

THE DIFFERENTIAL CHARACTERS OF THE SYNGNATHID AND HIPPOCAMPID FISHES.

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THE TYPICAL Lophobranchs have been distributed among two families by several authors, but by most have been combined in one. The reasons generally given for the separation have not been very satisfactory, and I now propose to indicate those which have influenced me.

I.

The first to recognize the family difference between the groups in question, and to give appropriate names to them, was Prof. Giovanni D. Nardo.

In 1842 (1844)¹ Professor Nardo divided the Lophobranchs into two families, Syngnathidæ and Hippocampidæ, in the following terms:

Fam. 1. *Syngnathidæ* NARDO. Annuli protovertebrales constituuntur scutis squamoso-corneis, medio angulosis, symmetricè striatis, contiguis, subimbricatis, corio superpositis, adhærentissimis. Ossa nasalia et palatina usque ad apicem rostri protracta, et maxillæ superiori conjuncta. Epidermis crassa, stipata, continua, adhærens, scutorum strias exhibens. Appendices cutaneæ nullæ.

Subfamilia 1. *Syngnathini* NARDO. Ventrals nullæ; os terminale; apertura branchiarum ad nucham.

Subfamilia 2. *Scyphini* NARDO.² Corpus pinna unica seu dorsali instructum est.

Fam. 2. *Hippocampidæ* NARDO. Annuli protovertebrales constituuntur ossiculis quadrangularibus, angulis porrectis, centro in tuberculum salientibus, distantes, et sibi invicem per angulos tantum seriatim et symmetricè conjunctis, corio intrinsicè obsitis. Ossa nasalia et palatina ad medium tantum rostri protracta, et maxillæ superiori contigua. Epidermis continua, adhærentissima, glabra. Appendices cutaneæ multæ, etc.

Subfamilia 1. *Hippocampini* NARDO. Ventrals et caudales nullæ; os terminale; apertura branchiarum ad nucham ec.

Subfamilia 2. *Pegasini* NARDO. Ventrals filiformes; os inferum ad basin rostri; apertura branchiarum ante pinnas pectorales, etc.

Subfamilia 3. *Solenostomini* NARDO. Ventrals grandes, pectoralibus conjunctæ; os terminale; apertura branchiarum ad jugulum ec.

¹Considerazione sopra alcune nuove famiglie de' Syngnathi e de' Plectognathi, e sui caratteri anatomici che le distinguono. <Atti Scienz. Ital., 1843, pp. 244, 245.

²*Syngnathini*, BONAPARTE, Catal. Metod. Pesci Europei, pp. 9, 89, 1846, is apparently coequal with *Scyphini* of Nardo.

In 1846 Prince Bonaparte (of Canino) adopted this classification, but changed the name from *Hippocampidæ* to *Pegasidæ*, and substituted for *Syngnathini*, *Siphostomini*, and for *Scyphini*, *Syngnathini*. The former change was effected doubtless for the reason that *Pegasus* was the longest named genus, and the latter because *Syngnathus* was restricted to the genus called *Nerophis* by other authors, while the one generally called *Syngnathus* was designated after Rafinesque *Siphostoma*. Bonaparte's arrangement, then, was as follows:

- Osteodermi* [= *Lophobranchii*].
- Pegasidæ* [= *Hippocampidæ* N.].
- Solenostomini*.
- Pegasini*.
- Hippocampini*.
- Syngnathidæ*.
- Siphostomini* [= *Syngnathini* N.].
- Syngnathini* [= *Scyphini* N.].

The relationship between the *Hippocampini* and the restricted *Syngnathidæ* is evidently far nearer than that between the former and the *Solenostomini* and *Pegasini*. Inasmuch as the last two types are now universally conceded to be of family rank, it is unnecessary to urge the differences between them and the *Hippocampini*. The characters used to combine the three by Nardo are, indeed, not only superficial, but illusive. There are, however, differences in dermal investment between the *Syngnathidæ* proper and *Hippocampini* (or *Hippocampidæ*) which may be appreciated on analysis, and which are indicated in the diagnoses of the respective families submitted in the following synopsis.

Swainson referred three Linnæan genera to his family *Syngnathidæ*, which he divided into subgenera as follows:

- Pegassus*, LINN. [= *Pegasidæ*, AD.].
- Hippocampus*, LINN. [! = *Hippocampidæ*, AD.].
- [*Hippocampus* restricted.]
- Phyllopteryx*, SW.
- Solenostoma*, LAC.
- Syngnathus*, LINN. [= *Syngnathidæ*, AD.].
- Syngnathus*, LINN.
- Aeus*, WIEL.
- Solegnathus*, SW.

It is probable that Adams, if he had proceeded independently, would not have been guilty of the gross inconsistencies which Swainson perpetrated, but, as a matter of fact, his diagnoses were almost interchangeable with those assigned to the corresponding groups by Swainson.

In 1854 Adams recognized three families of *Lophobranchii* and diagnosed the *Syngnathidæ* and *Hippocampidæ* as follows:

1. FAMILY.—*Pipefishes* (*Syngnathidæ*).—Body prolonged, slender, or angulated; snout greatly prolonged, cylindrical; mouth terminal, vertical; ventral fins absent; caudal fin wanting in some.

2. FAMILY.—*Sea-horses* (Hippocampidæ).—Head and body compressed; snout narrow, tubular; mouth terminal; pectorals small, dorsal single; caudal fin wanting.

3. FAMILY.—*Winged Sea-horses* (Pegasidæ).

Mr. Adams' work was largely based on Swainson's, and his diagnoses of families were often essentially similar to many of Swainson's.

In 1858 Dr. Girard adopted the families Hippocampidæ (after Owen and Baird) and Syngnathidæ, with the following data:

Family HIPPOCAMPIDÆ, Owen.

The sea-horse family being composed, to our knowledge, of but one genus (*Hippocampus*), we will not enlarge upon its characters here, since alluding to them would be a mere repetition of their enumeration further on.

He added that—

The position these fishes assume in the media in which they live is not the least of their peculiarities entitling them to the rank of a family in the ichthyic method.

Family SYNGNATHIDÆ, Bonaparte.

The same remark consigned under the head of Hippocampidæ applies again to this family, for the genus *Syngnathus* is the sole generic type which we have had an opportunity of examining. Those established by Kaup are quite numerous, but the description of their characters has not yet come into our hands.

The characters thus connected indirectly with the families in question are simply of generic value, and the agreement in many characters of *Hippocampus* with *Gasterotokeus*, *Solenognathus* and *Phyllopteryx*, associated with it by Kaup, shows that the "position these fishes assume" is of minor value and not significant of family differentiation. As Girard had knowledge of Kaup's article published in 1853,¹ he had data to forbid the assumptions he indulged in.

In 1882 Jordan and Gilbert accepted the two families in question and briefly differentiated them as follows:

"E. Snout tubular, bearing the short, toothless mouth at its end; body mailed.

"F. Caudal fin present; head in the line of the axis of the body...*Syngnathidæ*.

"FF. Caudal fin wanting; head not in line of axis of body...*Hippocampidæ*."

In the descriptive portion of their synopsis they gave amplified descriptions of the families, but did not add to their differential characters.

II.

It will be obvious to anyone who compares the definitions above given with a collection of the fishes for which they were framed, that they are not applicable to any natural groups, and that such natural groups are definable by characters that have been generally neglected. I am therefore led to submit diagnoses of the several groups which appear to me to be at least better than those for which they are

¹ Uebersicht der Lophobranchier. < Archiv Naturg., 1853, I, 226-234.

substituted. I do not anticipate, however, that they will be found to be definitive of the most natural arrangement, but the labor of years and a close and rigorous comparison of the skeletons of many genera will be requisite before such perfection is attainable. Meanwhile the notes here presented may be of some use in directing attention to features hitherto observed and as tentative to future work.

Some erroneous conceptions have been entertained and misstatements made respecting features of the pipefish's structure. Only a few need be here noticed, however. Such are the statements that the preoperculum and interoperculum are wanting, that the intermaxillaries are also absent, and that the symplectic is a very important element. The preoperculum and interoperculum, as well as intermaxillaries, are developed, but I am unable to identify the symplectic. In no respect do the Lophobranchs deviate so materially from ordinary fishes as has been supposed. But, as long ago shown by Parker, they manifest, in addition to the peculiarities generally noticed, deviations in the scapular arch. There is no posterotemporal, the posttemporal and proscapula being immediately connected, and the "coraco-scapular plate" is entire and not broken up into hypercoracoid and hypocoracoid bones.

III.

Order LOPHOBRANCHII.

Synonyms as Order.

- < *Lophobranches*, CUVIER, Règne Animal, 1e éd., II, p. 155, 1817.
- < *Osteodermi*, BONAPARTE, Giorn. Accad. di Scienze, LII (Saggio Distrib. Metod. Animali Vertebr. a Sangue Freddo, p. 39), 1832; Nuovi Annali delle Sci. Nat., II, p. 130, 1838; IV, p. 185, 1840.¹
- < *Bursipari vel Incubatores*, NARDO, Atti Congressi Scienze Ital. rac. et ord., I, p. 70, 1842 (1844).
- < *Lophobranchii*, GIRARD, Expl. and Surv. for R. R. Route to Pacific Oc., X, Fishes, p. 78, 1858.
- > *Solenostomi*, BLEEKER, Enum. Sp. Pisc. Archip. Ind., p. xiv, 1859.²
- > *Syngnathi*, BLEEKER, Enum. Sp. Pisc. Archip. Ind., p. xv, 1859.
- = *Prostomides*, DUMÉRIL, Hist. Nat. Poiss., II, p. 495, 1870.
- = *Lophobranchii*, GÜNTHER, Cat. Fishes Brit. Mus., VIII, pp. 150, 186, 1870.
- = *Lophobranchii*, COPE, Proc. Am. Assoc. Adv. Sci., XX, p. 330, 1872.
- = *Lophobranchii*, FITZINGER, Sitzungsber. k. Akad. der Wissensch., Wien, LXVII, 1. Abth., p. 49, 1873.

Synonym as Subclass.

Lophobranches, DUMÉRIL, Hist. Nat. Poiss., II, pp. 473, 488, 1870 (sous-classe).

Suborder SYNGNATHI.

Synonym as Order.

= *Syngnathi*, BLEEKER, Enum. Sp. Pisc. Archip. Ind., p. xv, 1859.

¹The "Sectio 2. Lophobranchii (Syngnathi)" of Bonaparte (op. cit.) is coequal with the "Ordo III. Osteodermi."

²The "series Hyperostomi" of the "sublegio Lophobranchii seu Dactylodermi," Bleeker, Enum. Sp. Pisc. Arc. Ind., p. xiv, 1859, is coequal with the order Lophobranchii as here accepted.

Synonym as Suborder.

=*Syngnathi*, GILL, Arrangement Families Fishes, p. 2, 1872.

Family SYNGNATHIDÆ.

Synonymy.

- <*Signatidi*, RAFINESQUE, Indice d'Ittologia Siciliana, p. 36, 1810.
 <*Syngnathidæ*, BONAPARTE, Giorn. Accad. di Scienze, LII (Saggio Distrib. Metod. Animali Vertebr. a Sangue Freddo, p. 39), 1832.
 <*Syngnathidæ*, BONAPARTE, Nuovi Annali delle Sci. Nat., II, p. 130, 1838; IV, p. 185, 1840.
 <*Syngnathidæ*, SWAINSON, Nat. Hist. and Class. Fishes, etc., II, pp. 195, 331, 1839.
 =*Syngnathidæ*, NARDO, Atti Congressi Scienz. Ital. rac. et ord., I, p. 70, (1842) 1844.
 <*Syngnathidæ*, KAUP, Archiv für Naturg., 19. Jahrg., I, p. 228, 1853; also Cat. Lophobr. Fishes Brit. Mus., p. 5, 1856.
 <*Syngnathidæ*, GIRARD, Expl. and Surv. for R. R. Route to Pacific Oc., X, p. 343, 1858.
 <*Syngnathoidei*, BLEEKER, Enum. Sp. Piscium Archipel. Indico, p. xv, 1859.
 <*Syngnathidæ*, DUMÉRIEUX, Hist. Nat. Poiss., II, p. 499, 1870.
 <*Syngnathidæ*, GÜNTHER, Cat. Fishes Brit. Mus., VIII, p. 153, 1870.
 =*Syngnathidæ*, COPE, Proc. Am. Assoc. Adv. Sci., XX, p. 339, 1872.
 =*Syngnathidæ*, GILL, Arr. Fam. Fishes, p. 2, 1872.
 =*Syngnathi*, FITZINGER, Sitzungsber. k. Akad. der Wissensch. (Wien), LXVII, 1. Abth., p. 49, 1873.
 <*Syngnathidæ*, MOREAU, Hist. Nat. Poiss. France, II, p. 28, 1881.
 =*Syngnathidæ*, JORDAN and GILBERT, Syn. Fishes N. Am., pp. 80, 382, 1882.

Syngnathi with squarish quadrangular plates attingent by extensive margins to the anterior and posterior plates, and allowing more or less lateral movements; tail not prehensile or curved downward. *

Subfamily SIPHOSTOMINÆ.

Synonymy.

- <*Syngnathini*, BONAPARTE, Giorn. Accad. di Scienze, LII (Saggio Distrib. Metod. Animali Vertebr. a Sangue Freddo, p. 39), 1832.
 <*Syngnathini*, BONAPARTE, Nuovi Annali delle Sci. Nat., II, p. 130, 1838; IV, p. 186, 1840.
 <*Syngnathini*, NARDO, Atti Sc. Ital. 1843, p. 244; Atti Congressi Scienz. Ital. rac. et ord., I, 1842, p. 70 (1844).
 <*Siphostomini*, BONAPARTE, Catal. Metod. Pesci Europei, pp. 9, 89, 1846.
 =*Syngnathina*, KAUP, Archiv für Naturg., 19. Jahrg., I, p. 231, 1853; also Cat. Lophobr. Fishes Brit. Mus., p. 21, 1856.
 =*Syngnathiformes syngnathini*, BLEEKER, Enum. Sp. Piscium Archipel. Indico, p. xv, 1859.
 =*Syngnathini*, DUMÉRIEUX, Hist. Nat. Poiss., II, pp. 499, 534, 1870.
 <*Syngnathina*, GÜNTHER, Cat. Fishes Brit. Mus., VIII, pp. 153, 154, 1870.
 =*Syngnathini*, MOREAU, Hist. Nat. Poiss. France, II, p. 40, 1881.

Syngnathidæ with pectoral fins, a long cleft subcaudal ovigerous pouch to males, and the upper caudal ridge continuous with the lateral and the lower caudal ridge with the ventrolateral ridge of the trunk.

Subfamily DORYRHAMPHINÆ.

Doryrhamphinae, KAUP, Archiv Naturgesch., 19. Jahrg., I, p. 233, 1853; Cat. Loph. Fish. Brit. Mus., p. 54, 1856.

Doryrhamphini, DUMÉRIL, Hist. Nat. Poiss., II, pp. 499, 585, 1870.

Syngnathidæ with pectoral fins and with a pectoral or abdominal ovigerous pouch to the males.

Subfamily SYNGNATHINÆ.

=*Scyphini*, NARDO, Atti Sc. Ital., 1843, p. 244.

=*Syngnathini*, BONAPARTE, Cat. Met. Pesci Eur., pp. 9, 90, 1846.

=*Nerophinae*, KAUP, Archiv Naturgesch., 19. Jahrg., I, p. 234, 1853.

=*Nerophini*, DUMÉRIL, Hist. Nat. Poiss., II, pp. 499, 600, 1870.

=*Nerophini*, MOREAU, Hist. Nat. Poiss. France, II, p. 61, 1881.

Syngnathidæ without pectoral fins or an ovigerous pouch, the eggs being attached to the belly of the male, and the upper caudal ridge continuous with the dorso-lateral and the lower caudal ridge with the lateral ridge of the trunk.

Subfamily GASTROTOKEINÆ.

Syngnathidæ with pectoral fins, no ovigerous pouch but eggs embedded in a soft membrane of the abdomen in the males; the upper caudal ridge continuous with the dorso-lateral, and the lower caudal ridge continuous with the ventro-lateral ridge; the body expanded below in a horizontal surface between the lateral lines, and the tail tapering and finless.

Family HIPPOCAMPIDÆ.

Synonymus as families.

<*Hippocampidæ*, NARDO, Atti Congressi Scienze Ital. rac. et ord., I, 1842, p. 70, (1844).

<*Pegasidæ*, BONAPARTE, Cat. Met. Pesci Eur., p. 9, 1846.

>*Hippocampidæ*, OWEN, Lect. Comp. Anat. Vert. An., I, p. 50, 1846.

>*Hippocampidæ*, BAIRD, Icon. Encycl., II, p. 232, 1850.

>*Hippocampidæ*, ADAMS, Man. Nat. Hist., p. 94, 1854.

>*Hippocampidæ*, GIRARD, Expl. and Surv. for R. R. Route to Pacific Oc., X, Fishes, p. 342, 1858. (Incl. *Hippocampus* only.)

=*Hippocampidæ*, COPE, Proc. Am. Assoc. Adv. Sci., XX, p. 339, 1872.

=*Hippocampidæ*, GILL, Arr. Fam. Fishes, p. 2, 1872.

=*Hippocampi*, FITZINGER, Sitzungsber. k. Akad. der Wissensch. Wien, LXVII, 1. Abth., p. 49, 1873.

=*Hippocampidæ*, JORDAN and GILBERT, Syn. Fishes N. Am., pp. 80, 385, 1882.

=*Hippocampidi*, POEY, Repert. Hist. Nat. Cuba, II.

Syngnathi with rhombiform quadrangular, or irregular plates with extensions buttressed against corresponding ones of the preceding and succeeding plates, thus prohibiting any lateral movement; tail more or less prehensile or curved downward; proscapular plates large and mammilated, and antepectoral plate wide.

Subfamily SOLEGNATHINÆ.

Synonyms.

< *Solegnathinae*, GILL, Proc. Acad. Nat. Sci. Phila. 1859, p. 149 (1859).

= *Solegnathinae*, GILL, Mem. Nat. Acad. Sci., VI, p. 137, 1893.

Hippocampidæ with the upper caudal ridge deflected and continuous into the lateral ridge and the lower caudal ridge continuous with the ventro-lateral ridge of the trunk; nuchal plate not elevated and not connate with the head.

Only one genus is known, viz:

Solegnathus, SWAINSON, 1839.

Subfamily HIPPOCAMPINÆ.

Synonyms as subfamilies.

< *Hippocampini*, BONAPARTE, Nuovi Annali delle Sci. Nat., II, p. 130, 1838; IV, p. 186, 1840.

< *Hippocampini*, NARDO, Atti Congressi Scienz. Ital. rac. et ord., I, 1842, p. 70, (1844).

< *Hippocampinae*, KAUP, Archiv für Naturg., 19. Jahrg., I, p. 228, 1853; also Cat. Lophobr. Fishes Brit. Mus., p. 6, 1856.

< *Hippocampiformes*, BLEEKER, Enum. Sp. Piscium Archipel. Indico, p. xv, 1859.

= *Hippocampinae*, GILL, Proc. Acad. Nat. Sci. Phila. 1859, p. 149 (1859).

< *Hippocampini*, DUMÉRIL, Hist. Nat. Poiss., II, pp. 499, 500, 1870.

< *Hippocampina*, GÜNTHER, Cat. Fishes Brit. Mus., VIII, pp. 153, 194, 1870.

= *Hippocampini*, MOREAU, Hist. Nat. Poiss. France, II, p. 34, 1881.

Hippocampidæ with the upper caudal ridge ceasing forward under the dorsal and the lower caudal ridge continuous with the lateral ridge of the trunk; nuchal plate more or less elevated, crowning the back of the head and connate with the preceding plate.

The subfamily thus defined includes five genera, which represent two sections which themselves should perhaps be raised to subfamily rank.

Section 1.

Hippocampus, RAFINESQUE, 1810.

Acentronura, KAUP, 1853.

Section 2.

Phyllopteryx, SWAINSON, 1839.

Phycodurus, GILL, 1895.

Hallichthys, GRAY.

The genus *Phyllopteryx*, as left by Dr. Günther, embraces three species, each of which appears to represent a distinct genus, one of which is unnamed. This is represented by the *P. eques* of Günther and may be termed *Phycodurus* on account of its tail, which seems to branch out like a seaweed (*φωκωδῆς*); it is distinguished further by the alternate contraction and expansion of the inferior contour of the body, the spinigerous inferior ridge and the low-set dorsal fin.