

ART. XXIX.—*Note on the Miocene Drum Fish—Pogonias multidentatus* Cope; by BURNETT SMITH.

Introduction.

THIS rare species of the Virginia Miocene was originally described by Cope in 1869* and in 1908 the type was figured the first time by Hussakoff† in the catalogue of fossil fishes published by the American Museum of Natural History. As far as the writer can learn, the type specimen has remained, for nearly forty years, the only known example of the species and it has always been regarded as a “left superior pharyngeal.”

Another specimen of a pharyngeal plate obviously referable to *Pogonias* was recently collected by the writer from the Miocene of Maryland. It is apparently identical with Cope's species though the pattern of the bean-like crushing teeth differs slightly from that of the type. The chief points of interest attaching to this second specimen are the following: (1) it gives us slight but much needed information as to the range and distribution of the fossil Drums, and (2) it furnishes additional data for working out one or two points in the structure of the pharyngeals which up to now have remained obscure. Taking up the second of these considerations, we find that, strangely enough, the type has always been interpreted as a “left superior pharyngeal.” It is indeed a part of the upper pharyngeal crushing pavement, but instead of being situated on the left side it was on the right side and furthermore represents only one of the three well-defined pharyngo-branchial plates which occur on either side in the pharynx of *Pogonias*.

Comparison of the Pharyngeal Teeth of Pogonias, Cynoscion, and Micropogon.

In order to understand the osteological value of the known parts of the fossil *Pogonias multidentatus* it is necessary to review briefly the conditions met with in the branchial arches of some of the recent Sciaenidae. In this family we find that the different genera manifest a great variety in the form and structure of the pharyngeal teeth. In some the pharyngeal plates are set with simple sharp denticles; others have in place of denticles blunt bean-like crushing elements, while between these two extremes we find forms whose pharyngeals are

* Cope, E. D., Proc. Bost. Soc. Nat. Hist., xii, p. 310.

† Hussakof, L., Bull. Am. Mus. Nat. Hist., vol. xxv.

adapted for either cutting or crushing. The most casual study of such a series suggests that the crushing type has resulted from a modification of the plate, which is covered with denticles. For this reason it is advisable to consider the pharyngeals of some sciaenoid genus which is primitive in this respect (*Cynoscion*) and compare them with those of a less primitive form (*Micropogon*), and finally with those of a highly specialized form (*Pogonias*). The species which have been selected for this purpose are *Cynoscion nebulosus* (C. and V.), *Micropogon undulatus* (L.) and *Pogonias cromis* (L.).

The Lower Pharyngeal Plates.—In *Cynoscion nebulosus* the lower pharyngeals differ little from those of the normal teleost fish. They represent the inward plate-like expansions from the rudimentary fifth cerato-branchial, are not fused but remain distinct (right and left), and are covered by sharp backwardly curved denticles which are largest along the inner (median) anterior margin of each plate. In *Micropogon undulatus* the same general shape prevails but each plate is proportionately broader and heavier. When, however, the dental elements of the plates are examined we find a marked change from the condition observed in *Cynoscion*, for in *Micropogon* the denticles are much fewer, and though still small and sharp on the lateral (outside) and postero-lateral regions they have become large and blunted on the anterior inner (median) border. If now we extend our comparison to *Pogonias cromis* we find that the inwardly directed plate-like portion of each fifth cerato-branchial has expanded until it meets its fellow on the opposite side and is firmly united by suture with it. In addition each bone has developed on its under surface a prominent process directed downward, forward, and outward for the attachment of the powerful muscles needed in the operation of the fused plates. In conjunction with this fusion and strengthening the functional surface has developed bean-like crushing teeth. These are largest along the median (inner) margin of each one of the plates and decrease in size forward, backward, and outward. A few sharp denticles are still retained on the postero-lateral margins of each member, but the transition from sharp denticles to crushing elements can only be well seen in young examples of the species (fig. 3).

The Upper Pharyngeal Plates.—The upper pharyngeal plates of *Cynoscion nebulosus* exhibit no marked divergence from the normal teleost type. There are three well-marked upper plates on each side all covered with sharp backwardly curved denticles. The anterior plates (right and left) are narrow, lie forward and outside of the second pair of plates, and are directed forward and inward. The second pair of plates are

the largest of the three and the denticles which they bear on their inner margins excel in size those of either the first or third pair. The posterior pair of plates are larger than the anterior pair but the denticles on their inner margins are very weak.

In *Micropogon undulatus* the plates of the second pair have increased in size at the expense of those of the first and third pairs. It is true the third (posterior) pair are not greatly reduced but their surfaces are covered with but small and weak denticles. The plates of the first (anterior) pair are much reduced in size and covered with weak denticles. The plates of the second pair are large, the outer (lateral) margins bear fairly sharp denticles while the inner (median) and central regions carry denticles which are larger and more blunt.

Turning now to the superior pharyngeals of *Pogonias cromis*, we find that the second pair of plates is proportionately much larger in size, while on the other hand the first and third plates are proportionately much smaller, being in each case narrow crescentic elements which are closely applied to the curved anterior and posterior margins of each plate in the second pair. These plates of the first and third pairs carry weak degenerate denticles. In *P. cromis* it is the second pair of plates which command our attention, for these are abnormally large in size and the denticles have for the most part been changed into blunt crushing elements. These bean-like teeth are largest along the inner margin of each plate midway between its anterior and posterior ends. From this region (on each plate) the teeth become smaller as we pass forward, backward, and outward. In addition as we go outward the typical bean-like condition is less and less marked, the teeth becoming gradually less and less blunt until we reach a small patch on the extreme outer margin which still retains the primitive sharp denticles. As might be expected, this transition between denticles on the one hand and crushing teeth on the other is much more evident in the plates of young individuals of *Pogonias cromis*; for the old examples of the species have but a relatively small denticled area and only a few transitional teeth (figs. 7 and 8).

Comparison of the Pharyngeal Teeth of Pogonias cromis and Pogonius multidentatus.

As stated above, the Miocene *Pogonius multidentatus* Cope is known by but two specimens. The type is a right superior pharyngeal from Nomini Cliffs, Westmoreland County, Virginia, and the other specimen is a left superior from the St. Mary's Formation of St. Mary's River, Maryland. Though

the fossils are fragmentary, there can be no question as to their osteological value when we compare them with the corresponding parts which have been taken from the branchial arches of the recent *P. cromis* (L.).

Considering first the type of *Pogonias multidentatus*, we see that the bean-like crushing elements have all disappeared leaving only their sockets, while the plate itself has lost much of its outer and posterior portions. Some of the anterior part is likewise gone. On its dorsal surface the most striking points observed are (1) the ridge on the anterior central portion of the plate leading backward to the knob, which in the recent Drum serves for the attachment of the second epibranchial; (2) a portion of the large rounded knob at its posterior extremity, which in the living form furnishes the surface for the attachment of the broadly expanded proximal end of the fourth epibranchial; and (3) the strong ridge and process on the median margin, which is for muscular attachment. These three features are unmistakable and can all be checked with similar ones in the corresponding plate of *P. cromis*. Especially is this true for the large posterior knob, whose surface bears the same minute wavy ridges which are found in the living form.

When, now, we examine the dorsal surface of the Maryland fossil, we find, in spite of its fragmentary condition, that it agrees in every structural feature with the second left superior pharyngeal plate of *P. cromis*, and that there can be no question of the position which it occupied in the pharynx. The broken surface along the inner margin shows that the dorsally directed ridge was here well developed. The ridge which led to the knob for the second epibranchial attachment is unusually sharp and strong, much more so than in the type, and in this respect it closely approaches the condition observed in immature examples of the recent *P. cromis*.

Range and Probable Evolution of Pogonias.

In Dr. Hay's "Bibliography and Catalogue of the Fossil Vertebrata of North America"* two species of *Pogonias* are listed. The first of these, *P. cromis*, is mentioned by Leidy† as being found in the sands of the Ashley River, South Carolina; the second, *P. multidentatus*, was described by Cope as having come from the Miocene Cliffs of Nomini, Westmoreland County, Virginia. Inasmuch as the Calvert, Choptank, and St. Mary's strata are all extensively exposed at this locality,‡ it is unfortunately impossible to tell from Cope's descrip-

* Bull. U. S. G. S. No. 719, Washington, 1901.

† Indications of Twelve Species of Fossil Fishes, Proc. Acad. Nat. Sci., Phila., vii, pp. 395-97.

‡ Md. Geol. Surv. Miocene, pp. lxxix and lxxx.

tion just which one of these Miocene horizons furnished the fossil. It is probable, however, that the type came from the St. Mary's formation, for this is the one in which the species has been found in Maryland.

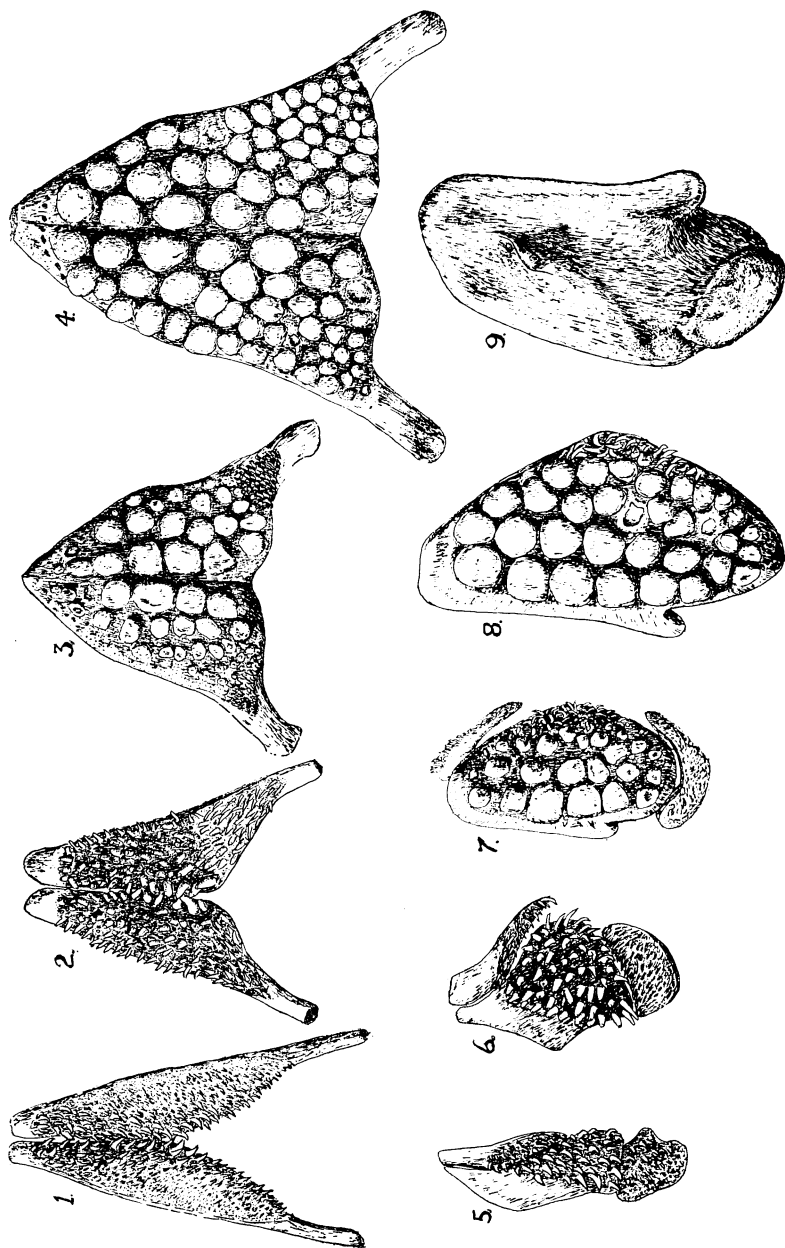
The very meager fossil material* at the writer's disposal is hardly sufficient to illustrate any evolutionary changes which may have taken place in the genus during its geological range. It is, therefore, to be regretted that we have, as yet, no means of checking the probable phylogeny which is suggested by an ontogenetic series of the pharyngeals of the recent *P. cromis*. It is evident from such a series that this peculiar type of crushing apparatus was developed by (1) the enlargement of the second pair of upper plates, (2) a progressive change from the inner margins outward from denticles to crushing teeth in both upper and lower plates, and (3) the fusion of the two lower plates. The enlargement of the second pair of upper pharyngeals was accompanied by a corresponding reduction of the first and third pairs together with a degeneration of their denticles. In both the second pair of upper plates and in the fused lower plates the young examples of this species exhibit every gradation between sharp denticle and blunt crushing tooth (figs. 3, 7). In the young the denticled area is relatively quite large, while in the old individuals a few blunt denticles only are found on the outer margins of the upper and on the postero-lateral angles of the lower fused plates (figs. 4, 8).

In conclusion, we can say that the peculiar crushing apparatus in the pharynx of *Pogonias* is, in all probability, the product of a series of evolutionary changes which in a general way corresponded to those shown in the ontogeny of *P. cromis*, and it is also reasonable to suppose that the *Pogonias* stock, which had acquired its generic characters as far back as the Miocene, was preceded in time by forms the pharyngeals of which had reached a stage of specialization somewhat similar to that exhibited by *Micropogon undulatus*. Though recognizing fully the scantiness of the data, it is believed that the morphological gradations exhibited by the lower pharyngeals of *Cynoscion*, *Micropogon*, and *Pogonias* (Pl. I, figs. 1, 2, 3, 4), and by the upper pharyngeals (Pl. I, figs. 5, 6, 7, 8) of the same three genera, represent an approximation to the phylogenetic changes which have culminated in the crushing apparatus of *Pogonias*.

Acknowledgments are due to Prof. Bashford Dean of the American Museum of Natural History for the loan of type material and to Mrs. Ethel Ostrander Smith for the careful execution of the drawings here reproduced.

*I have not yet been able to locate Leidy's specimens from the Ashley River Sands.

FIGS. 1-9.



EXPLANATION OF FIGURES 1-9.

- FIG. 1.—*Cynoscion nebulosus* (C. and V.). Lower pharyngeals (functional surface). Length along outer margin = 42^{mm}. Plates covered with sharp denticles.
- FIG. 2.—*Micropogon undulatus* (L.). Lower pharyngeals (functional surface). Length along outer margin = 24^{mm}. Plates relatively broader than in fig. 1, and with large blunt denticles on the inner margin of each plate.
- FIG. 3.—*Pogonias cromis* (L.). Lower pharyngeals (functional surface) of young individual. Length along outer margin = 38^{mm}. Plate fused. crushing teeth developed in the central region, but many sharp denticles still retained on the postero-lateral angles.
- FIG. 4.—*Pogonias cromis* (L.). Lower pharyngeals (functional surface) of mature individual. Length along outer margin = 108^{mm}. An advance on the condition shown in fig. 3. Denticles replaced by crushing teeth, though these are sharper on the postero-lateral angles.
- FIG. 5.—*Cynoscion nebulosus* (C. and V.). Left upper pharyngeals (functional surface). Length = 28^{mm}. All three plates covered with sharp denticles.
- FIG. 6.—*Micropogon undulatus* (L.). Left upper pharyngeals (functional surface). Length = 17.3^{mm}. Second plate proportionately larger than in fig. 5, its denticles larger and more blunt on the inner margin.
- FIG. 7.—*Pogonias cromis* (L.). Left upper pharyngeals (functional surface) of young individual. Length = 32^{mm}. Second plate proportionately very large with crushing teeth developed on its inner margin, but with many sharp denticles still retained on its outer margin.
- FIG. 8.—*Pogonias cromis* (L.). Second left upper pharyngeals (functional surface) of mature individual. Length = 83^{mm}. An advance on the condition shown in fig. 7, the crushing teeth occupying nearly the entire plate with but a few denticles on the outer margin.
- FIG. 9.—*Pogonias cromis* (L.). Second left upper pharyngeal (dorsal surface) of immature individual showing the processes for the attachment of the epibranchials. The fourth arch attaches to the large rounded knob on the posterior margin, the third just forward and to the left, and the second arch is attached to the process shown in the forward central region of the plate. The process on the right is for muscular attachment. Length = 42^{mm}.

All the figures are arranged with the anterior end uppermost.

FIG. 10.

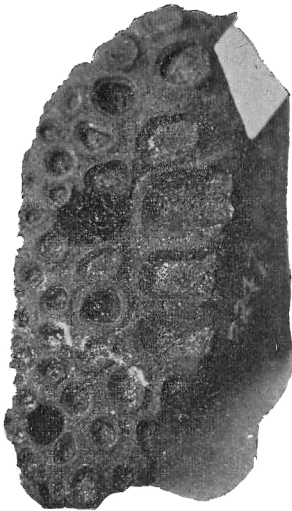


FIG. 11.

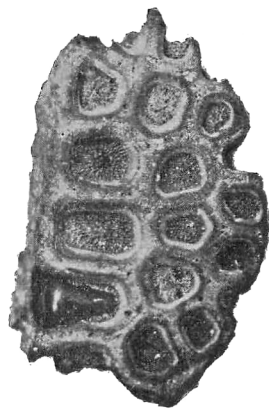


FIG. 10.—*Pogonias multidentatus* Cope. Type, Nomini Cliffs, Westmoreland County, Virginia. Second right upper pharyngeal (functional surface) with crushing teeth gone. Length = 49^{mm}.

FIG. 11.—*P. multidentatus* Cope. St. Mary's Formation, St. Mary's River, Maryland. Second left upper pharyngeal (functional surface) with crushing teeth gone. One successional tooth shows on the posterior part of the inner margin. Length = 35^{mm}.

FIG. 12.



FIG. 13.



FIG. 12.—Dorsal surface of fig. 11 showing ridge leading to the second epibranchial attachment.

FIG. 13.—Dorsal surface of fig. 10, showing the large rounded knob on the postero-lateral region which served for the attachment of the fourth epibranchial.

Figures all arranged with the anterior end uppermost.