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THE SUBSPECIES OF THE AMERICAN PERCID FISH,  
*POECILICHTHYS WHIPPLII*

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IN the course of an ichthyological survey of Arkansas, the junior author has disclosed the existence of two unnamed forms of the redbfin darter, *Poecilichthys whipplii*. Although they are only weakly characterized by average differences, these forms are here described as new subspecies. One of them, a very fine-scaled, small-eyed mountain form, is named *P. w. montanus*. It abounds in an Arkansas River tributary variously known and mapped as Clear Creek, Frog Bayou, and Jones Creek, and situated in Washington and Crawford counties, Arkansas. Here it replaces the typical subspecies, which inhabits other Arkansas River tributaries in Arkansas, northeastern Oklahoma, southeastern Kansas, and southwestern Missouri, and the White River system of Arkansas. The Red River drainage basin of Arkansas, Oklahoma, and Texas, and the coastal streams of eastern Texas, are occupied by the new subspecies, *P. w. radiosus*. The coarser scales of *radiosus* were indicated by the data given by Meek (1891: 139) and by the count of an especially large-scaled specimen that has been cited as a troublesome variant (Gilbert, 1887: 62; Jordan and Evermann, 1896: 1095). In the size of the scales *P. w. radiosus* bridges over the distinction between typical *whiplii* and its eastern representative *Poecilichthys artesiaae*, which is there-

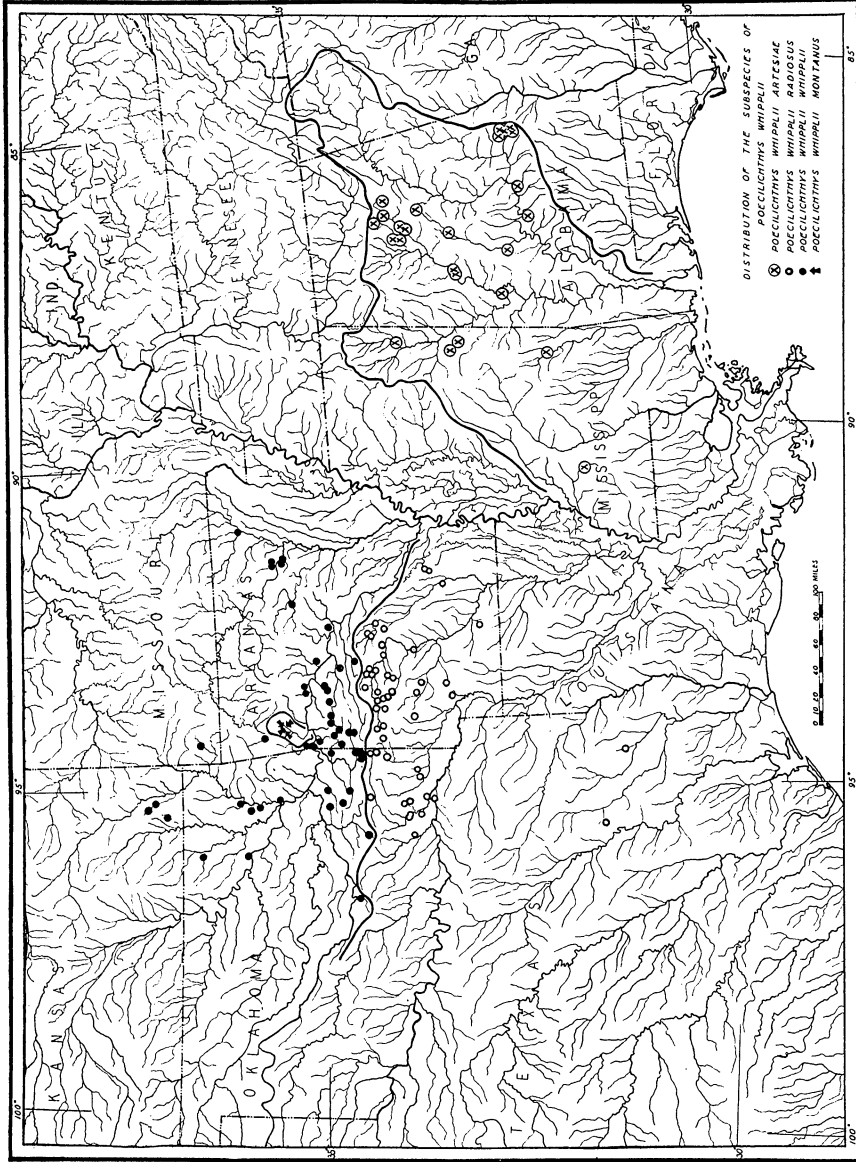
fore also regarded as a subspecies of *P. whipplii*. Were it not for the higher average number of dorsal soft-rays in the Red River form, it would not be practicable to distinguish *radiosus* from *artesiae*. We find no reason to maintain the nominal form *alabamae* as distinct from *P. w. artesiae*. With the exception of two new records (the Pascagoula River system near Enterprise, and a tributary of the Mississippi River near Hazelhurst, both in Mississippi) *artesiae* is known only from the drainage basin of the Alabama River.

The interesting distribution of the subspecies of *Poecilichthys whipplii* is shown on Map 1. All available record stations are indicated, since almost all of the literature records have been confirmed by a re-examination of the original material. We have studied all specimens of the species in the United States National Museum (U.S.N.M.), the University of Michigan Museum of Zoology (U.M.M.Z.), the Museum of Comparative Zoology (M.C.Z.), and the Iowa State College (I.S.C.). For the privilege of so doing we are very grateful to the authorities of these institutions. We are also indebted to Professor Frank E. Guyton and Dr. Reeve M. Bailey, for making available most of the specimens of *P. w. artesiae* which we have examined. In addition, Professor Guyton took particular pains in preserving and promptly sending a high nuptial male, for a description of the life colors, and Dr. Bailey furnished one of two specimens of *P. w. radiosus* from Texas.

#### THE GENERIC REFERENCE

The vagueness and impracticability of the separation of *Poecilichthys* into small genera is exemplified by the recent reference of the synonyms, *artesiae* and *alabamae*, to different genera (Jordan, Evermann, and Clark, 1930: 292). The status of *Poecilichthys* is treated in another paper (Hubbs and Black, 1940).

The four forms here regarded as subspecies of *Poecilichthys whipplii* agree with one another in essential respects and almost certainly comprise a single *Formenkreis*. The group as a whole differs from every other species of darter in some items of the following description.



MAP 1. Distribution of the subspecies of *Poeciliichthys whipplei*, as indicated by all published and original record stations.

COMMON CHARACTERS OF THE SUBSPECIES OF  
*Poeciliichthys whipplii*

The body is compressed and moderately slender (depth 4.4 to 6.2 in standard length). The parietal region of the cranium is strongly convex; the interorbital region is of moderate width. The rather sharply pointed snout measures 4.1 to 5.7 times in the slender head. Even when shortened the snout never has an abruptly decurved contour. The well-developed frenum shows no tendency toward obliteration when the mouth is tightly closed. The upper lip projects beyond the snout and slightly beyond the tip of the lower jaw (the mandible is more strongly included in *P. w. montanus* than in the other forms). The mouth is rather large (for a darter): the upper jaw extends to below the pupil. The gape is rather narrow and V-shaped as seen from below. The curved-conic teeth, forming rather broad villiform bands on the jaws, vomer, and palatines, are considerably enlarged only in the outer row of the premaxillary band. The gill-membranes are rather broadly united but retain a V-shaped outline. The distance from the union of the gill-membranes to the tip of the mandible measures 1.6 to 2.0 times in the head.

The genital papilla is typically a squarish flap, rarely subtriangular. It is usually about as broad as long (measured from the anus), but varies considerably in width. The posterior margin is rarely entire, usually with a median incision or emargination, sometimes with one to several flaps between creases on the surface of the papilla. In the adult female the papilla overlaps the front of the first anal ray. In the male it is similar but somewhat smaller. Radiating ridges (rarely papillae) occur about the anus.

The 8 pores of the lateral canal of the head are at the end of short branches extending downward and backward. The supratemporal commissure is complete; the median pore and the lateral pore are each at the end of a short tube. The interorbital pores are present. The anterior and posterior nasals lie a short distance anterior and mesial to the corresponding nostril. The coronal pore is at the end of a tube. The com-

plete infraorbital canal opens in 8, occasionally 9 pores (rarely 7 in *P. w. radiosus*), of which the second and third, rarely the second to fourth, lie near the edge of the suborbital; the following pores usually open at the end of short downward projecting tubes, though the fourth pore is often on the canal. There are 10 operculomandibular pores. (See Hubbs and Cannon, 1935: 10.)

The submedian and nearly straight lateral line is typically about three-fourths complete, leaving 2 to 21 unpored scales (occasionally none in *P. w. artesiaae*). The scales of the mid-ventral line are not modified. Except for a small temporal patch on each side, the top of the head is devoid of scales. The nape is usually but not always well covered with more or less embedded scales. The squamation of the sides of the head is highly variable: the opercles are usually well covered with scales which are commonly embedded (and rarely lacking in *P. w. radiosus*); the cheek scales are often absent, or developed only near the eye, and when present they are usually cycloid and embedded. The breast is scaleless. In size the body scales vary from moderate to small, numbering from 43 to 75 (Table I).<sup>1</sup>

Typically, the dorsal fins are neither markedly conjoined nor separated, and are neither low nor notably elevated. The dorsal rays number IX to XII, 11 to 16 (Table IV). In the breeding males the dorsal spines do not bear terminal knobs, and the soft rays are not exerted. The 2 (very rarely 3) anal spines are stiff and pungent. The soft portion of the anal, with 7 to 9 (very rarely 5 or 6) rays, is much smaller than the second dorsal. The anal fin is not greatly expanded and is not tuberculate in the breeding males. The caudal fin is truncate. The pelvics are closely approximated and short, usually extending not much more than halfway to the anal origin. The short and rounded pectoral extends only to above the end of the pelvic (with some variation).

The adults as a rule are irregularly spotted with red, and

<sup>1</sup> The scales in *artesiaae* vary from 43 to 58 according to the counts by Gilbert and Swain (in Gilbert, 1887: 62).

the high males are largely crimson. The color pattern of the body is rather vague and extremely variable, but neither bars nor stripes are ever very conspicuous. The black humeral mark is rather well developed. The sides of the head are typically punctulate and often mottled and are marked with a long, narrow subocular bar, a streak across the snout, a short dash behind the eye, and usually a similar short opercular dash on the same horizontal line. The entire length of the spinous dorsal is normally marked in both sexes by a submarginal red band with clear borders and by a dark margin. The second dorsal and caudal fins are similarly colored in the adult males, but in the females these fins are barred. On the second dorsal the bars are almost wholly confined to the membranes, but on the caudal the markings extend across the rays as well. Of the 3 dark spots in a vertical line on the caudal base, the uppermost is the least developed.

The forms of *Poecilichthys whipplii* are large (for darters). The maximum standard lengths of the specimens at hand are: *P. w. artesia*, 70 mm.; *P. w. radiosus*, 60 mm. (but commonly mature at a much smaller size); *P. w. whipplii*, 66 mm.; *P. w. montanus*, 75 mm.

#### COMPARISON OF SUBSPECIES

The main character by which *artesia* has been distinguished from *whiplii* is the size of the scales. The distinction does not hold as sharply as generally indicated, but is still of value. Each of the four subspecies has a distinctive average number of scales, and the difference between the extreme forms, *artesia* and *montanus*, is well marked (Table I). The two other subspecies bridge over the gap, though *radiosus* is close to *artesia* and typical *whiplii* is almost as extreme in the other direction as *montanus*. The differences, however, appear on statistical grounds to be reasonably reliable (Table VI). The counts for *montanus* are consistently high (Table I), and those for *whiplii* average less than 65 for all 16 localities for which there are more than 2 counts, with 1 exception: 5 counts for Lees Creek, Van Buren County, Arkansas, average 65.6 (it

is possible that this series should be referred to *montanus*). The difference between *radiosus* of the Red River drainage and *whipplei* of the Arkansas and White river drainages is rather sharp: on the sole basis of the scale counts as represented in Table I, 86 per cent of the specimens of the two forms, when examined in equal numbers, are identifiable if the break in the count is assumed to lie between 59 and 60. In the scale counts of *radiosus* there is some local variation, without any definite geographic trend.

The Red River form, *radiosus*, has only a slightly higher average number of scales than the Alabama River subspecies, *artesiaae*. Were it not for a higher average number of unpored scales in the lateral line series (Table III) and of dorsal soft rays (Table IV), it would not be feasible to separate *radiosus* from *artesiaae*, despite the fact that no representatives of the species are known from a rather wide band of intervening waters. On the bases of the available counts for these respective characters, 71 and 82 per cent of the specimens may be regarded as identifiable (in these computations the specimens of *artesiaae* from the Mississippi River system have been disregarded, though they are essentially typical). In the number of unpored scales and of soft dorsal rays *radiosus* agrees rather closely with the two other western subspecies. *P. w. radiosus* seems to be the smallest form.

The two subspecies of the Arkansas River basin, *P. w. whipplei* and *P. w. montanus*, would probably not have been separated on the sole basis of the average difference in number of scale rows. There are, however, a number of other average discrepancies. The difference in the scale counts appears much more definite when the numbers of pored scales are compared (Table II): on that basis 84 per cent of all specimens of the two forms when represented by equal numbers may be identified, if we assume that the pored scale count of *whipplei* should be 36 to 54, and that of *montanus*, 55 to 68. As a rule the eye is smaller and the snout longer in *montanus*, at comparable sizes (Table V). *P. w. montanus* seems to average somewhat larger and usually to have a slightly different

physiognomy: the snout is not only longer but is also somewhat more hooked downward, so that the mouth is more nearly horizontal, and the lower jaw is more definitely included.

### 1. *Poeciliichthys whipplii artesiae* Hay

#### Eastern Redfin Darter

*Poeciliichthys artesiae*.—Hay, 1881: 494, 515 (original description; tributary of Catawba River, Mississippi). Jordan and Gilbert, 1883: 516–17 (description; after Hay).

*Etheostoma artesiae*.—Jordan, 1885: 868. Jordan and Evermann, 1896: 1094 (description; range).

*Nivicola artesiae*.—Jordan, Evermann, and Clark, 1930: 292 (after Jordan and Evermann).

*Catonotus artesiae*.—Schrenkeisen, 1938: 232 (characters; Georgia to Texas).

*Etheostoma whipplei alabamiae*.—Gilbert and Swain, in Gilbert, 1887: 62 (diagnosis and comparisons; Black Warrior River, near Morris and Tuscaloosa, Alabama). Gilbert, 1891: 156–57 (records, Alabama).

*Etheostoma alabamiae*.—Jordan and Evermann, 1896: 1095 (description and comparisons; range).

*Claricola alabamiae*.—Jordan, Evermann, and Clark, 1930: 292 (range and synonymy, after Jordan and Evermann).

*Catonotus alabamiae*.—Schrenkeisen, 1938: 232 (characters).

*Etheostoma whipplii* (identification to species only).—Boulenger, 1895: 84–85 (description, synonymy, and range, in part).

In 20 specimens from 19 to 65 mm. in standard length the head enters the standard length 2.9 to 3.4 times; the depth, 4.4 to 5.5 times; the eye enters the head 3.8 to 5.8 times; the snout, 4.3 to 5.7 times. The distance from the union of the gill-membranes to the tip of the mandible measures 1.6 to 2.0 times in the head. The nape is usually completely covered with more or less embedded scales. The opercles are well scaled in nearly all specimens, and generally are not embedded. The cheeks vary from scaleless to about one-fourth covered with embedded scales.

When fresh in formaldehyde, a high male collected by F. E. Guyton at Auburn, Alabama, on April 18, showed the following colors: The background is pale yellowish above, whitish below, becoming blue-gray on the breast. The lower side of



the head is pale. The mid-sides are irregularly splashed with deep, brilliant red. The red spots composing the splashes decrease in size toward the back, becoming faint near the dorsal fin; on the lower side they become larger and are more joined in groups. Almost to the mid-line the sides of the abdomen are red; this color is strongest on the scale borders. There is a ring of gold around the pupil. Throughout its length the spinous dorsal bears an even, brilliant, deep red band, bounded with pale, and the fin is edged with dusky green (no doubt blue in life). There is a deep red spot near the base of each interspinous membrane. The soft dorsal has a submarginal, deep red band, with tongues extending basally on the membranes, just in advance of each ray, and breaking up ventrally into spots; there is a yellowish streak just beyond the red band and within the dark margin (blue in life). The caudal fin has a broad, submarginal band of deep red, separated from the dark margin by a yellowish streak; the red band sends streamers about one-third the distance to the base of the membranes. On the caudal base there is a band of orange blotches. Except for a wide margin of bright green (blue in life), the anal fin is a bright, deep red, becoming yellow only at the extreme base. The pectoral fin is pale lemon with some red on the rays. The pelvics are deep green (blue in life).

The range of *P. w. artesia* is commonly given as "Georgia to Central Texas (Palestine)," following Jordan and Evermann (1896: 1094). The only Georgia record, however, is that of a specimen (M.C.Z. No. 24524) in the Museum of Comparative Zoology with no further data; it perhaps came from the Alabama River system in Georgia. The record from Palestine, Texas, is here referred to *P. w. radiosus*. The specimen (M.C.Z. No. 24563) from "an artesian well in Alabama," mentioned by Jordan and Evermann (1896: 1094), proves on re-examination to be referable to *P. parvipinnis* Gilbert and Swain (in Gilbert, 1887: 59-60), a valid species which was wrongly synonymized with *Etheostoma squamiceps* by Jordan and Evermann (1896: 1096).

2. *Poecilichthys whipplii radiosus*, new subspecies

## Southern Redfin Darter

(Pl. I, Fig. 1)

- Etheostoma whipplei* (identification to species only).—Jordan and Gilbert, 1886: 13 (color; "Washita" and Saline rivers, Arkansas). Gilbert, 1887: 61–62 (records only; "Saline River at Benton, and Washita River at Arkadelphia, Ark."); including supposedly aberrant specimen, with 48 lateral line scales). Jordan, 1888: 131–32 (range, in part). Meek, 1891: 139 (scales 50 to 60; Ouachita River, Arkansas); 1894a: 272 (records, in part); 1894b: 91, 93 (records, Arkansas). Jordan, 1899: 131–32, 357 (range, in part).
- Etheostoma whipplii*.—Boulenger, 1895: 84–85 (description, synonymy and range, in part). Meek, 1896: 343 (records, Red River system, Oklahoma and Texas). Jordan and Evermann, 1896: 1095–96 (range in part; including aberrant specimen, with 48 lateral line scales, from "Washita River at Arkadelphia, Arkansas"). Fowler, 1904: 248–49 (color note; Limestone Gap, Indian Territory). Cockerell, 1913: 156 (scale; "Kaimishi, I. T.").
- Poecilichthys whipplii*.—Cockerell, 1927: 18 (scale). Ortenburger and Hubbs, 1927: 136–37 (records, Oklahoma). Hubbs and Ortenburger, 1929: 104 (records, Oklahoma and Arkansas).
- Claricola whipplii*.—Jordan, 1929: 168 (range, in part). Jordan, Evermann, and Clark, 1930: 292 (range, in part).

The holotype, an adult male 50 mm. in standard length, was collected by John D. and Ruby Y. Black on June 19, 1938, in Sugar Loaf Creek, tributary of Caddo River, Ouachita River system, on U. S. highway 70, in Township 4 S., Range 22 W., Hot Spring County, Arkansas; U.M.M.Z. No. 123080. Numerous other specimens from the Red River drainage are designated as paratypes. The localities are indicated on Map 1.

The distinctive characters of this form, as contrasted with its near relatives *P. w. artesia* and *P. w. whipplii* are given on pp. 6–7 and in Tables I to V. In most respects *radiosus* agrees with the other subspecies of *P. whipplii*; the common characters of the species, as given on pp. 4–6, apply completely to this subspecies.

In 13 specimens from 22 to 60 mm. in standard length the head enters the standard length 2.9 to 3.5 times; the depth, 4.5 to 5.5 times; the eye enters the head 4.1 to 5.5 times; the

snout, 4.6 to 5.3 times. The distance from the union of the gill-membranes to the tip of the mandible measures 1.6 to 1.9, usually about 1.7 times in the head.

The nape is well covered with embedded scales, of which some are exposed in a few specimens. The cheeks and opercles vary from scaleless to well scaled. When the cheeks are well covered, the scales are embedded.

The color pattern of the body is extremely variable. In many specimens the bars are completely disrupted into mottlings. In others they are moderately sharp and either narrow and solid or broader and hollow-centered. Some have a row of small dusky or blackish blotches along the mid-line. These blotches are most distinct and most frequently developed in the upper tributaries of the Ouachita River, where the sides of the head are clearer than usual; but even here large series show the whole range of variation. Some examples are marked with narrow, moderately intense lengthwise stripes.

The life colors are probably similar to those of the other subspecies, but may also show local and individual variation (Jordan and Gilbert, 1886: 13). Fowler's description (1904: 248) is in the main correct, though his account of the fin colors is misleading, if not actually incorrect.

Contrary to the indication of Jordan and Gilbert (1886: 13), this form, like the other subspecies, develops red pigment in the adults. Specimens from Gulpha Creek, tributary to the Ouachita River, near Hot Springs, Arkansas, were described as follows from preserved specimens which still retained some of the life colors: The body is marked with small blackish flecks on a background of olive tan. Similar flecks are especially conspicuous on the otherwise immaculate lower side of the head and breast, and on the cheeks and pectoral base. Small red blotches, covering about 1 to 3 scales, occur both above and below the lateral line. Just below the lateral line a row of 10 to 12 black blotches forms an interrupted lateral band. The back is tessellated with similar blotches. On the lower side the blotches are more scattered and smaller, covering 1 to 3 scales. In both sexes the first dorsal is blue

on the basal two-thirds, then shows a narrow creamy-clear band, a stripe of red, another and stronger clear band, and a border of blue; the red and clear stripes fade out posteriorly in some fish. In males the soft dorsal is dusky (presumably blue in life) on the basal two-thirds, grading into orange, inside a sharp subterminal clear stripe and strong blue border. In females the second dorsal has the same general pattern, but is checkered with light and dusky, obscuring the striped pattern. The caudal in the males is clear, grading backward through pale orange into red, followed by a narrow clear band, a broad subterminal blue bar, and a narrow clear margin. In females the caudal is finely checkered with dark and light, with terminal bands as in the males. The anal is similar to the soft dorsal, but not checkered, and basally paler, and with the orange band much stronger and much wider, covering about one-half of the fin. The pectoral is faintly washed with orange and has minute dusky flecks along the edges of the rays. The pelvic shows no orange, but is dusky on the membranes.

In life a highly colored female from Wolf Creek at Delight, Arkansas, showed the following colors: Numerous light spots on the sides vary from lemon to red. There is a prominent wash of chestnut on each side of the belly. The orange bars between the dark blotches on the posterior part of the body do not encircle the caudal peduncle below. Longitudinal striping is rather conspicuous. In the spinous dorsal the spines are clear and the membranes bluish basally, then clear, then blue, then orange red in a prominent stripe widest posteriorly, then clear, and finally bordered with a band of slaty blue. The soft dorsal and caudal fins are checkered with black and reddish orange, with a bluish black terminal band. The anal is similar, but has the orange area more extensive and brighter, with a narrow bluish subterminal band within a clear margin. The pectoral, which is tinged with lemon, and the pelvic are flecked with black along the rays.

The holotype agrees in all respects with the description of the species. Its special features are as follows: Scales,

8—(40 + 15 = 55)—10. Opercles with a few scales; breast and cheeks scaleless; nape covered with embedded scales. Dorsal rays, XI, 14; anal rays, II, 8; branched caudal rays, 15; pectoral rays, 12–12.

Depth, 5.2. Greatest width, 1.5 into projection of greatest depth. Head length, 3.2. Least suborbital width, 14.0 in head. Least interorbital width, 2.7 in eye. Eye, 4.8 in head, 1.1 in snout. Snout, 4.6 in head. Upper jaw, 3.4 in head. Angle of muzzle (not including the truncated lips),  $57^\circ$ ; of mouth,  $37^\circ$  with the horizontal; of gill-membranes,  $52^\circ$ . Eye, 2.9 in distance from tip of mandible to union of gill-membranes; latter distance, 1.8 in head and 0.8 times interspace between union of membranes and insertion of pelvic fin. Highest dorsal spine, 2.7 in head, 2.6 in first dorsal base, and 1.4 in the highest dorsal soft ray, which enters the head 2.1 times and the second dorsal base 1.6 times. Length of caudal fin, 1.5 in head. Highest anal ray, 2.0 in head and 0.8 in the anal base, which enters the head 2.4 times, and the second dorsal base 1.8 times. Longest pectoral ray 1.3 in head; length of pelvic fin, 1.3. Interspace between pelvic fins, 2.0 in pelvic base.

The record of Palestine, Texas, first given by Jordan and Evermann (1896: 1094), was based on a specimen (U.S.N.M. No. 34712) of *P. whipplii radiosus* sent to the National Museum by E. L. Yoakum of that city, without a definite statement that it was caught in the vicinity of Palestine, Texas. It was probably obtained locally, and the record has recently been verified by the collection of another specimen in the Neches River system, 6.3 miles southeast of Nacogdoches, Texas. The Palestine specimen has the following characters: standard length, 54 mm.; eye in snout, 1.1; dorsal, XI, 13; anal, II, 8; scales,  $52 + 7 = 59$ . The one from near Nacogdoches has: standard length, 28 mm.; eye in snout, 1.0; dorsal, XI, 14; anal, II, 8; scales,  $45 + 12 = 57$  (the counts for this specimen are not included in Tables I–VI). The species *whiplii* is not listed by Evermann and Kendall (1894) in their review of the fishes of Texas, although Jordan and Gilbert gave the range of *Poecil-*

*ichthys punctulatus* (which name they wrongly used for *P. whipplii*) as "Missouri to Texas." Without doubt the Missouri record referred to true *punctulatus*. The reason for including Texas in the range was obviously the unpublished identification, as "*Etheostoma whipplei* (Texas variety)," of a specimen of *Poeciliichthys jessiae* collected by Jordan and Gilbert in Sabine River at Longview, Texas (examined in the National Museum).

A highly successful darter with a wide range of habitat tolerance, this subspecies ascends headwaters even above the limit of *Semotilus* and *Campostoma* in the colder, more torrential streams of the Ouachita region, and at the same time is a common form in the muddy lowland bayous along with *Hololepis* and *Gambusia*.

The name *radiosus* refers to the large number of soft dorsal rays.

### 3. *Poeciliichthys whipplii whipplii* (Girard)

#### Western Redfin Darter

*Boleichthys whipplii*.—Girard, 1859: 103 (original description; "Coal creek, Arkansas" [= Coal Creek, a southern tributary of the Arkansas River in eastern Oklahoma]).

*Boleosoma whipplii*.—Vaillant, 1873: 96-97 (after Girard).

*Etheostoma whipplei*.—Jordan, 1885: 869 (compared with and removed from synonymy of *Poeciliichthys punctulatus*). Jordan and Eigenmann, 1885: 71 (skeleton; pyloric caeca). Jordan and Gilbert, 1886: 9 (color; type examined; removed from synonymy of *P. punctulatus*). Gilbert, 1887: 61 (description; compared with *E. punctulatum*; Poteau River record only). Jordan, 1888: 131-32 (range, in part; description). Gilbert, 1889: 610 (tributary, Poteau River, Arkansas). Meek, 1891: 131 (North Fork, White River, south of Cabool, Missouri); 1894a: 272 (records, in part); 1894b: 80, 83, 86, 90, 91, 93, and 94 (records and distribution, Arkansas; McAlester, Oklahoma). Evermann and Kendall, 1895: 471 (description; Indian Creek, near Neosho, Missouri; Sallisaw River, at Mackey, Indian Territory). Jordan, 1899: 131-32, 357 (range, in part; description).

*Etheostoma whipplii*.—Boulenger, 1895: 84-85 (description, synonymy, and range, in part). Meek, 1896: 343 (records, Arkansas River system, Oklahoma and Arkansas). Jordan and Evermann, 1896:

1095-96 (synonymy, description, and range, in part). Fowler, 1904: 248-49 (color note; Hartford, Arkansas).

*Claricola whipplii*.—Jordan, 1929: 168 (range, in part; description), Jordan, Evermann, and Clark, 1930: 292 (range, in part). Pratt, 1935: 127 (description; lower Arkansas basin).

*Catonotus whipplii*.—Schrenkeisen, 1938: 232 (description; lower Arkansas basin).

*Poecilichthys punctulatus* (erroneous synonymizing).—Jordan and Gilbert, 1883: 516 (range, in part; description).

In 17 specimens from 20 to 61 mm. in standard length the head enters the standard length 2.8 to 3.5 times; the depth, 4.7 to 6.2 times; the eye enters the head 4.4 to 6.0 times; the snout, 4.2 to 5.2 times. The distance from the union of the gill-membranes measures 1.6 to 1.9, usually about 1.8 times in the head. The nape consistently is completely scaled, but about half the scales are embedded. The scales on the cheeks and on the opercles vary from a few embedded ones to a complete set of exposed ones.

Observations on live and freshly preserved material show that the life colors of this subspecies are essentially like those described for *radiosus* and *montanus*. Pilsbry's notes on the life colors of this subspecies (Fowler, 1904: 249) are incorrect, since the fins of no form of *P. whipplii* are ever bordered with red, and since no specimen that we have examined shows "green spines and rays." The anal border is blue, not green.

Apparently this form is not so well adapted to the lowland habitat as is *P. w. radiosus*, but it is common in most small tributary creeks of the Arkansas River within its range and likewise ascends the headwaters into the smallest of mountain brooks.

#### 4. *Poecilichthys whipplii montanus*, new subspecies Mountain Redfin Darter

(Pl. I, Fig. 2)

The holotype is an adult male 75 mm. in standard length, collected by John D. Black and Jack Yerton on June 17, 1939, near the head of Blue Hole Creek, a tributary of Clear Creek, one mile south of Winslow, Washington County, Arkansas; U.M.M.Z. No. 127777.

There are 499 paratypes, as follows: 7 with the holotype; 227 from East Branch of Blue Hole Creek; 100 from the lower part of Blue Hole Creek; 107 from Railroad Creek just below the mouth of Blue Hole Creek; 53 from 1 mile below the junction of these streams; 4 from Schaberg Creek (of which Railroad Creek is the main tributary) at Schaberg, Crawford County; and 1 from Jones Fork of Clear Creek, near Winfrey, Crawford County. The other headwaters of Clear Creek have not been explored, nor have those of adjacent tributaries of the Arkansas River. Map 1 shows the location of these collections.

The principal characteristics by which *P. w. montanus* is separated from *P. w. whipplii*, its nearest relative, have been given on pp. 6-8, in Tables I-V, and on Plate I. The characters common to this and the other subspecies of *P. whipplii* are given on pp. 4-6. In 50 specimens from 22 to 75 mm. in standard length the head enters the standard length 3.2 to 3.6 times; the depth, 4.9 to 5.5 times; the eye enters the head 4.3 to 6.8 times; the snout, 4.1 to 5.1 times. The distance from the union of the gill-membranes to the tip of the mandible measures 1.7 to 2.0, usually 1.8 to 1.9 times in the head.

The nape is always well covered with small, embedded scales. The opercles vary from one-half to well scaled, and most of the scales are embedded. The invariably embedded cheek scales vary from a few to a complete investment and are often limited to two or three rows just back of the eye.

The color pattern of the body, as in the other subspecies of *P. whipplii*, is extremely variable. The remarks on this subject given above in the account of *P. w. radiosus* apply almost as well to *P. w. montanus*, except that the tendency toward the transformation of the main row of blotches into an interrupted lateral band, often evident in *radiosus*, is not seen in *montanus*. The principal patterns are (1) a rather uniform mottling, most characteristic of the larger individuals, and (2) a series of about 12 dark but hollow-centered crossbars, typical of the young. These bars tend to disappear in larger specimens, the transition from the barred to the mottled pattern progressing



from the head backward, with much variation in the rate and completeness of the change. The general ground color appears lighter than in any of the other subspecies; the dark mottlings tend to be brown rather than blackish, and the body is less intensely dusted with melanophores than in the other subspecies.

On the basis of a color photograph of the holotype, taken when captured, and of other color notes made on live and freshly preserved material, the life colors of the adult males of this form are described as follows: The general body color is mottled, as described above for adults. The brilliant crimson spots become more numerous posteriorly, to form irregular vertical bands, 2 to 4 scales wide, behind the origin of the soft dorsal fin. There are more red spots below than above the lateral line. A very high male is almost solid red along the sides. The abdomen and the lower side of the caudal peduncle appear to be suffused with orange-red, but this color is largely confined to the scale margins. The middle of the opercle, the top of the head, and the sides of the snout are bluish. The branchiostegals are margined with dusky blue, and there are blue specks on the breast. The spinous dorsal is marked with a row of irregular blocks of crimson, one at the base of each membrane; then a wide clear band; a strong band of crimson; a submarginal clear band; and a dusky blue marginal stripe. The soft dorsal is dusky cream, with 3 to 4 rows of crimson spots on the membranes, running into a band of crimson, bordered distally with a clear band and then margined by a narrow blue band. The caudal has a crimson basal bar, followed successively by a wide band of dusky cream, a wide crimson bar, and a narrow band of bright caerulean to royal blue. The anal is brilliant, opaque crimson on the basal three-fourths, and is bordered by blue (rarely by cream). The pectoral and pelvic rays are orange-red on their basal three-fourths; otherwise these fins are clear, save for minute dusky flecks along the edges of the rays. There is a faint dusky blue bar at the base of each pectoral and pelvic fin, visible only when the fish is dry.

The females have the soft dorsal and caudal checkered with red and dusky, as in the other subspecies. They show less red than the males (often none on the body), and the blue borders on the fins are faint or lacking.

The holotype agrees with the species description already given and has the following special features: Scales 11—(60 + 10 = 70)—13. Opercles with partially embedded scales on posterior half; cheeks with embedded scales anteriorly; nape well covered with embedded scales. Dorsal rays, XII, 14; anal rays, II, 9; branched caudal rays, 15; pectoral rays, 13–13.

Depth, 4.9. Greatest width, 1.6 into projection of greatest depth. Head length, 3.6. Least suborbital width, 14.0 in head. Least interorbital width, 1.9 in eye. Eye, 6.6 in head; 1.5 in snout. Snout, 4.6 in head. Upper jaw, 3.4 in head. Angle of muzzle, 68°; of mouth, 25° with the horizontal; of gill-membranes, 68°. Eye, 3.7 in distance from tip of mandible to union of gill-membranes; latter distance, 1.9 in head and 0.9 times interspace between union of membranes and insertion of pelvic fin. Highest dorsal spine, 2.5 in head, 3.2 in first dorsal base, and 1.4 in the highest dorsal soft ray, which enters the head 2.3 times and the second dorsal base 1.7 times. Length of caudal fin, 1.7 in head. Highest anal ray, 2.2 in head and 1.2 in the anal base, which enters the head 1.7 times, and the second dorsal base 1.5 times. Longest pectoral ray, 1.4 in head; length of pelvic fin, 1.6. Interspace between pelvic fins, 1.6 in pelvic base.

This subspecies is not unlike *P. w. whipplii* in its habitat preferences, except that it becomes relatively more abundant in headwater brooks. It is the only species of fish which penetrates to the extreme source of certain tributaries of Clear Creek. It is particularly abundant in small streams. In a single dip with a 3-foot seine, 26 adults were caught in a pool only 3 feet in diameter. The headwater brooks commonly inhabited by this darter dry up completely every few summers, but seem to be repopulated quickly by migrants from farther downstream, where the form is also common.

This subspecies is named *montanus* as it inhabits mountain streams.

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TABLE I  
LATERAL LINE SCALE COUNTS IN SUBSPECIES OF *Poecilichthys whippelii*

Scales	<i>artesia</i> Alabama System*	<i>artesia</i> Miss. R. System	<i>radiosus</i> Total	<i>whippelii</i> Total	<i>montanus</i> Total	<i>montanus</i> Railroad Cr.	<i>montanus</i> Blue Hole Cr.	<i>montanus</i> Jones Cr.	<i>montanus</i> Schaberg Cr.
45	3	.....	.....	.....	.....	.....	.....	.....	.....
46	.....	.....	1	.....	.....	.....	.....	.....	.....
47	2	.....	1	.....	.....	.....	.....	.....	.....
48	3	2	4	.....	.....	.....	.....	.....	.....
49	8	1	3	.....	.....	.....	.....	.....	.....
50	10	3	18	.....	.....	.....	.....	.....	.....
51	8	.....	13	1	.....	.....	.....	.....	.....
52	7	2	11	1	.....	.....	.....	.....	.....
53	3	1	12	.....	.....	.....	.....	.....	.....
54	2	4	12	.....	.....	.....	.....	.....	.....
55	6	1	8	3	.....	.....	.....	.....	.....
56	2	1	12	1	1	.....	.....	.....	.....
57	4	.....	13	6	.....	1	.....	.....	.....
58	2	.....	8	2	.....	.....	.....	.....	.....
59	1	.....	8	6	.....	.....	.....	.....	.....
60	.....	1	3	11	.....	.....	.....	.....	.....
61	.....	.....	5	10	1	.....	1	.....	.....
62	.....	.....	1	14	1	.....	3	.....	.....
63	1	.....	22	6	6	3	3	.....	.....
64	.....	.....	3	7	3	3	4	.....	.....
65	.....	.....	1	14	4	3	3	1	.....
66	.....	.....	.....	5	4	.....	.....	.....	.....
67	.....	.....	.....	5	6	3	3	.....	1
68	.....	.....	1	5	11	10	6	.....	.....
69	.....	.....	1	5	9	3	6	.....	1
70	.....	.....	1	2	8	1	8	.....	.....
71	.....	.....	.....	.....	11	3	5	.....	.....
72	.....	.....	.....	1	8	.....	2	.....	1
73	.....	.....	.....	.....	2	.....	1	.....	.....
74	.....	.....	.....	.....	2	.....	2	.....	.....
75	.....	.....	.....	.....	2	.....	2	.....	.....
.....	.....	.....	.....	.....	1	.....	1	.....	.....
Number	62	16	139	114	80	20	56	1	3
Average	51.81	52.44	54.51	62.24	67.66	66.55	68.00	65.00	69.67
Standard error	± 0.46	.....	± 0.35	± 0.32	± 0.37	± 0.81	± 0.41	.....	.....

\* Including one specimen, from the Pascagoula River system, with 49 scales.

TABLE II  
 COUNTS OF PORED SCALES IN LATERAL LINE IN SUBSPECIES OF  
*Poecilichthys whipplei*

Pored Scales	<i>artesia</i> Alabama R. Sys- tem*	<i>artesia</i> Miss. R. System	<i>radius</i>	<i>whipplei</i>	<i>montanus</i>
30 .....	.....	..	1	.....	.....
31 .....	.....	..	.....	.....	.....
32 .....	.....	..	.....	.....	.....
33 .....	.....	..	2	.....	.....
34 .....	1	..	1	.....	.....
35 .....	.....	..	8	.....	.....
36 .....	1	..	6	1	.....
37 .....	.....	..	9	.....	.....
38 .....	4	..	11	1	.....
39 .....	14	..	11	.....	.....
40 .....	3	2	15	1	.....
41 .....	8	3	11	3	.....
42 .....	6	1	11	1	1
43 .....	2	1	8	4	.....
44 .....	4	3	7	5	.....
45 .....	8	2	5	8	.....
46 .....	4	2	5	7	2
47 .....	3	2	5	4	.....
48 .....	1	..	1	8	.....
49 .....	2	..	5	8	1
50 .....	.....	.....	.....	19	.....
51 .....	.....	.....	2	9	1
52 .....	.....	.....	2	5	4
53 .....	1	..	1	7	3
54 .....	.....	.....	1	7	3
55 .....	.....	.....	.....	2	7
56 .....	.....	.....	.....	3	7
57 .....	.....	.....	.....	6	10
58 .....	.....	.....	.....	2	9
59 .....	.....	.....	.....	.....	8
60 .....	.....	.....	.....	1	4
61 .....	.....	.....	.....	.....	3
62 .....	.....	.....	.....	.....	1
63 .....	.....	.....	.....	.....	5
64 .....	.....	.....	.....	.....	5
65 .....	.....	.....	.....	.....	2
66 .....	.....	.....	.....	.....	3
67 .....	.....	.....	.....	.....	.....
68 .....	.....	.....	.....	.....	1
Number .....	62	16	128	112	80
Average .....	42.16	43.50	41.15	49.38	57.75
Standard error ...	±0.45	.....	±0.40	±0.43	±0.53

\* Including one specimen, from the Pascagoula River system, with 39 pored scales.

TABLE III  
 COUNTS OF UNPORED SCALES IN THE LATERAL LINE SERIES IN  
 SUBSPECIES OF *Poeciliichthys whippelii*

Unpored Scales	<i>artesia</i> Alabama R. Sys- tem*	<i>artesia</i> Miss. R. System	<i>radiosus</i>	<i>whippelii</i>	<i>montanus</i>
0 .....	2	...	.....	.....	.....
1 .....	.....	...	.....	.....	.....
2 .....	.....	...	.....	.....	1
3 .....	2	...	.....	.....	1
4 .....	.....	.....	.....	.....	.....
5 .....	1	1	2	.....	3
6 .....	4	...	.....	6	3
7 .....	6	4	3	4	11
8 .....	11	1	2	8	8
9 .....	4	3	9	3	12
10 .....	7	5	9	8	11
11 .....	6	...	10	12	9
12 .....	6	1	14	6	7
13 .....	5	1	16	13	3
14 .....	3	...	17	20	4
15 .....	.....	.....	15	7	4
16 .....	3	.....	16	7	.....
17 .....	2	.....	10	7	1
18 .....	.....	.....	.....	6	1
19 .....	.....	.....	2	2	.....
20 .....	.....	.....	2	2	.....
21 .....	.....	.....	1	1	1
22 .....	.....	.....	1	.....	.....
Number .....	62	16	129	112	80
Average .....	9.65	8.94	13.29	12.78	9.89
Standard error ...	± 0.46	.....	± 0.29	± 0.34	± 0.39

\* Including one specimen, from the Pascagoula River system, with 10 unpored scales.



TABLE IV  
FIN-RAY COUNTS IN SUBSPECIES OF *Poccilichthys whipplii*

	<i>artesia</i> Alabama R. Sys- tem*	<i>artesia</i> Miss. R. System	<i>radiosus</i>	<i>whiplii</i>	<i>montanus</i>
Dorsal spines					
9 .....	1	.....	.....	.....	.....
10 .....	27	.....	20	9	5
11 .....	31	16	46	35	33
12 .....	3	.....	6	17	12
Number .....	62	16	72	61	50
Average .....	10.58	11.00	10.81	11.13	11.14
Standard error	± 0.08	.....	± 0.07	± 0.08	± 0.08
Dorsal soft rays					
11 .....	3	.....	.....	.....	.....
12 .....	31	9	4	.....	.....
13 .....	24	7	18	24	14
14 .....	1	.....	38	33	27
15 .....	.....	.....	4	5	8
16 .....	.....	.....	1	.....	1
Number .....	59	16	65	62	50
Average .....	12.39	12.44	13.69	13.69	13.92
Standard error	± 0.08	.....	± 0.09	± 0.08	± 0.10
Anal spines					
2 .....	49	16	68	60	50
3 .....	.....	.....	.....	1	.....
Anal soft rays					
5 .....	.....	.....	1	.....	.....
6 .....	1	.....	1	.....	.....
7 .....	28	11	35	14	7
8 .....	29	5	29	43	38
9 .....	4	.....	2	4	5
Number .....	62	16	68	61	50
Average .....	7.58	7.31	7.44	7.84	7.96
Standard error	± 0.08	.....	± 0.08	± 0.07	± 0.07

\* Including one specimen, from the Pascagoula River system, with XI, 13 dorsal rays and II, 9 anal rays.

TABLE V  
 MEASUREMENTS OF EYE INTO SNOUT IN SUBSPECIES OF  
*Poeciliichthys whipplii*

Size Group	<i>artesia</i> Alabama R. Sys- tem*	<i>artesia</i> Miss. R. System	<i>radiosus</i>	<i>whiplii</i>	<i>montanus</i>
19 to 29 mm.					
0.7 .....	5	...	4	2	...
0.8 .....	10	1	4	4	...
0.9 .....	5	...	8	1	...
1.0 .....	2	...	2	.....	2
1.1 .....	.....	.....	.....	.....	1
30 to 39 mm.					
0.8 .....	1	1	2	.....	.....
0.9 .....	7	4	3	.....	.....
1.0 .....	17	6	5	8	1
1.1 .....	3	.....	3	3	5
1.2 .....	.....	.....	.....	1	1
1.3 .....	.....	.....	.....	.....	2
1.4 .....	.....	.....	.....	.....	.....
1.5 .....	.....	.....	.....	.....	1
40 to 49 mm.					
0.9 .....	1	.....	3	1	.....
1.0 .....	12	1	7	10	.....
1.1 .....	.....	1	2	11	3
1.2 .....	9	.....	.....	9	5
1.3 .....	.....	.....	.....	2	8
1.4 .....	.....	.....	.....	1	3
1.5 .....	.....	.....	.....	.....	1
50 to 59 mm.					
1.0 .....	1	.....	.....	.....	.....
1.1 .....	7	.....	1	1	.....
1.2 .....	.....	.....	.....	3	3
1.3 .....	3	.....	.....	2	1
1.4 .....	.....	.....	.....	.....	4
1.5 .....	.....	.....	.....	.....	3
60 to 74 mm.					
1.0 .....	.....	.....	.....	1	.....
1.1 .....	1	.....	1	.....	.....
1.2 .....	.....	.....	.....	.....	.....
1.3 .....	1	.....	.....	.....	.....
1.4 .....	.....	.....	.....	.....	2
1.5 .....	.....	.....	.....	.....	4

\* Including one specimen, from the Pascagoula River system, 58 mm. long, with eye 1.3 in snout.

TABLE VI

DIFFERENCES BETWEEN MEANS FOR SCALE AND FIN-RAY COUNTS OF THE FOUR SUBSPECIES OF *Poecilichthys whipplii*, COMPARED WITH THE STANDARD ERROR OF THE DIFFERENCES

In these computations we have used the formulas stated by Hubbs and Kuhne (1937: 7).

	<i>arte- siae*</i> and <i>radi- osus</i>	<i>arte- siae*</i> and <i>whip- plii</i>	<i>arte- siae*</i> and <i>mon- tanus</i>	<i>radi- osus</i> and <i>whip- plii</i>	<i>radi- osus</i> and <i>mon- tanus</i>	<i>whip- plii</i> and <i>mon- tanus</i>
Lateral line scales						
$\Delta$	2.70	10.43	15.85	7.73	13.15	5.42
$SE_{\Delta}$	0.58	0.56	0.59	0.47	0.50	0.49
$\Delta \div SE_{\Delta}$	4.7	18.6	26.9	16.4	26.3	11.1
Pored scales						
$\Delta$	1.01	7.22	15.59	8.23	16.60	8.37
$SE_{\Delta}$	0.60	0.62	0.70	0.59	0.66	0.68
$\Delta \div SE_{\Delta}$	1.7	11.6	22.3	13.9	25.2	12.3
Unpored scales						
$\Delta$	3.64	3.13	0.24	0.51	3.40	2.89
$SE_{\Delta}$	0.54	0.57	0.60	0.45	0.49	0.52
$\Delta \div SE_{\Delta}$	6.7	5.5	0.4	1.1	6.9	5.6
Dorsal spines						
$\Delta$	0.23	0.55	0.56	0.32	0.33	0.01
$SE_{\Delta}$	0.11	0.11	0.11	0.11	0.11	0.11
$\Delta \div SE_{\Delta}$	2.1	5.0	5.1	2.9	3.0	0.1
Dorsal soft rays						
$\Delta$	1.30	1.30	1.53	0.00	0.23	0.23
$SE_{\Delta}$	0.12	0.11	0.13	0.12	0.13	0.13
$\Delta \div SE_{\Delta}$	10.8	11.8	11.8	0.0	1.8	1.8
Anal soft rays						
$\Delta$	0.14	0.26	0.38	0.40	0.52	0.12
$SE_{\Delta}$	0.11	0.11	0.11	0.11	0.11	0.10
$\Delta \div SE_{\Delta}$	1.3	2.4	3.5	3.6	4.7	1.2

\* The data for *P. w. artesiæ* apply only to the specimens from the Alabama River system plus one from the Pascagoula River system.

*Carl L. Hubbs and John D. Black*

PLATE I

Subspecies of *Poecilichthys whipplii*

FIG. 1. *Poecilichthys whipplii radiosus*.

From the holotype, an adult male 50 mm. in standard length, from Sugar Loaf Creek, Hot Spring County, Arkansas.

FIG. 2. *Poecilichthys whipplii montanus*.

From the holotype, an adult male 75 mm. in standard length, from Blue Hole Creek, Washington County, Arkansas.

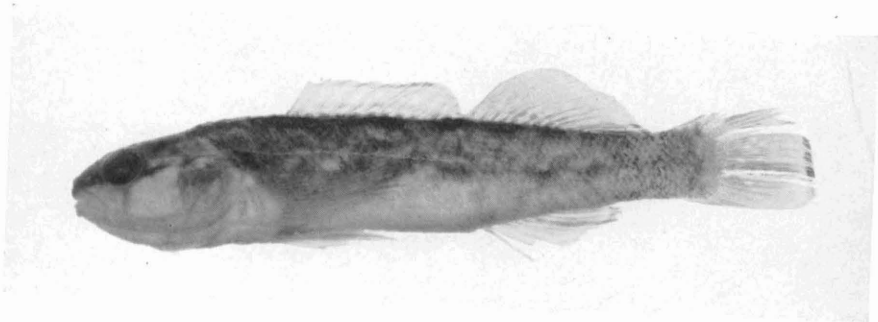


FIG. 1

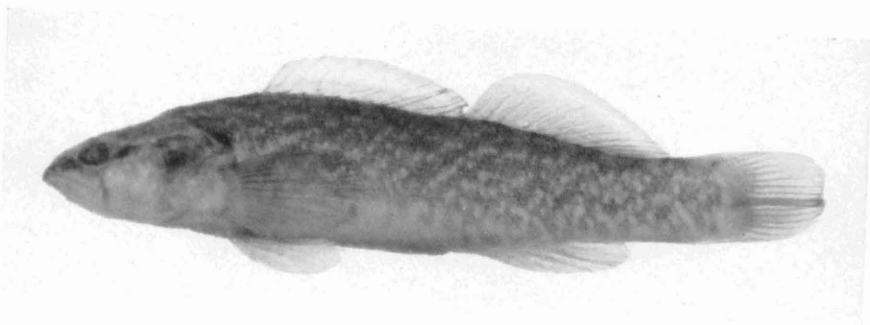


FIG. 2

