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THE SCALES OF THE MORMYRID FISHES

WITH

REMARKS ON ALBULA AND ELOPS

BY

T. D. A. COCKERELL

University of Colorado, Boulder, Colo.



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THE SCALES OF THE MORMYRID FISHES, WITH REMARKS ON ALBULA AND ELOPS

By T. D. A. COCKERELL

UNIVERSITY OF COLORADO, BOULDER, COLO.

The Mormyridæ constitute a remarkable family of Malacop-
terygian fishes confined to Africa. The brain is of unusual size and
the shape of the head is peculiar, in some forms being produced
into a long snout, reminding one of an ant-eater. The Nile system is
rich in these fishes, having no fewer than seven genera, as follows:
Mormyrops (one species), *Petrocephalus* (4), *Marcusenius* (4),
Gnathonemus (5), *Mormyrus* (4), *Hyperopisus* (one), and *Gym-
narchus* (one). The last, *Gymnarchus niloticus*, constitutes a dis-
tinct subfamily, having many peculiar characters, in consequence of
which Günther treated it as a distinct family, *Gymnarchidæ*. In
Gill's arrangement, published in 1872, the Mormyridæ and Gym-
narchidæ constitute the Scyphophori of Cope, and are thought to be
nearest related to the Gymnonoti (*Gymnotidæ*). It is now known,
however, that the Gymnotids are really allies of the Characinidæ,
and consequently little allied to the Mormyrids. According to Bou-
lenger, the Mormyridæ appear to be nearest to the Albulidæ, but it
is recognized that the relationship is not at all close. Thanks to the
kindness of Doctor Boulenger and the government of Egypt, I have
received specimens of five genera of Mormyridæ proper and scales
of *Gymnarchus*. These fishes all have scales of the same general
type; cycloid with well-developed circuli and with strong basal
radii. The truly remarkable feature is found in the apical radii,
which are greatly modified and join irregularly, forming a network,
as is well shown in the accompanying drawing by Miss Evelyn V.
Moore (figure 1). The apex of the scale is usually broad and blunt,
or even subtruncate, while the base is more pointed and narrower.

The following key separates the scales examined:

- | | |
|---|---|
| Scale elongate, much longer than broad..... | 1 |
| Scale not thus elongate..... | 2 |
| 1. Scales near lateral line 7-7.5 mm. long, about 3.5 broad. Yellowish, sub-
opaque, with the circuli extremely fine; reticulation of radii extend-
ing down sides, the spaces often diamond-shaped; scales of dorsal
region much smaller..... <i>Gymnarchus niloticus</i> | |

- Scales near lateral line about 3 mm. long, 1.66 broad, white, translucent, the circuli not so fine; nuclear area more central (River Nile at Assuan) *Mormyrus kannume*
2. Scales oblong, longer than broad..... 3
Scales about as broad as long, obtusely subtriangular, about 2.5 mm. diameter, white; sculpture as shown in figure (Lahûn, Fayoum)...
Petrocephalus bane
- Scales broader than long, very small, breadth 1.25-1.33 mm.; reticulation variable, but reduced (near Luxor)..... *Marcusenius isidori*
3. Scales larger, about 2 mm. long or a little over; about 12 basal radii; apical reticulation well developed (Fashoda).... *Gnathonemus cyprinoides*
- Scales smaller, about 1.33 mm. long; about 7 basal radii (near Luxor)..
Hyperopisus bebe

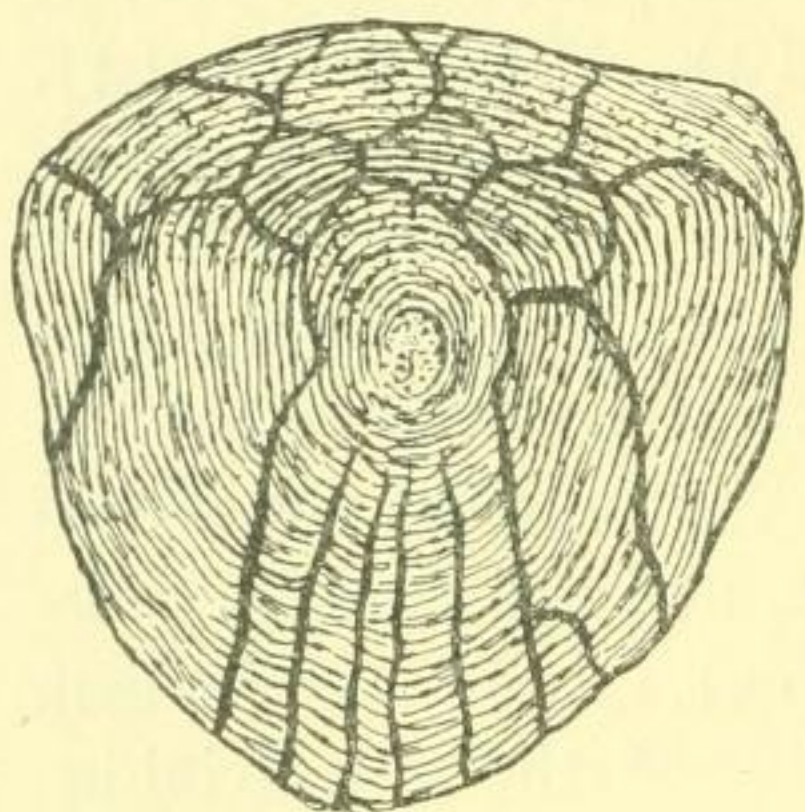


FIG. 1.—*Petrocephalus bane* (Lacep). Lahûn, Fayoum.



FIG. 2.—Scale of *Mormyrus kannume*. Forsk.

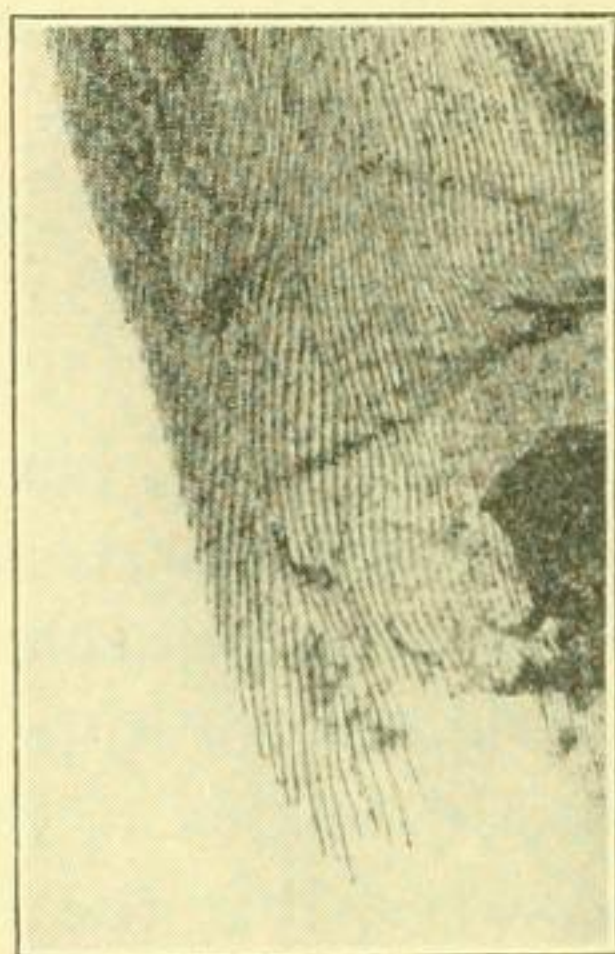


FIG. 3.—*Amia calva*. Plymouth, Indiana. Part of base of scale, showing longitudinal fibers which apparently correspond to the circuli of other fishes.

Thus it is seen that, although there are good specific characters, the scales are in general of the same type, and are, so far as I know, very distinct from those of any other fishes. *Gymnarchus*, according to the scales, goes with the Mormyridæ.

In view of the suggested relationship with the Albulidæ, I was anxious to see scales of that family. Doctor Evermann has very kindly sent me scales of *Albula vulpes*, from Woods Hole, Mass. The scales come from just above the lateral line, under front of dorsal. It may be said at once that they show no resemblance to the Mormyrid scales whatever. They are large (about 15 mm. long and 13-14 broad), quadrate in form, opaque, yellowish, with three (rarely four) nearly parallel basal radii, which hardly extend to the middle of the scale, and which reach the margin at the ends of incisions, the base of the scale being coarsely scalloped with four

(rarely five) lobes. The circuli are extremely fine, and are mainly longitudinal, breaking into a roughened area apically, the whole structure of the circuli being extraordinarily like that of *Amia calva*. This is a matter of interest in connection with the known great antiquity of the Albulidæ.

Another ancient family, placed next to the Albulidæ in the system, is the Elopidae. Doctor Evermann kindly sends me scales of *Elops saurus* from Jamaica. They are also subquadrate, about 6 mm. diameter, with fine circuli which are complete basally, and here *transverse*, as in ordinary fishes, whereas *Albula* shows in this region *longitudinal* strands consisting of minute segments.¹ The basal structure of *Elops* is evidently more "advanced" than that of *Albula*—much more like that of Teleosts in general; that of *Albula* (except for the radii and the scalloping) differs little from *Amia calva*. *Elops saurus* has a variable number (about 12 to 22) of strong basal radii, which really do radiate from the central nuclear area of the scale, though failing centrally. The apical region of the *Elops* scale is very thin, and shows numerous parallel radii.

Supplementary Note on the Scales of Hiodon.

Since writing the above paper I have received through the kindness of Dr. S. Graenicher scales of *Hiodon tergisus*, from the St. Croix River, Polk County, Wisconsin. In Boulenger's arrangement the Hiodontidæ, which are exclusively North American, follow the Mormyridæ. The scales are large (about 12 mm. long and broad), with the nuclear area between 4 and 5 mm. from the apex. The circuli are excessively fine and numerous, the same all around, and of course transverse in the basal region. Rather numerous apical radii are indicated by obscure broken lines, easily overlooked. The basal radii are very distinct, irregularly placed, a group of seven or eight closely adjacent ones going to each sublateral concavity of the basal margin. The basal margin is not crenulate, and the basolateral angles are distinct.

This is wholly diverse from *Albula*, very distinct from the Mormyridæ, but not far from *Elops*. The silvery skin and minute pigment spots are quite as in *Elops*. *Elops* differs by the modification of the apical circuli, which in the subapical field become coarse, wavy, and transverse, actually at right angles to the lateral ones.

¹ Compare Tims on scales of *Gadus*; Quart. Journ. Micros. Science, Oct., 1905, pl. vi. See also the structure of apical radii in the Serranids *Apsilus* and *Aprion*, as figured by Sauvage in his work on the fishes of Madagascar.

The basal radii of *Elops* are also much more regularly spaced, and the laterobasal angles are rounded.

According to the scales, the four families considered are related thus:

- A. Albulidæ.
- B. { a. Mormyridæ.
 { b. { 1. Elopidae.
 { 2. Hiodontidæ.

A remarkable thing about the scales of *Hiodon* is their close resemblance to those of certain old world Cyprinidæ. Comparison may be made, for instance, with *Cyprinus carpio*. The resemblance is such that, if the scales had come to me nameless, I should certainly have guessed them to be Cyprinoid. The Hiodontidæ cannot be directly related to the Cyprinidæ, but I believe that they may stand close to the ancestors of the Characinidæ. I do not know a Characinid scale similar to *Hiodon*, but, of all the South American Characinids, I know scales of only two genera.