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STATUS OF *POECILICHTHYS HOPKINSI* FOWLER AND
ETHEOSTOMA TRISELLA, NEW SPECIES, PERCID FISHES
FROM ALABAMA, GEORGIA, AND SOUTH CAROLINABY REEVE M. BAILEY AND WILLIAM J. RICHARDS¹

COLLECTIONS of fishes from the southeastern United States have yielded two relatively rare species of *Etheostoma*; one is unnamed, the other has been confused by most recent authors. Their description and discussion of their relationships and group characteristics constitute the subject material for this paper. *Poecilichthys hopkinsi* Fowler is a member of the relatively large and rather diverse subgenus *Oligocephalus* Girard. *Etheostoma hopkinsi* is herein regarded as a valid, polytypic species; the Savannah River population is described as a new subspecies, *E. h. binotatum*. *Etheostoma trisella*, new species, is assigned to the previously monotypic *Psychromaster* Jordan and Evermann. *Oligocephalus* and *Psychromaster* have been variously treated as genera, as subgenera, or have not been recognized by recent authors. We employ them provisionally as subgenera of *Etheostoma* with the limits established by Bailey and Gosline (1955:40-42). Since that work did not provide characterizations, they are supplied herein.

In the preparation of this paper we have utilized specimens from several institutions through the kindness of those in charge of their collections, whom we thank for their courtesies: Academy of Natural Sciences of Philadelphia (abbreviated ANSP), James E. Böhlke; Cornell University (CU), Edward C. Raney; University of Georgia (UG), Donald C. Scott; University of Michigan (UMMZ); United States National Museum (USNM), Leonard P. Schultz. We are further indebted to Dr. Raney for allowing us to deposit the unique specimen of *E. trisella* in the Museum of Zoology fish collection. Bruce B. Collette has kindly provided data on specimens examined at Stanford University (SU).

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In order to express differences in placement of the pelvic fins, we introduce in this paper a measurement not previously employed in darter systematics. Some darters have the pelvic fins rather well separated, whereas in others they lie close together. In the past we have attempted to express this relationship by the ratio of the interspace and the width of one pelvic-fin base. The resultant value is not especially satisfactory because (1) the inner angles of the pelvic fins are flaccid and fail to provide firm anchorage for caliper points, and (2) the distance is small and personal error in measurement is large. The halves of the pelvic girdle are firmly sutured at the midline, and the pelvic spines articulate with the girdle; thus the pelvic spines provide firm supports. We measure the width between the outer edges of the pelvic spines just behind their bases while the pelvic fins are held so that the spines are parallel. This *transpelvic width* is expressed as a percentage of (or in thousandths of) the standard length.

SUBGENUS *Oligocephalus* GIRARD

The following generic and subgeneric names are applicable to the subgenus *Oligocephalus* Girard, as defined below.

- Oligocephalus*. Girard, 1859: 67. Type species, *Boleosoma lepida* Baird and Girard, by subsequent designation of Jordan and Evermann, 1896: 1066.
- Boleichthys*. Girard, 1859: 103. Type species, *Boleichthys exilis* Girard, by original designation.
- Astatichthys*. Vaillant, 1873: 106. Type species, *Etheostoma caerulea* Storer, by original designation.
- Nivicola*. Jordan and Evermann, 1896: 1066, 1082. Type species, *Poecilichthys borealis* Jordan, by original designation.
- Rafinesquiellus*. Jordan and Evermann, 1896: 1066, 1082. Type species, *Aplesion potsii* [misprint for *pottsii*] Girard, by original designation.
- Claricola*. Jordan and Evermann, 1896: 1066, 1093. Type species, *Etheostoma juliae* Meek, by original designation.
- Belophlox*. Fowler, 1947: 1. Type species, *Belophlox mariae* Fowler, by original designation.
- Litocara*. Bailey, 1948: 79. Type species, *Poecilichthys sagitta* Jordan and Swain, by original designation.
- Niviperca*. Whitley, 1951: 68. Type species by original designation, *Etheostoma boreale* Jordan. Substitute for *Nivicola* Jordan and Evermann, preoccupied by *Nivicola* Hodgson, 1844, in Aves.

This, the largest, most wide-ranging, and structurally most diverse subgenus of *Etheostoma*, includes about twenty named species. These share common morphological and ecological patterns and there is no reason to doubt their relatively close alliance. Some of the other subgenera of *Etheostoma* (e.g., *Austroperca*, *Psychromaster*, *Hololepis*,

Villora, *Catonotus*, and *Microperca*) probably have been derived from ancestry in *Oligocephalus*.

The subgenus *Oligocephalus* may be diagnosed as follows. Lateral line straight or gently arched upward anteriorly, incomplete or (frequently) complete; infraorbital canal complete or (infrequently) incomplete; supratemporal canal complete or (frequently) incomplete; preoperculomandibular pores 8 (very rarely), 9 (infrequently), or 10 (usually); prevomer and palatine well toothed; branchiostegal membranes separate (sometimes overlapping) to moderately connected, each with six rays; preopercle entire; top of head scaleless (except sometimes at posterolateral corners); nape, opercle, cheek, breast, and prepectoral area variably naked or scaled; body scales large or small (35 to 82 in lateral series); flesh opaque; body moderately elongate to rather robust, usually moderately compressed; head moderate; vertebrae 33 to 40; snout sharp to blunt; premaxillary frenum rather broad; interorbital area moderate. Fin rays: dorsal (VII) IX to XIII, 9 to 16; anal II (rarely I), 5 to 12; pectoral 11 to 16 (18). First dorsal fin moderate to high, the spines without fleshy tips; rays of second dorsal not notably elevated; pectoral fin short to moderate, usually slightly shorter than head; pelvic fins closely set, typically separated by less than two-thirds of pelvic-fin base; transpelvic width 6.2 to 8.4 per cent of standard length; anus not encircled with fleshy villi; breeding males with or without nuptial tubercles on ventral surface, pelvic, and anal fin. Sexual dimorphism in pigmentation is usually well marked and males in most species are highly colored, with orange or red-orange and blue or blue-green predominating. Most species have a submarginal band of reddish or red-orange in the first dorsal fin.

Etheostoma hopkinsi (Fowler)

Christmas Darter

Poecilichthys hopkinsi. Fowler, 1945: 249-51, figs. 205-206 (original description; Osewichee Springs, 14 mi. N of Fitzgerald, Wilcox Co., Ga.; holotype, ANSP 71548, s.l., 52 mm.).

Etheostoma (Oligocephalus) fricksium (in part). Bailey and Gosline, 1955: 17, 41 (misidentification, in part; CU 17616, 18458, and 18459; vertebral counts; *Poecilichthys hopkinsi* a probable synonym).

DIAGNOSIS.—A moderately heavy-bodied species of the subgenus *Oligocephalus* with the infraorbital canal complete, usually with 8 pores; the supratemporal canal complete; the lateral line scarcely arched anteriorly, typically incomplete, with 3 to 13 unpored scales in 90 per cent of specimens; preoperculomandibular pores usually 10;

branchiostegal membranes moderately conjoined; nape, opercle, cheek, and prepectoral area naked to fully scaled; breast naked (rarely with a few embedded scales); belly partly scaled. Scale rows: along body (39) 40 to 49² (52), transverse rows (10) 11 to 13 (15), around caudal peduncle (14) 16 to 19 (20). Fin rays: dorsal (VIII) X or XI (XII), 11 to 13 (14), anal (I) II, 7 to 9 (10); pectoral (11) 12 or 13 (14). Vertebrae 37 to 39, usually 38; snout moderate or blunt; pectoral fin shorter than head length; nuptial tubercles in breeding male present on lower surface of pelvic fin, anal fin, and on ventral body scales; genital papilla in female a long, slender tube that is slightly crenulate dorsally; dorsum usually with a series of 7 or 8 (0 to 10) subrectangular blotches, these sometimes faint or obsolete; side of male with about 10 red or red-orange bars alternating with green bars; spinous dorsal in male with submarginal red or red-orange band; anal with little or no red; subocular bar present; prepectoral dark spot usually present; a dark humeral blotch over supracleithrum (dark humeral scale, *auct.*); and three or four small dark spots in vertical series at caudal base, one subaxial and intense.

The vernacular name Christmas darter is suggested because of the gay decoration of the body with symbolic red and green bands.

RANGE.—*Etheostoma hopkinsi* is apparently confined to the basins of the Altamaha, Ogeechee, and Savannah rivers on the Atlantic slope of Georgia and South Carolina; it lives both above and below the Fall Line in each of these drainages.

COMPARISONS.—*Etheostoma hopkinsi* was confused with *Etheostoma fricksium* Hildebrand by Bailey and Gosline (1955), but subsequent study indicates that the species are distinct, although similar in many characters (Table 1). The only other species of *Oligocephalus* known from within the range of *E. hopkinsi* is *E. parvipinne* Gilbert and Swain, which occurs east to the Altamaha basin, Georgia (CU 18230, trib. to Ocmulgee R., E Rhine, at U.S. hwy. 280, Dodge Co.; UMMZ 88336, trib. Indian Cr., 2 mi. from Perry, Houston Co.). That species, which is allopatric with and perhaps representative of *E. fricksium*, differs from *E. hopkinsi* in the incomplete supratemporal canal, the fully-scaled breast, the blunter snout, the very short pectoral fin, the weak second anal spine (often absent), the reduced number of second dorsal rays (9 or 10, occasionally 11), and the absence of well-defined dorsal blotches.

² Counts for approximately 90 per cent of specimens; extreme counts in parentheses.

TABLE 1
 COMPARISON OF *Etheostoma fricksium* AND *Etheostoma hopkinsi*
 In recording counts, usual numbers (about 90 per cent) are given; extremes are in parentheses

Character	<i>E. fricksium</i>	<i>E. h. binotatum</i>	<i>E. h. hopkinsi</i>
Lateral line	Usually complete; unpored scales 0 to 4 (9)	Incomplete; unpored scales (3) 8 to 13 (15)	Usually incomplete; unpored scales (0) 2 to 11 (14)
Scales in lateral series	(35) 37 to 42 (45)	(39) 41 to 49 (52)	(39) 40 to 47 (50)
Prepectoral area	Scaled	Naked (rarely with a few scales)	Scaled
Opercle	Fully scaled	Naked	Fully scaled
Dorsum	No series of well-defined blotches; abruptly lighter than dark of side	A well-defined series of 7 to 9 blotches	A well-defined series of 7 to 9 blotches
Predorsal area	Immaculate	Two well-developed, subrectangular dark blotches always present	Two poorly-developed, irregular dark blotches usually present
Range	Savannah, Broad, Combahee, and Edisto drainages, below the Fall Line, Georgia and South Carolina	Savannah River drainage, above and below the Fall Line, Georgia and South Carolina	Altamaha and Ogeechee river drainages, above and below the Fall Line, Georgia

The closest relatives of *Etheostoma hopkinsi* probably are to be found in allopatric species living to the west in the Gulf of Mexico drainage. The forms of the *E. whipplei* complex (Hubbs and Black, 1941; Moore and Rigney, 1952) resemble *hopkinsi* in many respects, including the moderately wide connection of the branchiostegal membranes, but these forms have the spinous dorsal longer and lower, the body more slender and the head and snout somewhat sharper, the dark spot near the middle of the caudal base axial rather than subaxial, and the pigmentation otherwise different, including broader and darker margins on the median fins. Probably even closer in relation-

TABLE 2
FREQUENCY DISTRIBUTION OF FIN-RAY COUNTS IN *Etheostoma hopkinsi*

Subspecies and Drainage	Dorsal Spines							Dorsal Soft Rays					
	VIII	IX	X	XI	XII	N	Mean	11	12	13	14	N	Mean
<i>hopkinsi</i>													
Altamaha		10	49	27	2	88	10.24	4	32	38	13	87	12.69
Ogeechee			2			2	10.00		2			2	12.00
<i>binotatum</i>													
Savannah	1	5	36	31	1	74	10.35	35	33	2		70	11.53
	Anal Spines							Anal Soft Rays					
	I*	II						7	8	9	10	N	Mean
<i>hopkinsi</i>													
Altamaha		85						2	28	48	7	85	8.71
Ogeechee		2							2			2	8.00
<i>binotatum</i>													
Savannah	2	72						22	43	8	1	74	7.84
	Total Pectoral Rays (both sides)												
	23	24	25	26	27	28	N	Mean					
<i>hopkinsi</i>													
Altamaha		25	8	48	4	10	95	25.64					
Ogeechee				2			2	26.00					
<i>binotatum</i>													
Savannah	2	27	8	28			65	24.95					

* Two atypical fins have counts of I,7 and I,10.

ship to *E. hopkinsi* are *E. swaini* and *E. asprigene*, species that share many diagnostic features. These species differ notably in having separate branchiostegal membranes, the ventrolateral surface bright orange in adult males, and the basicaudal spot much more diffuse, lighter, and median rather than subaxial in position. *E. swaini* usually has larger scales than does *hopkinsi*.

GEOGRAPHIC VARIATION.—Analysis of characters reveals appreciable differences in meristic counts and pigmentation and notable discordance in squamation between specimens from the Altamaha and Ogeechee drainages on one hand and those from the Savannah system on the other. Fin-ray counts (Table 2) indicate that Savannah River

TABLE 3
FREQUENCY DISTRIBUTIONS OF SCALE ROW COUNTS IN *Etheostoma hopkinsi*

Subspecies and Drainage	Scales in Lateral Series												N	Mean		
	39	40	41	42	43	44	45	46	47	48	49	50			51	52
<i>hopkinsi</i>																
Altamaha	4	7	10	17	23	12	14	4	4	1	1	2		99	43.19	
Ogeechee		1	1						2	43.00	
<i>binotatum</i>																
Savannah	1	1	4	7	5	10	6	8	9	10	5	3	..	2	71	45.52
	Scales in Transverse Series								N	Mean						
	10	11	12	13	14	15										
<i>hopkinsi</i>																
Altamaha		3	41	29	14				87	11.62						
Ogeechee				1	1				2	12.50						
<i>binotatum</i>																
Savannah		2	7	35	14	1	1		60	12.13						
	Scales around Caudal Peduncle								N	Mean						
	14	15	16	17	18	19	20									
<i>hopkinsi</i>																
Altamaha		1	8	14	38	19	7		87	17.00						
Ogeechee					2				2	17.00						
<i>binotatum</i>																
Savannah		1	3	9	25	11	10	2	61	17.31						

TABLE 4
DEVELOPMENT OF LATERAL LINE IN *Etheostoma hopkinsi*

Subspecies and Drainage	Pored Scales in Lateral Series																			N	Mean
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44			
<i>hopkinsi</i>																					
Altamaha			1	3	2	5	13	5	7	12	12	9	9	7	5	6	3		99	36.57	
Ogeechee						1	..	..	..	1									2	34.00
<i>binotatum</i>																					
Savannah	1	..	2	1	1	4	14	11	10	8	9	3	2	1	..	..	1	1	69	34.78
	Unpored Scales in Lateral Series															N	Mean				
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14			15			
<i>hopkinsi</i>																					
Altamaha	3	2	5	1	9	9	17	11	12	14	9	5	1	..	1			99	6.75		
Ogeechee									1	..	1							2	9.00		
<i>binotatum</i>																					
Savannah				1	..	..	..	1	8	3	11	19	14	7	3	2		69	10.88	

fish have, on the average, fewer soft-dorsal rays, anal rays, and pectoral rays than do those from the Altamaha basin. Scale counts (Table 3) show somewhat higher averages for the Savannah specimens in lateral and transverse row counts. The lateral line is better developed in the Altamaha basin, with a higher average of pored scales (Table 4) and fewer unpored scales.

The populations of *Etheostoma hopkinsi* from the Altamaha and Savannah drainages are notably similar in pigment features except for the development of blotches on the nape (Table 1). This difference is so consistent that high accuracy in separation can be achieved with this character alone by one familiar with the animals.

Fish from the Altamaha and Ogeechee drainages differ abruptly from those in the Savannah system in the squamation of certain anterior areas. The differences in opercular and prepectoral squamation, in particular, are so consistent that 100 per cent separation of our specimens is possible from examination of either character.

On the basis of the above differences we recognize two subspecies of *Etheostoma hopkinsi*.

Etheostoma hopkinsi hopkinsi (Fowler)

(Pl. I, A; Fig. 1)

DIAGNOSIS.—A subspecies of *Etheostoma hopkinsi* with opercle and cheek fully scaled; prepectoral area well scaled; nape usually fully scaled; posterolateral part of head always with some scales; nape with two poorly-developed, irregular dark blotches; scales somewhat larger, and fin rays somewhat more numerous than in *binotatum*. (See Tables 1 to 5.)

RANGE.—Altamaha and Ogeechee river drainages, above and below the Fall Line, Georgia (Fig. 1).

MATERIAL EXAMINED (all from Georgia).—*Ocmulgee River Drainage*: Oswitchce (=Oscewitchee or Osewitchee) Springs, 10 mi. SE Abbeville, Wilcox Co. (ANSP 71548 [holotype], UG 159, UMMZ 180300, CU 17616, 18458, and 37908). Spring Lake Cr. 2 mi. E Bowens Mill, Wilcox Co. (UG 206). Little Ocmulgee R., 1.2 mi. N McRac, Telfair Co. (CU 17265). Turnpike Cr., 1 mi. E Milan, Telfair Co. (UG 158). Town Cr., Hawkinsville, Pulaski Co. (UMMZ 88351). Little Towaliga Cr., Barnesville, Lamar Co. (UMMZ 88304). Tobesofkee Cr., trib. Ocmulgee R., 5 mi. S Macon, Bibb Co. (UMMZ 88325).

Oconee River Drainage: Richland Cr., 1.5 mi. W Greensboro, Greene Co. (UMMZ 158012). Rocky Cr., at Ga. hwy. 26, 2 mi. E Bleckley Co. line, near Dudley, Laurens Co. (UMMZ 88378). Hunger and Hardship Cr., 5 mi. SW Dublin, Laurens Co. (UMMZ 88381). Trib. Oconee R., 1.5 mi. ENE Glenwood at U.S. hwy. 280, Wheeler Co. (CU 18459).

Altamaha River Drainage: Cobb Cr., 15.7 mi. N Baxley at U.S. hwy. 1, Toombs Co. (CU 21467). Trib. Ohoopsee R., 3 mi. E Wrightsville, at Ga. hwy. 57, Johnson Co. (CU 38492). Trib. Ohoopsee R., 5 mi. E Wrightsville, at Ga. hwy. 57, Johnson Co. (CU 29753). Little Ohoopsee R., Kite, Johnson Co. (UG 482). McKinneys Pond, Emanuel Co. (UG 150B). Ohoopsee R., 15 mi. S Swainsboro, at U.S. hwy. 1, Emanuel Co. (UMMZ 88420). Trib. Ohoopsee R., 15.2 mi. W Swainsboro at U.S. hwy. 80, Emanuel Co. (CU 17685). Little Ohoopsee R., 9.2 mi. W Swainsboro at U.S. hwy. 80, Emanuel Co. (CU 17188). Mulepen Cr., 12 mi. W Swainsboro at U.S. hwy. 80, Emanuel Co. (UG 155). Rocky Cr. at U.S. hwy. 1, W Lyons, Toombs Co. (UG 257). Brozells Cr., trib. Ohoopsee R., 2.3 mi. W Reidsville at U.S. hwy. 80, Tattnall Co. (CU 42885).

Ogeechee River Drainage: Trib. Ogeechee R., 10.2 mi. W Jewell, 1.7 mi. E Sparta, Ga. hwy. 16, Hancock Co. (CU 15599). Ogeechee R. at Effingham-Bullock Co. line (UG).

Etheostoma hopkinsi binotatum, new subspecies

(Pl. I, B, C; Fig. 1)

DIAGNOSIS.—A subspecies of *Etheostoma hopkinsi* with opercle naked; cheek usually imperfectly scaled but sometimes fully scaled or naked; prepectoral area naked or rarely with a few scales; nape naked or, occasionally, imperfectly scaled; posterolateral part of head either scaled or naked; nape with two, well-developed, subrectangular dark blotches; scales somewhat smaller, and fin rays somewhat less numerous than in *E. h. hopkinsi*. (See Tables 1 to 5.)

DESCRIPTION.—*E. h. binotatum* is compared with *E. h. hopkinsi* as well as with *E. fricksium* in Table 1. These species have not, to our knowledge, been collected in association, but since both occur in the same general area they may live together. Fin-ray and scale-row counts are presented in Tables 2 and 3, numbers of pored and unpored scales in the lateral series are given in Table 4, and the squamation of the two subspecies of *E. hopkinsi* is compared in Table 5.

The holotype has the following counts: dorsal fin rays IX, 12; anal rays II, 8; pectoral rays 12–12; lateral line, pored scales 33, unpored 11, total 44; transverse scales downward and backward from origin of second dorsal fin to anal fin, 12 (5 above and 6 below lateral line); caudal peduncle scales $7 + 2 + 9 = 18$. It is an adult male with nuptial tubercles on the pelvic and anal fins and on the belly scales. The nape, opercle, breast, and prepectoral area are naked, the cheek is fully scaled, there are a few scales on the posterolateral angle of the head, and the belly is about half scaled.

The holotype has the following proportions, expressed as thousandths of the standard length (53.0 mm.): body depth at dorsal

TABLE 5
COMPARISON OF SQUAMATION IN SUBSPECIES OF *Etheostoma hopkinsi*

Area	<i>hopkinsi</i>	<i>binotatum</i>
Nape	Usually fully scaled, often imperfectly scaled, naked in about 30 per cent	Naked, imperfectly scaled in about 5 per cent
Posterolateral part of head	Some scales always present	Scales about equally present or absent
Opercle	Fully scaled	Naked
Check	Fully scaled	Usually imperfectly scaled; fully scaled in about 10 per cent; naked in about 20 per cent
Prepectoral	Well scaled	Naked; a few scales only in 2 of 55 specimens
Breast	Naked; a few scales in 2 of 60 specimens	Naked
Belly	Partly scaled	Partly scaled

origin, 217; caudal peduncle depth, 123; body width, 138; caudal peduncle length, 262; highest dorsal spine, 117; highest dorsal soft ray, 134; caudal-fin length, 196; first anal spine, 58; highest anal soft ray, 126; longest pectoral ray, 217; pelvic-fin length, 200; pelvic interspace, 17, or 43 per cent of fin base, which is 40; transpelvic width, 77; head length, 274; head depth at occiput, 157; head width, 159; snout length, 57; orbit length, 60; fleshy interorbital width, 40; upper jaw length, 83; branchiostegal membranes moderately conjoined, meeting at an angle of about 87°, the distance from point of juncture to mandibular symphysis 155, and that from juncture of branchiostegal membranes to base of pelvic fin 140. The angle formed by the upper (measured tangentially at the eye) and lower profiles of the head is about 41°, and the entrance angle of the muzzle is about 64°.

Colors of specimens in UMMZ 137773, collected on March 11 and April 12, 1941, by O. K. Fletcher, Jr., were recorded by Dr. Carl L.

Hubbs when received alive in Ann Arbor on April 16, 1941, as follows: "Dark markings on body, first dorsal, and anal fins deep blue-green (almost turquoise). Submarginal streak on first dorsal brownish red. Light bars of body with deep coppery red spots." Colors noted from a color photograph of a large male in CU 19604 are as follows: Dorsal fin with bright red submarginal band, remainder of fin light green except for a dark margin and a clear area on each side of the red band. Base of fin dark green. Some brownish red flecks on the soft dorsal and pectoral fins. Side of body with 10 bright green diagonal bars, two to three scale rows wide, that extend down onto the belly and encircle the caudal peduncle. These bars are interspersed with coppery red bars which are less well developed than the green bars. Pelvic and anal fins dark. Ground color of body yellow with much brown pigment.

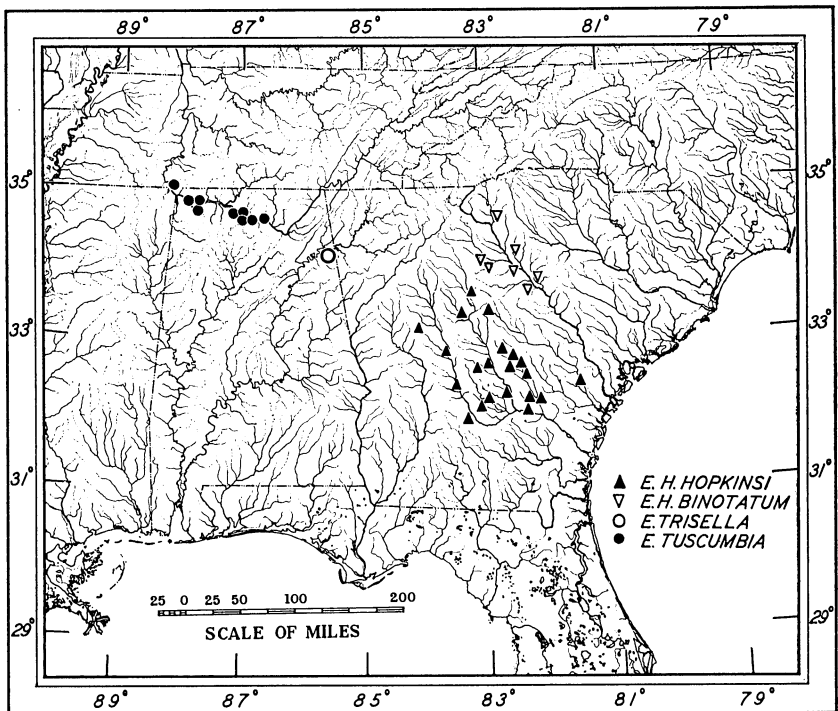


FIG. 1. Alabama, Georgia, South Carolina, and parts of adjoining states showing the distribution by record stations of *Etheostoma (Oligocephalus) hopkinsi* (triangles), *E. (Psychromaster) trisella* (open circle), and *E. (Psychromaster) tuscombiana* (solid circles).

RANGE.—Savannah River system, above and below the Fall Line, Georgia and South Carolina (Fig. 1).

MATERIAL.—The holotype, CU 44157, is an adult male 53.0 mm. in standard length, collected in Calhoun Creek, 7.6 miles east of Calhoun Falls at South Carolina highway 72, Abbeville County, South Carolina, on March 27, 1951, by E. C. Raney, C. R. Robins, R. H. Backus, R. W. Crawford, J. N. Layne, and R. L. Wigley (field number ECR 1932). Taken with the holotype were 19 paratopotypes, 37.4 to 55.4 mm. in standard length (CU 19600, UMMZ 180075).

Additional specimens examined, all from Savannah River drainage, are as follows: *Georgia*: S. Fk. Broad R., 2 mi. W Comer, Madison Co. (UG 269). S. Fk. Broad R., 1–2 mi. S Carlton, Madison Co. (UG 22E, UG 22D). S. Fk. Broad R., Anthony Shoals near Carlton, Madison Co. (UG 22C, CU 43994). Dry Fork Cr., Oglethorpe Co. (UMMZ 133122, UMMZ 133224). Dry Fork Cr., about 1 mi. N U.S. hwy. 78, Oglethorpe and Wilkes cos. (UMMZ 137773). Buffalo Cr., 6 mi. E Lexington, Oglethorpe Co. (UG 283). Lloyds Cr., Lincoln Co. (UG 80). W. Fk. Cliatt Cr., Columbia Co. (UG 90).

South Carolina: Twentythree Mile Cr., 0.9 mi. NW Sandy Springs, 11.1 mi. NW Anderson at U.S. hwy. 76, Anderson Co. (CU 19604). Three mi. E Edgefield Co. line at Ga. hwy. 23, Edgefield Co. (CU 43515).

ETYMOLOGY.—The name *binotatum* is derived from the Latin, *bis*, two, *nota*, mark, and the neuter *-atum* of the adjectival suffix *-atus*, provided with, in reference to the diagnostic spots on the nape. It is likely that these are recognition marks of importance to the fish as well as to the systematist.

SUBGENUS *Psychromaster* JORDAN AND EVERMANN

Psychromaster. Jordan and Evermann, 1896: 1019, 1099. Type species, *Etheostoma tuscumbia* Gilbert and Swain, by original designation.

The new species appears to be most intimately related to *E. (Psychromaster) tuscumbia* Gilbert and Swain. For the present it seems convenient to retain *Psychromaster* as a subgenus of *Etheostoma*, but to modify its description to include both *tuscumbia* and *trisella*.

The subgenus *Psychromaster* may be diagnosed as follows: Lateral line straight or gently arched upward anteriorly, complete or incomplete; infraorbital canal complete, supratemporal canal complete or not; preoperculo-mandibular pores 10; prevomer and palatine well toothed; branchiostegal membranes separate, overlapping anteriorly; branchiostegal rays 6; preopercle entire; top of head and breast naked or closely scaled; nape and opercle covered with exposed, ctenoid scales; cheek partly or entirely covered with ctenoid scales; prepectoral area naked or well scaled; belly covered with unspecialized, ctenoid

scales; body scales of moderate size (43 to 52 in lateral series); flesh opaque; body moderately elongate to rather robust, somewhat compressed; head moderate to large; vertebrae 35 to 37; snout moderately blunt and rounded; premaxillary frenum rather broad; interorbital area narrow, slightly concave. Fin rays: dorsal IX to XI, 11 to 13; anal I (rarely II), the spine rather weak to moderately long and stiff, 7 to 9; pectoral 11 to 13. First dorsal fin moderate or high, the spines without fleshy tips; rays of second dorsal not notably elevated; pectoral fin short and rounded, shorter than head; pelvic fins closely set, usually separated by less than two-thirds of pelvic-fin base; transpelvic width 6.5 to 7.4 per cent of standard length; anus not encircled with fleshy villi. In the male (of *tuscumbia*) the urogenital papilla is elongate, thickened in its basal half, then tapers abruptly into a slender, translucent tube that is slightly crenulate around the aperture. The body is marked with a series of 3 to 6 dark middorsal blotches, and there is a large dark blotch near the caudal base. *Psychromaster* differs from *Oligocephalus*, to which it appears to be most closely related, in typically having a single anal spine. In addition the pectoral fin is shorter than in most if not all species of *Oligocephalus*.

***Etheostoma trisella*, new species**

Trispot Darter

(Pl. I, D, E; Fig. 1)

MATERIAL.—The holotype, UMMZ 180073, a juvenile, 35.2 mm. in standard length, was collected in Cowans Creek (a tributary to Spring Creek, which flows into the Coosa River), at Jordans Farm [and store], at the U.S. highway 411 crossing, 6.7 miles southeast of Centre, Cherokee County, Alabama, on September 13, 1947, by Ernest A. Lachner and Paul S. Handwerk (original Cornell University catalogue number 18579, E. A. Lachner field number 534).

DIAGNOSIS.—*Etheostoma trisella* is a species of the subgenus *Psychromaster* with the lateral line complete; breast and top of head naked; prepectoral area naked or very imperfectly scaled; body moderately slender; supratemporal canal complete; and with three prominent dorsal blotches, one in advance of first dorsal, one between the dorsal fins, and the third just behind the second dorsal fin.

DESCRIPTION.—Proportionally *Etheostoma trisella* is not distinctive among darters such as those of *Oligocephalus*. The following proportions of the holotype are expressed as thousandths of the standard length (35.2 mm.): Body rather elongate and slightly compressed,

depth at dorsal origin, 173; caudal peduncle depth, 114; body width, 119; caudal peduncle length, 239; highest dorsal spine, 125; highest dorsal soft ray, 142; caudal fin length, 230; anal spine slender, not much stronger than first soft ray, the length 60; highest anal soft ray, 136; pectoral much shorter than head, the longest ray 227; pelvic length, 216; pelvics closely approximated, the interspace 20, or 58 per cent of the fin base, which is 34; transpelvic width, 74; head rather large, length 312; head depth at occiput, 168; head breadth between opercles, 165; muzzle blunt, the anterior profile almost vertical, the frenum broad, snout length 62; orbit large, 97; fleshy interorbital width, 48; upper jaw to below front half of pupil, length 97. Branchiostegal membranes entirely separate and overlapping anteriorly, forming an angle of about 34° with one another; distance from point of juncture to mandibular symphysis 122, and distance from juncture of branchiostegal membranes to base of pelvic fin 199. The angle formed by the upper (measured tangentially at the eye) and lower profiles of the head is about 36° .

The spinous dorsal fin has nine spines and is narrowly separated from the soft dorsal, which has 11 rays. The anal rays number I, 8; pectoral rays, 13-13; principal caudal rays (branched rays plus two), 16. The branchiostegal rays are 6-6. Vertebrae, 36.

The body, including the nape and belly, is fully invested with rather large, ctenoid scales. The lateral line is complete, with 47 scales, and there are 13 scales in a transverse series counted downward and backward from the origin of the second dorsal fin to the anal fin. Caudal peduncle scales are 9 above and 9 below the lateral lines, total 20. The breast is naked and the prepectoral area is almost naked (a single imbedded scale seen on the left side). The opercle is fully covered with exposed, ctenoid scales and there are similar scales on the upper part of the cheek. The top of the head is naked except for a few scales near the junction of the lateral and supratemporal canals.

The infraorbital canal is complete with 8 pores (9 on right side) and there are 10 preoperculomandibular pores on each side. The supratemporal canal is complete, with three pores. As usual in darters, there is a postorbital pore, an interorbital pore, and an anterior and a posterior nasal pore on each side, but the branches leading to the coronal pore do not fuse so there are two coronal pores (likely an individual aberration).

Easily the outstanding characteristic of the color pattern in alcohol is the dorsal series of three dark saddles, all of which gradually fade out one or two scale rows above the lateral line. The first lies on the

posterior half of the nape, immediately in front of the dorsal fin, and is inclined slightly downward and forward. The second lies between the bases of the last dorsal spine and the first dorsal soft ray; like the third it is oriented vertically (not as in the species of the *E. variatum* group). The third blotch lies astride the caudal peduncle somewhat closer to the second dorsal fin than to the procurent caudal rays. These three blotches correspond closely in position with three that are present in *E. tuscumbia*, but in that form there are in addition slightly fainter to equally well-developed saddles near the middle of each dorsal fin, and there may be another far back on the peduncle at the origin of the procurent caudal rays. The side in *trisella* is irregularly mottled with ill-defined dark areas, with a large, diffuse dark blotch posteriorly on the caudal peduncle. There is no well-defined humeral blotch. The undersurface of the body is pale and immaculate, with all pigment lost at the sixth scale row below the lateral line. There is a dark interorbital bar that crosses the iris and extends downward across the cheek as a subocular bar. Similar dark bars lie behind and before the eye, and the lips, lower jaw and top of head have irregularly-disposed clumps of melanophores. The spinous dorsal has flecks of dark pigment in its basal half; in the next third the rays have some groups of melanophores but the membranes are clear (colored in life?); near the margin the fin has much dark pigment both on the rays and membranes. In the soft dorsal there are three or four irregular series of dark flecks on the rays. The anal and pelvic fins are light with a few dark flecks on the rays. The rays of the pectoral and caudal fins have many dark flecks that form four or five irregular cross bands. In the basal part of the caudal the membranes are shaded gray with micromelanophores.

COMPARISONS.—*Etheostoma trisella* is interpreted, on the basis of common characters indicated in the subgeneric diagnosis and close overall resemblance, as a relative of *tuscumbia*. Both species live in northern Alabama, but they are allopatric, *tuscumbia* occurring in the Tennessee River drainage and *trisella* in the Coosa River basin (Fig. 1). Ecologically, *tuscumbia* is restricted to springs and spring outlets that are in close proximity to the Tennessee River. The single specimen of *trisella* was taken from a small pasture stream, but we suspect that it usually lives in springs.

Despite indications of relationship, *trisella* differs abundantly from *tuscumbia* as indicated by the comparison in Table 6. In the complete lateral line and supratemporal canals *trisella* is less specialized than *tuscumbia*. The more fully scaled head and breast of *tuscumbia*

TABLE 6
COMPARISON OF SPECIES OF THE SUBGENUS *Psychromaster* (GENUS *Etheostoma*)

Character	<i>trisella</i>	<i>tuscumbia</i>
Lateral line	Complete	Extends to below front of second dorsal; 18 to 29 unpored scales
Supratemporal canal	Complete	Widely interrupted
Middorsal saddles	3	(4) 5 or 6
Lateral blotches	Not distinct	Well defined
Pectoral rays	13	11 or 12
Breast	Naked	Well scaled
Prepectoral area	Few or no scales	Well scaled
Cheek	Lower part naked	Fully scaled
Top of head	Median part naked	Well scaled
Posterior blotch on side..	On caudal peduncle	On base of caudal rays
Body form	More slender	More robust
Anal spine	Slender; little thicker than first soft ray	Strong; much thicker than first soft ray

perhaps also point to increased specialization, but the small number of dorsal blotches of *trisella* is likely a derived condition.

The placement of *trisella* in *Psychromaster* depends in part on its possession of a single anal spine. This condition is normal in the species of *Ammocrypta*, in the subgenus *Austroperca*, and in *E. tuscumbia*, as well as in some forms of the subgenera *Boleosoma*, *Hololepis*, and *Microperca*. But in some species, for example in certain populations of *Etheostoma nigrum*, *E. parvipinne*, and *E. vitreum*, the anal spines number one or two, and in still other species a single spine occurs as an infrequent or rare variation or not at all. If more material demon-

strates that *trisella* typically or usually has two anal spines, not only will its reference to *Psychromaster* need be reconsidered, but the separation of that group from *Oligocephalus* should be reviewed.

HABITAT.—Until recently, Cowans Creek at the type locality of *E. trisella* was a small, sluggish stream that was heavily overgrown with emergent *Dianthera*, making seining difficult. Following the capture of the holotype in 1947, this station was visited by Bailey in 1954 and 1956, but although a specimen of *Etheostoma (Ulocentra) coosae* and several individuals of *E. (Boleosoma) stigmaeum* were taken, *trisella* was not caught. The stream flowed through a pasture and had a bottom of silt mixed with sand and fine gravel. There was but scanty flow and few fishes were taken. Of these, *Semotilus atromaculatus*, *Notropis chrysocephalus*, *Gambusia affinis*, and *Lepomis cyanellus* were the most common.

In 1960 Cowans Creek was inundated by Weiss Lake, a 45-square-mile impoundment of the Coosa River formed behind Weiss Dam, which is operated by the Alabama Power Company. Richards visited the type locality in September, 1962, and found it to be flooded to a depth of 15 feet. He discovered no suitable habitat for the species in the vicinity. Thus, *E. trisella*, like *E. acuticeps* Bailey (1959), is apparently extinct at the only known station of occurrence, both sites having been converted into reservoirs.

ETYMOLOGY.—The specific name *trisella* is a Latin substantive derived from *tri-*, three, and *sella*, a saddle, in reference to the diagnostic significance of the series of three dark saddles on the back.

DISTRIBUTION OF *Etheostoma tuscumbia*

(Fig. 1)

The spring darter, *Etheostoma (Psychromaster) tuscumbia* Gilbert and Swain, has a very restricted range (Fig. 1) and is little known. The following collections are plotted on the distribution map and represent all of the localities for the species known to us. Most of these stations were visited in preimpoundment surveys of Tennessee Valley Authority mainstream reservoirs, and several of the populations have perhaps disappeared following impoundment.

ALABAMA

UMMZ 115180, Huntsville Spring Branch, T. 5 S, R. 1 W, sec. 17, Madison Co. UMMZ 132293 and 132301, springs near Rockhouse Landing, T. 5 S, R. 3 W, sec. 34, Limestone Co. UMMZ 115133, Allen Pond, 1 mi. W Rockhouse Landing, T. 5 S, R. 3 W, secs. 28 and 33, Limestone Co. UMMZ 115120, Blair Spring, 1 mi. E Rockhouse Landing, T. 5 S, R. 3 W, sec. 25, Limestone Co. UMMZ 104244 and

USNM 117593, Harris Spring Pond, about 3 mi. N Decatur, Limestone Co. UMMZ 114698 and 159174, Pryor Springs and Spring Branch, 4 mi. NNE Decatur, T. 4 S, R. 4 W, Limestone Co. USNM 43535, Decatur, Morgan Co. UMMZ 115552, impounded pond near mouth of Mallets Cr., T. 4 S, R. 6 W, sec. 10, Lawrence Co. UMMZ 122898, Mallard Cr., T. 4 S, R. 6 W, sec. 20, just above impounded water of Wheeler Reservoir, Lawrence Co. USNM 36154 (holotype of *E. tuscumbia*, now reduced to fragments), UMMZ 61717, USNM 43484, USNM 63115 (paratopotypes), Spring Branch flowing from Tuscumbia Spring, Tuscumbia, Colbert Co. USNM 125096, Tuscumbia, Colbert Co. UMMZ 114703, Big Spring, Tuscumbia, Colbert Co. UMMZ 132686, Cave Spring, near Smithsonia, T. 3 S, R. 13 W, sec. 15, Lauderdale Co. SU 2683, Florence, Lauderdale Co.

TENNESSEE

UMMZ 132576, Spring Branch, tributary to Dry Creek, near Walnut Grove, Hardin Co. USNM 109437, Big Spring, opposite Dry Creek Cave, at base of Cave Bluffs on east side of Tennessee R., Hardin Co.

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PLATE I

Etheostoma hopkinsi and *Etheostoma trisella*

- A. *Etheostoma hopkinsi hopkinsi* (Fowler). Dorsal view of a topotype (UMMZ 180300), 44.5 mm. in standard length.
- B. *Etheostoma hopkinsi binotatum*, new subspecies. Dorsal view of the holotype (CU 44157), 53.0 mm. long.
- C. *Etheostoma hopkinsi binotatum*. Lateral view of the holotype.
- D. *Etheostoma trisella*, new species. Dorsal view of the holotype (UMMZ 180073), 35.2 mm. long.
- E. *Etheostoma trisella*. Lateral view of the holotype.

(Photographs by University of Michigan Photographic Services)

