

THE OSTEOLOGICAL CHARACTERISTICS OF THE FAMILY ANGUILLIDÆ.

BY

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The diversities within the restricted Apodes (or those anguilliform fishes without developed intermaxillaries and with the "vomer" projecting and forming, with the supramaxillaries, the upper arcade of the mouth) are very great, but were not appreciated till Professor Cope considered them in his "Observations on the Systematic Relations of the Fishes." * That great naturalist was so impressed by them that he distributed them under two orders, the *Enchelycephali*, † embracing the *Congridæ*, *Anguillidæ*, and *Murænesocidæ*, and the *Colocephali*, † including the *Murænidæ* and *Rataburidæ* (= *Moringuidæ*). While I am not prepared yet to admit the "orders" of Professor Cope, I retain the groups as suborders with modified characters, and the families appear not only to be justified, but, it seems to me, must be increased. A comparison of the skulls of *Anguilla*, *Conger*, *Murænesox*, *Simenchelys*, *Synaphobranchus*, *Ophichthys*, and *Muræna* has convinced me of the advisability of recognizing for each of them family rank. The characters of the family *Anguillidæ* contrasting with one or other of the other families are now given in the order which I have heretofore employed for full descriptions of families of normal fishes.

ANGUILLIDÆ.

Synonyms as family names.

- < Pantoptères, *Dunéril*, Zool. Anal., pp. 111, 115, 1806.
- < Anguillidi, *Rafinesque*, Indice d' Ittiolog. Siciliana, p. 37, 1810.
- < Pantopteria, *Rafinesque*, Analyse de la Nature, 23 fam., p. —, 1815.
- < Anguilliformes, *Cuvier*, Règne Animal [1^o 6d.], t. 2, p. 229, 1817; 2^o 6d., t. 2, p. 348, 1829.
- < Anguilloides, *Latreille*, Fam. Nat., Règne An., p. 142, 1825.
- < Les Murénides, *Risso*, Hist. Nat. Europe mérid., t. 3, p. 189, 1826.
- < Murænidæ, *Bonaparte*, Giorn. Accad. di Scienze, v. 52 (Saggio Distrib. Metod. Animali Vertebr. a Sangue Freddo, p. 34), 1832.
- < Murænidæ, *Bonaparte*, Nuovi Annali delle Sci. Nat., t. 2, p. 133, 1833; t. 4, p. 276, 1840.
- < Murænidæ, *Swainson*, Nat. Hist. and Class. Fishes, etc., v. 2, pp. 195, 333, 1839.
- < Anguillares, *Müller*, Archiv f. Naturgesch., 9. Jg., B. 1, p. 328, 1843.
- < Murænidæ, *Bonaparte*, Cat. Metod. Pesci Europei, p. 6*, 33*, 1846.
- < Murænidæ, *Adams*, Man. Nat. Hist., p. 110, 1854.

* Proc. Am. Ass. Adv. Science 1871, v. 20, pp. 317-343, 1872.

† *Op. cit.*, p. 334.

- = Anguillidæ, *Kaup*, Archiv f. Naturgesch., 22. Jg., B. 1, p. 54, 1856.
 = Anguillidæ, *Kaup*, Cat. Apod. Fish B. M., p. 32, 1856.
 = Anguillidæ, *Richardson*, Enc. Brit. 8th ed., v. 12, p. 232, 1856.
 = Anguilloidei, *Bleeker*, Enum. Sp. Piscium Archipel. Indico, p. xxxiii, 1859.
 < Anguilloidei, *Kner*, Sitzungsber. k. Akad. Wissensch. (Wien), v. 42, p. 1, 1860.
 < Murænida, *Günther*, Cat. Fishes Brit. Mus., v. 8, p. 19, 1870.
 = Anguillidæ, *Cope*, Proc. Am. Assoc. Adv. Sci., v. 20, p. 334, 1872.
 = Anguillidæ, *Gill*, Arrangement Fam. Fishes, p. 20, 1872.
 < Anguilla, *Fitzinger*, Sitzungsber. k. Akad. der Wissensch. (Wien), B. 67, 1. Abth., p. 45, 1873.
 = Murænidi, *Poey*, Anal. Soc. Esp. Hist. Nat., v. 4, p. 10, 1875.
 < Anguillidæ, *Moreau*, Hist. Nat. Poiss. France, v. 3, p. 560, 1881.
 < Anguillidæ, *Jordan & Gilbert*, Syn. Fishes N. Am., p. 357, 1882.
 = Anguillidæ, *Gill*, Standard Nat. Hist., v. 3, p. 101, 1885.
 = Anguillidæ, *Jordan*, An. Rep. Com. Fish. for 1885, p. 843, 1887 (Sep., p. 55, 1885).
 = Anguillidæ, *Jordan*, Man. Vertebrates North. U. S., 5th ed., p. 89, 1888.

Synonyms as subfamily names.

- < Anguillinia, *Rafinesque*, Analyse de la Nature, p. —, 1815.
 < Murænini, *Bonaparte*, Nuovi Annali d. Sci. Nat., t. 2, p. 133, 1838; t. 4, p. 276, 1840.
 < Anguillina, *Swainson*, Nat. Hist. and Class. Fishes, etc., v. 1, p. 220, 1838.
 < Anguillini, *Bonaparte*, Cat. Metod. Pesci Europei, p. 6*, 38*, 1846.
 = Anguillina, *Kaup*, Archiv f. Naturgesch., 22. Jg., B. 1, p. 54, 1856.
 < Anguillina, *Günther*, Cat. Fishes B. M., v. 8, pp. 20, 23, 1870.
 = Anguillina, *Jordan & Gilbert*, Syn. Fishes N. A., p. 357, 1882.

DIAGNOSIS.

Enchelycephalous Apodals with conic head, well developed opercular apparatus, lateral maxillines, cardiform teeth, distinct tongue, vertical lateral branchial apertures, continuous vertical fins with the dorsal far from the head, pectorals well developed, scaly skin, and nearly perfect branchial skeleton.

Description.

Body typically anguilliform, anteriorly subcylindrical, compressed behind, robust and with the caudal portion gradually attenuated backwards, and with the anus in the anterior half of the length.

Scales small, linear or elongated elliptical, distant, arranged in small groups obliquely at right angles to those of the neighboring groups.

Lateral line distinct.

Head moderate, oblong conic, with all the bones invested in the muscles or skins.

Eyes within the anterior half of the head, directed sideways, of moderate size; not covered by the skin.

Nostrils mostly lateral; the posterior directly in front of the eyes, the anterior near the margin of the snout and tubular.

Mouth with the cleft slightly oblique, extending below or little behind the eyes.

Jaws well developed; maxillines approximated to the front of the

vomer, with the clamping processes selliform and appressed closely to the sides of the ethmo-vomer behind its head, with ledge-like extensions within, and attenuated backwards.

Mandible moderately stout; the dentary with the coronoid process well developed near its posterior end; the articular little produced externally in front of the condyle, but considerably extended backwards and below.

Teeth conic, in cardiform bands on the jaws and vomer.

Lips thick, mostly with free lateral margins, but undifferentiated in front.

Tongue well developed and free at its anterior portion as well as sides.

Periorbital bones moderately developed.

Opercular apparatus well developed; operculum lamelliform and oblong, inserted high up on the hyomandibular; suboperculum falciform, bordering the operculum; interoperculum large, partly covered by the preoperculum; preoperculum well developed, lamelliform.

Branchial apertures lateral vertical slits in front of and lower than the inferior rays of the pectoral fins.

Branchiostegal rays in moderate number (about twelve), some attached to the ceratohyal and others to the epihyals, quite robust and much bowed.

Dorsal, anal, and caudal confluent in one uninterrupted fin with the rays readily perceptible through the thin skin; dorsal commencing far behind the head and little before the anus; anal close behind the anus; caudal prominent.

Pectorals well developed, nearer the breast than back, with the rays distinct, unbranched, and articulated.

Branchial arches nearly complete, with well developed glossohyal and urohyal, but with the first and second basibranchials only ossified; the first and second hypobranchials ossified, third and fourth cartilaginous; ceratobranchials and epibranchials, of four pairs, ossified; pharyngobranchials of first and second pairs, rod-like; of third and fourth pairs, in close apposition and developed as dentigerous epipharyngeals; hypopharyngeals oblong and closely apposed and superincumbent on a rudimentary fifth arch, covered with cardiform teeth. Interbranchial slits extended.

There are numerous other characters which support the family distinction of the Anguillidæ, but the only ones that need be here added are the separation of the two frontals, the oblique, forward trend of the suspensorium, and the moderate development of the hyomandibular.

Only one genus of the family is known—that generally called *Anguilla*, but also by Bleeker and some others endowed with the name *Muraena*.

Anguilla is generally ascribed by authors to "Thunberg," but without any definite reference to place of publication. Agassiz, in his "Nomenclator Zoologicus," refers to "*Anguilla*, *Thunb.*, Nuov. Mem. Stock.,

179-," and Günther to "Anguilla (Thunberg) Cuv. Règne Anim.;" but no such name is to be found in the Memoirs of the Stockholm Academy.

The first division of the old genus *Muraena* appears to have been made by Thunberg or Ahl in 1789 in an inaugural dissertation.* Therein the genus *Muraena* is subdivided into, *Muraena* restricted to species without pectoral fins, and *Ophichthus* proposed for those with such fins. The species enumerated are as follows:

<i>Muraena</i> .	<i>Ophichthus</i> .
1. <i>M. helena</i> L.	1. <i>O. ophis</i> .
2. <i>M. nebulosa</i> .	2. <i>O. serpens</i> .
3. <i>M. pieta</i> .	3. <i>O. cinereus</i> .
4. <i>M. annulata</i> .	4. <i>O. myrus</i> .
5. <i>M. fasciata</i> .	5. <i>O. conger</i> .
	6. <i>O. anguilla</i> .

The name *Muraena* was thus definitely restricted to species without pectoral fins, and therefore the subsequent restriction of it to species with pectoral fins, and especially to *M. anguilla*, as Professors Jordan and Gilbert † have already shown, was illegitimate. If not belonging to *Ophichthus*, it was necessary, consequently, that another generic name should be given to the *Anguilla*. *Ophichthus*, indeed, proved to be a very incongruous group, each species representing a peculiar genus. Genera were proposed for them as follows:

<i>O. ophis</i> .	<i>Ophichthys</i> , Ahl., 1789.
<i>O. serpens</i> .	<i>Leptognathus</i> Sw. 1839. ‡
<i>O. cinereus</i> .	<i>Muraenesox</i> , McCl., 1843.
<i>O. myrus</i> .	<i>Myrus</i> Kaup., 1856.
<i>O. conger</i> .	<i>Conger</i> , Cuv., 1817.
<i>O. anguilla</i> .	<i>Anguilla</i> Shaw, 1803.

The name *Anguilla* therefore rightly belongs to the division so named, but (unless there is some memoir that has been overlooked) must be credited to Shaw and not Thunberg. The synonymy of the genus will then be, in brief, as follows:

ANGUILLA.

< *Anguilla* Shaw, Gen. Zool., v. 4, p. 15, 1803.

< *Anguilla* Cuvier, Règne, Animal, v. 2, p. 230, 1817.

= *Anguilla* Kaup, Cat. Apodal Fish, p. 32, 1856.

= *Muraena* Bleeker Atlas, Ich. Ind. Neerland, v. 4, p. 1, 1864.

Muraena sp. anct. vet.

Ophichthus sp. Thunberg, Ahl.

* Specimen ichthyologicum de *Muraena* et *Ophichtho* quod seria exp. fac. med. Ups. præs. Carol. Vet. Thunberg æquite, etc. modeste offert Jonas Nicol. Ahl. 27. Jan. 1789. Upsalia.

† On the nomenclature of the genus *Ophichthus* < Proc. U. S. Nat. Mus., v. 5, pp. 648-651.

‡ See Jordan & Gilbert, *op. cit.*