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# STUDIES OF THE FISHES OF THE ORDER CYPRINODONTES. X. FOUR NOMINAL SPECIES OF *FUNDULUS* PLACED IN SYNONYMY

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IN preparing a systematic revision of a group of animals, such as I have been attempting for the Cyprinodontes (Hubbs, 1926, and other papers of the same series), one of the most baneful circumstances confronted is the recognition of doubtful, nominal species, known only from the original accounts. A real contribution to the systematics of the group is affected, when such forms are either rediscovered or synonymized—in either case definitely allocated in the series.

The genus *Fundulus,* restricting this group to American species (Hubbs, 1924 and 1926; Myers, 1924 to 1931), still contains a full share of such nominal species. Four of these, the most troublesome and dubious, now appear referable to their places in the system, three as synonyms, and one, by chance, as the oldest available name for a fairly well known species.

The conclusions arrived at in this paper followed from recent examinations of the type specimens in the United States National Museum and the Academy of Natural Sciences of Philadelphia. I wish to thank the authorities of these

institutions for the privilege of making and recording these studies.

1. *Fundulus vinctus* Jordan and Gilbert

In 1883 Jordan and Gilbert described (1882a: 354–356), on the basis of already old material in the National Museum, three species of Cyprinodontes from "Cape San Lucas." Two of these, *Fundulus vinctus* and *Fundulus extensus,* which have never been rediscovered, are treated in the present paper as synonyms of common species inhabiting the eastern part of the United States. The third of these forms, *Characodon furcidens,* is obviously a valid species, but presumably likewise was never obtained in Lower California, because the two subsequent records are for the mainland, at Colima (Jordan and Gilbert, 1882b: 371) and Rio de Mascota in Jalisco (Regan, 1907: 90, pl. 12, fig. 2), and because the whole group Goodeidae to which this species belongs is confined to the Lerma River system and peripherally related stream systems.

Jordan and Evermann (1896: 637) suggest that these fluviatile or estuarine types may have been "obtained in the pools and lagoons about La Paz," but no one has before or since taken any of these species anywhere in Lower California. Furthermore, although the type lots were entered in the old National Museum register in among a small part of Xantus' Cape San Lucas collection, it is not certain that they were attributed to that locality. Now, inasmuch as one of these species has been taken in another region, more distant faunally than geographically, and inasmuch as the other two have never been rediscovered and appear identical with Eastern United States species, we must regard the assigned type locality, Lower California as well as Cape San Lucas, as entirely erroneous.

Of the two nominal species of *Fundulus* with the erroneous type locality of Cape San Lucas, *Fundulus vinctus* Jordan and Gilbert (1882a: 355) is represented solely by a black, shrivelled, and partly decayed remnant, catalogued as No. 30973 in the National Museum. By very careful scrutiny, the

characters of what was once a fish may be reconstructed with fair assurance. The result of this reconstruction is an example of the common East Coast *Fundulus heteroclitus macrolepidotus*. The scales were apparently not larger than often in that form, for counting pockets where scales are lost I estimate the number in the lateral line to caudal base to be 33. The color account by Jordan and Gilbert fits the male of *heteroclitus* satisfactorily. I therefore recommend that *Fundulus vinctus* Jordan and Gilbert be laid to rest as another synonym of *Fundulus heteroclitus macrolepidotus*.

2. *Fundulus extensus* Jordan and Gilbert

This, the other nominal species of *Fundulus* attributed in obvious error by Jordan and Gilbert (1882a: 355) to Cape San Lucas at the tip of Lower California, remains represented by a type, No. 30972 in the National Museum. This is now shrivelled to a blackened mummy, but enough of its characters remain to allow one familiar with the group to fill it out in reconstruction to a close approximation of its former self. The fish was probably already in poor condition when it was originally made the type of a new species—apparently chiefly on the strength of its supposed geographical isolation. I think so, because the split fin-rays lead easily to the high count (dorsal, 15; anal, 13) given by the describers. When the divided rays are carefully reunited, the ray number appears to be 13 in the dorsal and 10 in the anal fin. The dorsal origin lies midway between the caudal base and pupil, nearly a pupil's length farther forward than anal origin.

These and all other apparent characters point clearly to the specific identity of *Fundulus extensus* with *F. diaphanus*, and probably to the subspecific identity with *Fundulus diaphanus diaphanus*. The nominal species was differentiated from *diaphanus* on the basis of being slenderer, but I find specimens of *F. d. diaphanus* which are as slender as the type of *extensus* was described as being, for their depth is contained 5.7 times in their standard length.

3. *Fundulus confluentus* Goode and Bean

This species, described from Lake Monroe, Florida, by Goode and Bean (in Goode, 1879: 118), was recognized by Jordan and Evermann (1896: 650) with the remark: "One specimen known." By Garman (1895: 96) it was referred, together with *Fundulus ocellaris* Jordan and Gilbert (1882: 891), to the synonymy of *F. grandis*. Although Jordan and Evermann placed *confluentus* and *ocellaris* in distinct subgenera, a comparison of the types shows them to be specifically, at least, identical. The same conclusion, expressed by Evermann and Kendall in 1899 (p. 58), has been consistently overlooked. Since the poorly defined form was in this instance the first to be described, the better known name *ocellaris* falls into synonymy.

Following its original description, *Fundulus ocellaris* has been recorded or its variations discussed by Jordan (1884: 319), Woolman (1890: 300, pl. 52, fig. 2), Henshall (1891: 374), Lönnberg (1894: 116), Jordan and Evermann (1896: 642, and 1900: 3254, pl. 102, fig. 274), Hildebrand (1916: 306), Hildebrand and Schroeder (1917: 141, fig. 74, 75), Hubbs (1926: 9) and probably others. These authors have shown the species to have a rather wide range, in salt and fresh water, from Chesapeake Bay to Louisiana, and to vary rather widely in color and other characters.

The variability of *Fundulus ocellaris* is illustrated by a series collected by Remington Kellogg and A. J. Poole in May, 1927, in a brackish tide-pool on a mud flat of Cape Hatteras, North Carolina. The males in this series are very dark, and are thickly speckled and blotched with blackish brown; they show only a bare trace of either dark or silvery bars; the basal part of their caudal and anal fins are darkened, and show distinct traces only of pale spots; the dorsal ocellus is developed in the male as well as the female, as a black spot bordered above and below by pale. The females are paler, with narrow bars on middle third of the depth, with many blackish brown specks and with one or two more or less dis-

rupted black bars on the caudal base. The females are very similar to the females from New Orleans which have been regarded as possible variants of *ocellaris*. The anal pouch is minute in these Cape Hatteras specimens: it is extended less than a millimeter along front of fin, and is less full than in the larger southern examples of the species. These specimens differ from the types further in showing less sexual dimorphism in form and in size of fins: the height of the dorsal in each sex is contained 2.4 to 2.7 times in the head.

The types of *ocellaris* stand at the opposite extreme of specific variation as regards larger size; paler color; lack of specks in females; strength of bars and contrast with silvery interspaces, development of silvery flecks on median fins and body and lack of ocellus, in male; and in sexual dimorphism in fin size (height of dorsal in types of *ocellaris,* 1.4 in head in males, 2.4 in head in females). The dorsal origin in the Hatteras series is 1.8 to 2.1 times as distant from tip to snout as from base of caudal.

Certainly the variant types are not well ordinated geographically, because the Cape Hatteras and New Orleans variants are somewhat alike, while the Chesapeake Bay population described and figured by Hildebrand and Schroeder is similar to the type lot from Pensacola.

I believe that the two extreme types discussed above are ecological forms, one marine, represented by the types of *ocellaris,* and the other brackish or freshwater. The latter appears to be an incompletely developed type, retaining juvenile characters, especially in the male sex, and showing but slight sexual dimorphism. The Cape Hatteras brackish water series mentioned above appears to be a dwarf type, for the 9 adult specimens obtained vary in length from 26 to 40 mm. to caudal.

Whether these ecological types are genetically distinct and therefore worthy of nomenclatorial recognition, will probably remain to be demonstrated experimentally. That they are not specifically distinct is indicated by the fact that some

Florida and Louisiana specimens are intermediate between the two extreme types. For the present, it would appear best to refer all *Fundulus* material of the "*ocellaris*" type to *Fundulus confluentus* Goode and Bean.

### 4. *Fundulus balboae* Fowler

The type of *Fundulus balboae* Fowler (1916: 423, fig. 2) in the Academy of Natural Sciences of Philadelphia bears an old label merely reading "Lieut. Fields Panama." This nominal species since its description has remained an enigma (Myers, 1924: 7), especially since it is far out of the range of the genus *Fundulus,* which according to current restriction (Hubbs, 1924 and 1926; Myers, 1924 to 1931) does not range south of Yucatan. No one has rediscovered such a species in Panama, in fact not within 1,500 miles of Panama. It would hardly be expected that a species of *Fundulus* should have escaped the intensive collecting of Meek and Hildebrand in Panama.

Impressed by these circumstances, and by the resemblance of Fowler's figure to the common United States species *Fundulus notatus,* I have on a recent date carefully examined the type of *balboae.* The specimen has apparently been stained from cork, but a black lateral band can still be clearly discerned on the snout and across the cheeks and opercles. Here it runs horizontally as in *notatus,* not downward as shown in the figure of *balboae.* Farther backward the band can hardly be traced, though its extension horizontally to the caudal base is indicated by the presence of a pale streak, doubtless the former upper border of the band, and retained because of original preservation in alcohol. Traces are evident of the black spots on the dorsal fin and upper part of body, which are conspicuous in many southern specimens of *F. notatus.* The physiognomy is also that of the southern type of *notatus.* The position of the fins and the number of fin-rays (dorsal, 9; anal, 12) also correspond. We can only conclude that *Fundulus balboae* was based on an example of *Fundulus notatus* with an erroneous locality label.

## Conclusions

*Fundulus vinctus, Fundulus extensus,* and *Characodon furcidens,* all described by Jordan and Gilbert, were wrongly accredited to Cape San Lucas and to Lower California. *Fundulus vinctus* and *F. extensus* are synonyms, respectively, of *F. heteroclitus macrolepidotus* and *F. diaphanus,* common species of eastern United States. *Characodon furcidens* is a valid species, but is confined to the Mexican mainland.

*Fundulus ocellaris* Jordan and Gilbert is to be synonymized with *F. catenatus* Goode and Bean. Variants in this species comprise ecological forms of uncertain significance.

*Fundulus balboae* Fowler is wrongly attributed to Panama. and is a synonym of *F. notatus* of eastern United States.

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