

# ON THE RELATIONS OF THE FISHES OF THE FAMILY LAMPRIDIDÆ OR OPAHS.

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## I.

Dr. Boulenger, in the third number of his suggestive and valuable Notes on the Classification of Teleostean Fishes, has published some novel ideas respecting the systematic position of the Opah. He has found the same number of bones in the scapular arch as in that of normal Acanthopterygians, but has homologized them differently from his predecessors. The "very large bone to which the pelvis is attached" is designated as an "infraclavicle" and homologized with a so-called infraclavicle of Hemibranchiate fishes. A comparatively small bone in serial relation with the actinosts or "pterygials" is identified as the homologue of the hypocoracoid or "coracoid" of ordinary Acanthopterygians. There would then be only three actinosts or "pterygials," and it is especially remarked that the foremost of these is "fused with" the hypercoracoid or "scapula." As a result of these identifications, Dr. Boulenger thinks that "all difficulties from the systematic point of view disappear at once" and that "the Opah must be regarded as more nearly allied to the Hemibranchii than to any other group of fishes with which we are as yet acquainted." Consequently the Opah is isolated not only as the representative of a distinct family (*Lamprididae*), but an independent group (*Selenichthys*) of a new suborder (*Cutosteomi*), which includes also the *Hemibranchii* and *Lophobranchii*.

## II.

The great respect and admiration I have for Dr. Boulenger's work has led me to consider very carefully the grounds for the determinations in question, but I find greater difficulty in accommodating myself to his views than in accepting those (or nearly those) of his predecessors. Among the latter was William Kitehen Parker, who in 1868 commented on the structure of the Opah in A Monograph of the Structure and Development of the Shoulder Girdle (p. 51). His identifications essentially correspond with those now to be given, although his meaning is somewhat obscured by the curious mode of expression to which he was addicted. At any rate, he writes that

“the coracoid [hypocoracoid] reaches to the basal line below,” and it “seems very probably to have had originally some assistance from an interclavicular ossicle.” Parker regarded the Opah and Dory as “most aberrant Scomberoids,” with a tendency toward the Plectoynathi. The difficulties of the homologization of the shoulder girdle of

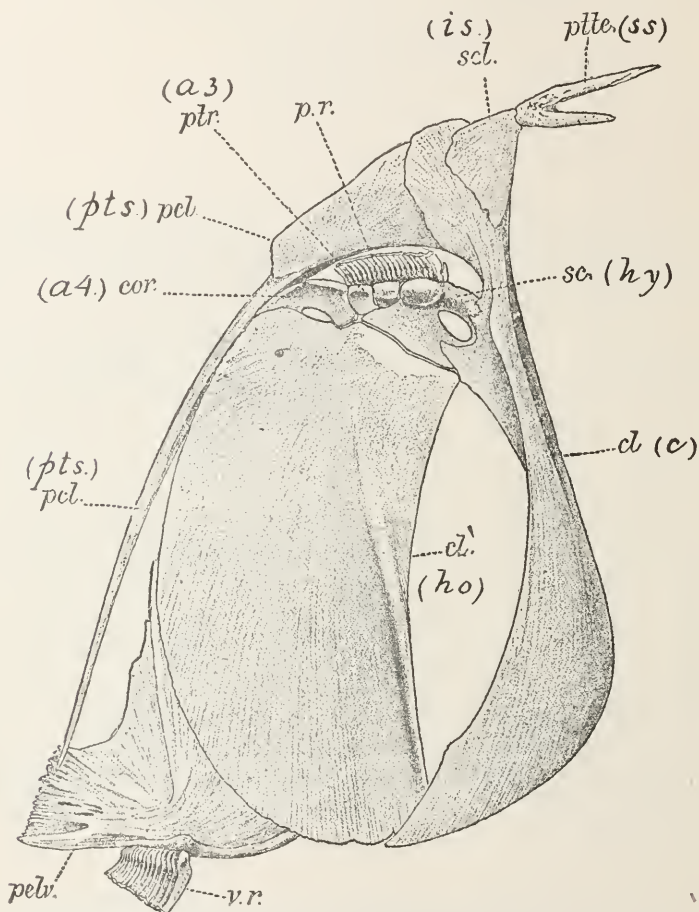


FIG. 1.—SHOULDER GIRDLE OF *LAMPRIS GUTTATA*, OUTER VIEW

*Gill.*

- c.* suprascapula.  
*is.* interscapula.  
*ps.* cenosteon or proscapula.  
*hy.* hypercoracoid.  
*ho.* hypocoracoid.  
*ac.* actinosts 1-3.  
*a4.* actinost 4.  
*pts.* postscapula.  
*ptr.* pelvis.  
*v.r.* ventral rays.

*Boulenger.*

- posttemporal (*pttc.*).  
 supraclavicle (*scl.*).  
 clavicle (*cl.*).  
 scapula (*sc.*)  
 infraclavicle (*cl.*).  
 pterygials (*ptr.*).  
 coracoid (*cor.*)  
 postclavicle (*pcl.*).  
 pelvis (*ptr.*).  
 ventral rays (*c.r.*).

*Lampris* may be made most evident and the explanation for other views best elucidated by the reproduction of Dr. Boulenger's excellent illustration of the shoulder girdle of the Opah. The names given are those which are preferred for the present, and the equivalents of Dr. Boulenger follow.<sup>a</sup>

With these identifications the structure of the Opah would be in conformity with that of most acanthopterygians, and the normal number of bones of the scapular arch would be realized.

The three main bones of the arch (cenosteon, interscapula, and suprascapula) are developed essentially as usual, and as to them there is agreement with Dr. Boulenger except as to general morphological relations and nomenclature.

The actinosts or "pterygials," according to the present view of homologies, would also be realized. The almost universal number of four would thus be developed. There seems to me no more difficulty in considering that one actinost may be "synchondrosially united with the scapula" (or hypercoracoid) than that another should be coossified or "fused with" it. Consequently the complete number of actinosts (4) is recognized, although none is as slightly connected with the supporting bones as usual. Thus, also, the relative proportions of the various elements of the shoulder girdle and its appendages would be manifest approximately as in ordinary fishes.

### III.

One objection against the homology of the hindmost (or lowermost) actinost of the Opah with an actinost is urged by Dr. Boulenger in the statement "that the posterior of the supposed pterygials [actinosts] does not support rays and is altogether unlike a pterygial."

<sup>a</sup> It might be supposed by one unfamiliar with the intricacies of anatomical nomenclature, from the difference in the nomenclature of the bones, that the differences between Dr. Boulenger and myself are greater than they really are. The only extranomial differences relate to the two bones called coracoid and infraclavicle by Boulenger, and hypocoracoid and fourth actinost by myself. I am happy to know that the divergencies respecting the other names are simply the result of different interpretations of the same facts from a general standpoint. Dr. Boulenger is the orthodox party, inasmuch as he agrees with the majority of anatomists in accepting the nomenclature that has been most current (except in Great Britain) since the time of Gegenbaur. I have to confess to being the heterodox party. But a review of the paleontological and developmental history of the shoulder girdle, as well as of its comparative anatomy, compels me to reject a nomenclature which appears to me to be extremely misleading. The hypercoracoid and hypocoracoid are only developed in specialized teleost fishes and are (as well as the mesocoracoid) the results of the ossification and disintegration of a single cartilage occurring in primitive and ganoid fishes and inherited from the Selachians. The application of the names scapula and coracoid, originally given to mammalian parts, entails a very erroneous and distorted idea of their relations and history, if it is assumed that the words have any extrinsic meaning at all.

There is such great variety in the form of the fourth actinost (as well as others) in fishes that the objection urged apparently is not of very great importance. Even among the universally recognized constituents of the group of Hemibranchs there is great diversity and differences as important as those differentiating the Opah from other fishes exist between the Centriscids or Amphisilids on the one hand and the Gasterosteids and Aulorhynchids on the other.

The cases of exclusion of rays from the fourth actinost are rare, but by no means confined to the Lampridids. We need, indeed, only look to the Hemibranchs again to find parallel cases. In the genus *Aulorhynchus*, as shown by Mr. Starks in his excellent article on those fishes, recently published, the fourth actinost is represented as destitute of rays quite as much as that of *Lampris*, and that of the common Sticklebacks of the north is almost if not quite as much so. In fact, one of the characters of the superfamily Gasterosteioidea would appear to be the nearly or quite complete exclusion of rays from the fourth actinost.

Such a condition, too, is realized or approximated among Malacopterygians (*e. g.*, Salmonids and Esocids or Luciids). It is possible that in the excessively modified Opah, deviation from the ordinary type is manifested in such exclusion as well as in other characters and may be the result of mechanical adaptation to the special conditions of position and other modification of the pectoral fin and supporting bones.

#### IV.

If the views as to the homologies of the bones in question are correct, the approximation of *Lampris* to the neighborhood of the Hemibranchs can not be sustained, as the only ground for it was the supposed homology of the hypocoracoid of the present article with an assumed infraclavicle. The supposititious infraclavicle (or interclavicle) of the Hemibranchs has been recently shown, in an excellent paper by Mr. E. C. Starks, to have no independent existence (a conclusion I was forced to come to on scanty material many years ago). The so-called infraclavicle of *Lampris*, then, has no counterpart among the Hemibranchs. As the supposed agreement of *Lampris* with the Hemibranchs was based mainly on the assumed possession of the same peculiar bone ("infraclavicle") by both types, the negation of that agreement involves the denial of the relationship.

But what is the relationship of *Lampris*? Cuvier and the elders were perhaps not far out of the way in approximating it to the great Scombroidean series with which it agrees in characteristic modifications of the vertebrae and clasping rays. So far as the scapular arch is concerned, the Caproids agree better than any other known form. Mr. Starks has recently published an article on The Relationship and Osteology of the Caproid Fishes or Antigoniidae, and given therein

a figure as well as description of the "shoulder girdle of *Antigonia rubescens*." On the whole, there is considerable similarity between the corresponding parts of *Lampris* and *Antigonia*. The front border of the cœnosteon is decurved backward in both, and the proportions of the hypocoracoid and hypercoracoid do not differ very widely. The actinosts of *Antigonia*, however, are comparatively free and the supra-seapula not forked. The pelvis is also quite different.

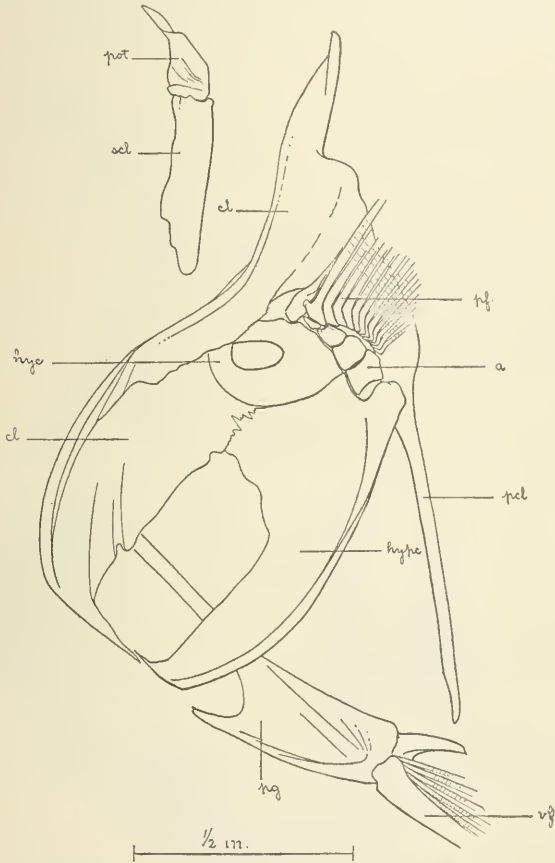


FIG. 2.—SHOULDER GIRDLE OF ANTIGONIA RUBESCENS. (FROM STARKS.)

In fine, at present apparently no better position can be found for *Lampris* than somewhere in the line of the Scombroidean superfamily. It even agrees with the Scombrids, Xiphiids, Coryphænids, Carangids and their relatives in the deep bifurcation of the roots of the caudal rays which clamp the hypural and epural bones, and provisionally at least it should be approximated to them.

Dr. Boulenger has proved, however, that the Opali is not especially related to the Scombroidea, and it is quite possible that he may be sustained in the isolation of the family Lamprididæ as representative

of a special group or suborder; at any rate, it is at least entitled to distinction as a special superfamily (LAMPRIDOIDEA). This superfamily may be briefly defined in the following terms:

## V.

## LAMPRIDOIDEA.

Acanthopterygian fishes with the foremost rays only spiniform, the myodome completely shut off from the cerebral chamber, ribs sessile on the centra of the vertebrae, suprascapulars connected by squamous suture and ligaments with the cranium, cœnosteons postcurved toward each other, hypocoracoids much enlarged and extended upward and backward, actinosts diverted to a nearly horizontal row, pelvic bones enlarged and connected by cartilage with the cœnosteons as well as the hypocoracoids, ventrals subabdominal and with numerous rays, and caudal rays clasping epurals and hypurals.

The family was first named in 1862, and has been adopted by the authors named in the synonymy herewith given and in a few other places. Many naturalists still prefer to leave it in the incongruous family of *Scombridae*.

The family name was originally written *Lamprididae*, and in this form it was adopted by Jordan and Gilbert and by others, but Jordan and Evermann have changed it to *Lamprida*. The reason for the change is not evident and has not been given. It is possible that it may have been from confusion with  $\lambda\alpha\mu\pi\rho\acute{o}\varsigma$  (radiant), but the generic name is not derived directly from the Greek but modified from it, and agrees with such well-known fish names as *Chalcis*, *Etelis*, *Julis*, *Pelamis*, *Phycis*, *Smaris*, *Synagris*, and *Teuthis*, which have -id in the oblique cases (*e. g.*, -idos in the genitive, etc.). The original form of the name is consequently justified by analogy and should be retained.

The history of the nomenclature may be gleaned from the following partial synonymy:

## LAMPRIDIDÆ.

## FAMILY NAMES.

*Lampridoide* GILL, Proc. Acad. Nat. Sci. Phil., 1862, p. [127,] 241. (Named only.)

*Lamprididae* GILL, Arr. Fam. Fishes, 1872, p. 7. (Name only.)

*Lamprididi* POEY, Enum. Pisc. Cub., p. 93, 1876.

*Lamprididae* JORDAN and GILBERT, Syn. Fishes N. Am., 1882, p. 453.

*Lamprididae* GILL, Johnson's Univ. Dict., II, 1885, p. 1621 (defined).

*Lamprididae* SMITT, Hist. Scand. Fishes, I, 1892, p. 121.

*Lamprididae* GOODE and BEAN, Oceanic Ich., 1895, p. 222.

*Lamprida* JORDAN and EVERMANN, Syn. Fishes N. M. Am., I, 1896, p. 953.

*Lamprididae* BOULENGER, An. Mag. Nat. Hist. (7), 1902, p. 151.

## SUBFAMILY NAME.

*Lamprini* MOREAU, H. N. Poiss., France, II, p. 483.

## VI.

The skeleton in the United States National Museum, so far as the scapular arch is concerned, naturally manifests essential similarity with the one figured by Dr. Boulenger. There are certain differences, however, which are noteworthy. The cenosteon<sup>a</sup> and hypocoracoid terminate in and are united by cartilage which also extends backward and under the hypocoracoid to connect with the infero-anterior angle

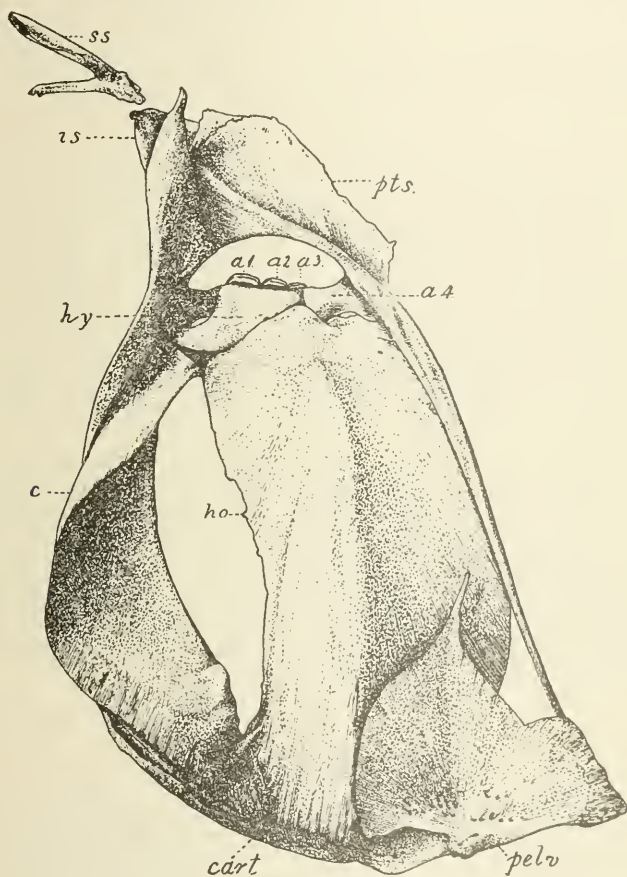


FIG. 3.—SHOULDER GIRDLE OF LAMPRIS GUTTATA, INNER VIEW. (FOR LETTERING SEE P. 916.)

of the pelvic bone. The upper half of the anterior border and most of the posterior border approximate more toward a straight oblique line than the corresponding margins of Boulenger's specimen. The

<sup>a</sup>Several names I have previously used have been abandoned in this communication, post-temporal giving place to the previously named *Suprascapula*, posterotemporal to *Interscapula*, and proscapula to *Cenosteon*.

*Cenosteon* is named in the Synonymy of the Fish Skeleton, by Mr. Edwin Chapin Starks, but without any data. In the Proceedings, Washington Academy Sciences

interseapula has a convex inferior margin and reminds one of the lower mandible of some cuttlefishes. The postseapula is more decurved. The cœnosteon and hypercoracoid are connected toward the front at the symphysis by the intervention of cartilage.

The hypercoracoid has a foramen which appears as a notch from the outer side as the result of the overlapping of the cœnosteon by squamous suture, but internally the bone extends forward and is separated from the cœnosteon by a long unguiform gap and intervening cartilage or membrane.

The fourth actinost is much broader in front than in the British Museum skeleton and its posterior portion much more deflected and wedged in between the hypocoracoid and styliiform extension of the postseapula, which is suturally connected with it as well as with the hypocoracoid; there is little cartilage between its anterior portion and the hypocoracoid as well as third actinost. The third actinost intervenes between the hypercoracoid and fourth actinost, quite widely separating them, and has the same kind of union with the fourth as with the third; the second is longer, and has an oblong convex articular surface; its sutures, though close, are well defined; the first actinost has a still larger, more oblong, and more convex articular surface, and is so intimately connected with the hypercoracoid that the sutures are obliterated; it is, in fact, completely "fused with" the hypercoracoid.

The pelvic bones are connected with the postflected lowermost or symphyseal angles of the cœnosteons through the intervention of cartilage and have lamellar extensions, separated by fissures from the body of the bone, which are connected by cartilage with a slightly defined ridge of the hypocoracoid parallel with its anterior margin. The ventrals are subabdominal and inserted in the pelvic bones some distance in advance of the hinder ends of those bones.

## VII.

The pectoral fins of the Opah are represented inclined downward in Smitt's Scandinavian Fishes (I, p. 123, 1892), as they are in the old article by Günner. Boulenger remarks, "On examining the shoulder bones on a skeleton of *Lampris lina*, I was struck by two things—first,

(III, p. 521, 1901) the word is quoted under "55, Clavicle, Parker," and in a footnote the following remark is made: "I get this reference from Owen's Comp. Anat. Lectures (Vertebrates), p. 118. By some ichthyotomists the bone in question has received the special name of Cœnosteon." The name was given by Bakker in his "Osteographia Piscium" (1822). Bakker thought that the so-called clavicle of fishes was more than the clavicle of other vertebrates, corresponding to the clavicle and humerus together (Nec tamen claviculam solam facere, sed e clavícula et osse humeri componi mihi visum est, p. 111), and consequently gave the name cœnosteon (evidently from κοινός, common or shared in common, and ὀστέον, bone). The implication is certainly false, but the name itself may be retained.



that the disposition of the articulating facets of the pterygials allows of a much greater downward than upward movement of the rays of the pectoral, by which the fin can be pressed down close against the sides of the body, and precludes the opposite vertical position—a fact which I have been able to verify on a specimen in the flesh. This mode of articulation seems so contrary to our ideas that most figures and stuffed specimens represent the pectoral fin directed upward, as in *Brama*, to which the Opah was believed to be related."

It is noteworthy that representatives of the genus *Pempheris* are also able to deflect their pectorals against the sides of the body, but they are not limited to that movement and can fold the fins backward.

### VIII.

The Opah appears to be not rare in certain regions, and the paucity in collections is probably due to the want of sufficient motive to hunt for them rather than absolute rarity or difficulty in obtaining them. In the Twentieth Annual Report of the Fishery Board of Scotland (1902), kindly sent to me recently, there is an interesting record (p. 541) of individuals "landed at Aberdeen market during 1891," with a "note of the place where they were stated to have been caught." In June, "three specimens;" in July, ten; in August, one, and in September two were received. All "were taken by line" and the one was caught at a depth of 125 fathoms.

The only previous notice of the capture of the Opah off the coast of Aberdeenshire I am acquainted with is one published in the Zoologist for August<sup>a</sup> on The Opah or Kingfish off Aberdeen that "there was lately on view at Messrs. J. and T. Sawers's fish market, Belfast, a fine specimen of the Opah or Kingfish caught off the coast of Aberdeenshire. It weighed 70 pounds, was about 4 feet long, and measured 2½ feet at the broadest part."

### IX.

The etymology of the curious name Opah is stated to be unknown by the various English dictionaries, as the Century Dictionary ("Opah (ō'pä) *n.* [Origin unknown]").

Further research would have revealed it. The first appearance of the name with explanation is in 1750, in the Philosophical Transactions (vol. 46). Therein is published "The Description of a Fish flewed to the Royal Society by Mr. Ralph Bigland, on March 22, 1749-50: Drawn up by C. Mortimer, M. D., Secret. R. S." (pp. 518-520.) This seemed to the author "to be a new Species of Fish not yet described by any author." It was a *Lampris*, and immediately after the dec-

laration just quoted the author appended the following two paragraphs. The italics, capitals, antique s(f), orthography, and brackets are reproduced from the original:

“The black Prince, and his Cousin, from *Auamaboe* on the Coast of *Guinea*, and Mr. *Creighton*, formerly Governor of *Capo Corso Castle*, upon seeing this Fish immediately knew it, and said it was common on that Coast, and is very good to eat. The Natives call it *Opah*, and the English there call it the *King fish*. I shall therefore retain the *Guinea* Name, with these Characterifticks; *OPAH Guinienfium est pifeis offeus, non squammofus, alentulus; habens unicam in dorfo pinnam anteriùs aculeatam, pone branchias par pinnarum, in medio ventre par pinnarum, ad pofticam ventris partem unicam pinnam, caudam forcipatam.*

“Mr. *Bigland* fays, that, upon opening of it, all its Bowels would have gone into a Quart-Mug; that the Flefh of the fore Part was firm, and look'd like Beef, and the hinder Part like fine Veal; that the Bones were like thofe of Quadrupeds; particulary the Shoulder-blades, which refembled thofe of Sheep. [See an Article in the *Scots Magazine* for *October 1748*, printed at *Edinburgh* in 8vo.] In a Letter to me, he adds, that probably this was a [Pelagian or] Ocean Fish, wandring by chance into the Frith of *Forth*; and, by the Tide ebbing, being left upon a confiderable Shoal, or flat Sand, near *Leith*, was difcover'd from Land in a State of Distrefs; whereupon fome Fifhermen plunged into the Sea, and with a Net furrounded it, and brought it to Shore.”

It is not at all probable that “the black prince” or the “former governor of *Capo Corso*” ever saw a specimen of *Lampris*. The fish has never been recorded from the western coast of tropical Africa, and it certainly is not and never “was common on that coast.” Inasmuch, however, as it is a wide-ranging pelagic form, it is no more impossible that an individual may have been caught near the coast of Africa than that one was actually caught near Cuba. Probably, however, the origin of the name is due either to the fancy of a negro chieftain and the subserviency of a white man, or to a misunderstanding or misrepresentation of what was said. It was a “ghost-word,” at least so far as the *Lampris* is involved.