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STUDIES OF THE FISHES OF THE ORDER
CYPRINODONTESXVII. GENERA AND SPECIES OF THE COLORADO
RIVER SYSTEM

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THE description of "*Arizonichthys psammophilus*, new genus, new species" (Nichols, 1940: 1-2) induces us to list and discuss the cyprinodont fishes which inhabit the waters of the Colorado River system. The four genera and species, representing the Cyprinodontidae and the Poeciliidae, are to be treated by us in more detail in subsequent publications.

GENUS *CRENICHTHYS* HUBBS

Crenichthys.—Hubbs, 1932: 1-4 (original description; comparisons and relationships; type, *C. nevadae* Hubbs).

Our field studies of 1934 and 1938 have demonstrated that this remarkable derivative of *Empetrichthys* has a rather wide distribution in the springs and creeks of southern Nevada, including one of the present tributaries of the Colorado River.

1. *Crenichthys baileyi* (Gilbert)

Cyprinodon macularius baileyi.—Gilbert, 1893: 233 (original diagnosis; Pahrnagat Valley, Nevada).

Cyprinodon baileyi.—Jordan and Evermann, 1896: 671, 675 (diagnosis, after Gilbert).

Crenichthys baileyi.—Sumner and Sargent, 1940: 45–54, Fig. 2 (physiology and adaptation to warm-spring conditions; Preston and Mormon Springs, Nevada). Hubbs, 1941: 68.

Although long confused with *Cyprinodon*, this species agrees with *Crenichthys nevadae* in all essential respects, including the invariable lack of pelvic fins and the bifid rather than trifid teeth. It is obviously to be referred to *Crenichthys* (our conclusions in this regard have received preliminary notice in the paper by Sumner and Sargent). The chief apparent difference between *baileyi* and *nevadae* lies in coloration, for the lateral dark spots are arranged in two rows rather than in a single series.

Crenichthys baileyi does not occur in Railroad Valley, Nevada, where *C. nevadae* abounds in warm springs, but replaces that species in the White River and Pahranaagat valleys. It also occurs in the warm-spring headwaters of Moapa or Muddy River, which still flows into the Colorado River (the lower course of Moapa River is now flooded by Lake Mead), and is therefore to be included in the present Colorado River fauna. It is now confined to a chain of isolated warm-spring waters, all of which were formerly connected with one another, and with the Colorado River, through Quaternary White River (Carpenter, 1915: 53). The former course of this now extinct river can thus be traced by its relict fish populations as well as by its continuous terraces and dry canyons (Hubbs, 1941: 68, Fig. 7).

The now isolated populations of *Crenichthys baileyi* show indications of partial differentiation and will probably be treated as subspecies. Several thousand specimens have been preserved for the analysis of this speciation.

GENUS *CYPRINODON* LACÉPÈDE

2. *Cyprinodon macularius* Baird and Girard

As we have in preparation a revision of the genus *Cyprinodon*, we will not attempt to give here any synonymy or critical discussion of its Colorado River representatives. Several forms of other river systems, at least subspecifically distinct, have

been confused with *macularius*, which in turn shows local differences that will likely prove of subspecific significance. The partial confusion of *Crenichthys baileyi* with *Cyprinodon macularius* is mentioned above.

Regan's (1907: 85) record of this species from "Colorado (*Eigenmann*)" was doubtless based on specimens from the Colorado Desert, which is in southeastern California.

GENUS *GAMBUSIA* POEY

3. *Gambusia affinis affinis* (Baird and Girard)

This fish has been widely introduced and established through the Colorado River system, as elsewhere through the West, in mosquito-control work. Its nomenclature will be treated by the senior writer.

GENUS *POECILIOPSIS* REGAN

Poeciliopsis.—Regan, 1913: 980, 996-7, Fig. 170D (original description; in part; no type designated; synopsis of species). Henn, 1916: 119 (type, *Poecilia presidionis* Jordan and Culver; in part). Meek and Hildebrand, 1916: 314, 324 (diagnosis; type, *Poecilia presidionis*; in part). Hubbs, 1924: 10 (characters; type, *Poecilia presidionis*, not *Poeciliopsis isthmensis* as indicated by Jordan, 1920); 1926: 62-66 (characters; comparisons; species; *Leptorhaphis* as synonym); 1936: 232, 235 (characters; comparisons; possibly a complex; species). Hildebrand, 1938: 307 (division into smaller genera by Hubbs not accepted; in part).

Leptorhaphis.—Regan, 1913: 980, 998 (original description; haplotype, *L. infans*). Hubbs, 1924: 10 (characters; comparisons).

Arizonichthys.—Nichols, 1940: 1-2 (characters, in description of "*Arizonichthys psammophilus*, new genus, new species," without formal characterization of genus or formal designation of genotype).

Large series of poeciliopsines from the Pacific drainage of Mexico are available for a prospective revision of this group. For present purposes it will suffice to say that the status of the genus *Poeciliopsis* as a unit (see Hubbs, 1936: 235) remains somewhat uncertain.

Arizonichthys is to be quoted in the synonymy of *Poeciliopsis*, since its haplotype, *Arizonichthys psammophilus*, is clearly a synonym of *Poeciliopsis occidentalis* (Baird and Girard).

Even if *occidentalis* be segregated generically from *Poeciliopsis* (as it well may), the name *Arizonichthys* will almost surely remain a synonym, for *occidentalis* seems to be separable on only very trivial characters from *Poeciliopsis infans*, the type species of *Leptorhaphis* (see Hubbs, 1926: 65). These species, *occidentalis* and *infans*, are geographically connected by a chain of related forms, as we shall indicate in a later publication.

On technical, nomenclatorial grounds it is not certain that *Arizonichthys* was validly proposed. We do not wish to stress this point, however, in view of the uncertain acceptability of the provisions that new generic names proposed after 1930 are invalid unless accompanied by a definite description and a definite designation of type species.

Arizonichthys was proposed not only without any formal generic diagnosis or comparison, but even without allocation to family. It may be pointed out that the ovarian structure differs in the viviparous and oviparous cyprinodonts, providing a means for family identification of series which do not include males.

4. *Poeciliopsis occidentalis* (Baird and Girard)

Heterandria occidentalis.—Baird and Girard, 1853: 390 (original diagnosis; "Rio Santa Cruz of the Rio Gila"). Bleeker, 1860: 485 (Rio Gila). Jordan, 1885: 838 (range). Evermann and Rutter, 1895: 477-79, 486 (literature records). Jordan and Evermann, 1896: 687, 689 (description; range; Tucson); 1898: 2833 (properly to be referred to *Poecilia*). Pratt, 1923: 99, and 1935: 99 (description; range; habitat). Schrenkeisen, 1938: 189 (characters; range; relationships).

Girardinus occidentalis.—Girard, 1859a: 73, Pl. 39, Figs. 16-19 (diagnosis; Rio Santa Cruz, Mexico); 1859b: 119-20 (description; "Tucson," Arizona). Bleeker, 1860: 484 ("Sonora. R. st. Cruz"). Von Müller, 1865: 643. Günther, 1866: 354-55 (after Girard). Jordan and Copeland, 1876: 142, and Jordan, 1878: 434 ("New Mexico"—by error). Jordan and Gilbert, 1883: 349 (after Girard). Eigenmann, 1893: 58 (Rio Santa Cruz, Mexico).

Poecilia occidentalis.—Garman, 1895: 61, Pl. 5, Fig. 5 (synonymy; description; San Bernardino Creek, Mexico; Nickson, Ari-

zona). Rutter, 1896: 261, 267 (description; Hermosillo, and Yaqui River east of Oposura, Sonora; Sabino Cañon, tributary of the Santa Cruz; probably not the record from Rio Grande de Santiago at Tepic, Mexico). Gilbert and Seofield, 1898: 498 (description; Salt River at Tempe, and Tucson, Arizona). Meek, 1902: 122 (Rio Yaqui); 1904: 149-50 (comparisons; synonymy; diagnosis). Regan, 1907: 101-2 (synonymy; literature records); 1908a: 459 (comparisons). Snyder, 1915: 585 (embryos; Santa Cruz River near Tucson; Gila River near Gila City and Adonde Siding; San Bernardino River; Cajon Bonito Creek).

Molliensia occidentalis.—Regan, 1913: 1010, 1013 (characters; synonymy and range, in part). Fowler, 1921: 399 (Santa Cruz River at "Tuecon").

Poeciliopsis occidentalis.—Hubbs, 1926: 64-65 (synonymy; genus; comparisons; Huachuca Mountains, Tempe, Sabino Canyon in Santa Catalina Mountains, and Rio Santa Cruz at Tucson, all in Arizona, and Yaqui River and Hermosillo, Sonora, Mexico). Jordan, Evermann, and Clark, 1930: 189 (synonymy; range). Hubbs, 1936: 235 (characters; relationships). Schrenkeisen, 1938: 189 (characters; range; relationships).

Girardinus sonoriensis.—Girard, 1859b: 120 (original description; San Bernardino Creek, tributary of Rio Yaqui, Mexico). Bleeker, 1860: 484 (Mexico). Günther, 1866: 355 (after Girard; probably identical with *G. occidentalis*). Cope and Yarrow, 1875: 695 (Camp Lowell, Arizona). Jordan and Copeland, 1876: 142 (Sonora). Jordan, 1878: 434 (Sonora; Arizona).

Arizonichthys psammophilus.—Nichols, 1940: 1-2 (original description; 3½ miles east of Tanque Verde, Pima County, Arizona).

This is one of the commonest fishes in the southern part of the Colorado River drainage basin, particularly in the Santa Cruz River system, from which *Arizonichthys psammophilus* has recently been described. The types of *occidentalis* came from the Santa Cruz River in Mexico, and numerous topotypes are at hand, as well as hundreds of other specimens from various tributaries of the Santa Cruz in Arizona. No series precisely topotypic of *psammophilus* (that is, from Tanque Verde Creek) has been seen, but there is no reason to doubt its identity with *occidentalis*. Comparing the description of the 48-mm. type of *psammophilus* with an example of *occidentalis* of the same relatively large size, we find the agreement complete.

The type habitat of *Arizonichthys psammophilus*—pools on the sandy bed of a hill stream which nearly disappears in the dry season—is a characteristic abode of *Poeciliopsis occidentalis*. The local belief that these fish can dig into the sand to survive periods of desiccation is a natural but implausible explanation of the seasonal reappearance of the stock (no doubt from more permanent spring-fed waters upstream).

Creeks like Tanque Verde Creek, which dry up seasonally but at times flow normally to river courses, do not provide the locus for the development or survival of peculiar forms. There is truth in Nichols' statement that "the occurrence of peculiar cyprinodont fishes in isolated desert environments of the West is not without precedent," though the examples of *Empetrichthys* and *Crenichthys* have a wider distribution than at first indicated, and "*Arizonichthys*" is definitely not to be included among the isolated types.

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