Miss., Jones Co., Leaf R. 1 mi W Moselle, RDS 3354, 2 Nov. 1963. *Tombigbee River drainage*. TU 34603 (21, 42-55) Miss., Lowndes Co., Tombigbee R. 9 mi NW Columbus 0.5 mi downstream from Hwy 50 bridge, RDS 3583, 9 Sept. 1964. TU 37584 (11, 34-76) Miss., Lowndes Co., Tombigbee R. 9 mi NW Columbus, 0.5 mi

upstream from Hwy 50 bridge, RDS 3663, 6 May 1965. TU 38546 (3, 19-27) Miss., Clay Co., Tombigbee R. 9 mi NW of Columbus, 0.5 mi downstream from Hwy 50 bridge, RDS 3712, 26 June 1965. *Black Warrior drainage*. CU 45968 (4, 34-47) Ala., Tuscaloosa Co., North R. 6 mi W Hwy 69 on Hwy 38, TZ 17, 14 Aug. 1963. TU 30203 (2, 37 and 42) Ala., Tuscaloosa Co., trib. to North R. and North R. 8 mi N Northport, Hwy 69, RDS 3214, 10 Apr. 1963. UAIC 1594 (3, 51-68) Ala., Tuscaloosa Co., Black Warrior River below Oliver Dam at Tuscaloosa, 7 May 1965.

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February 24, 1967