

ON THE RELATIONS OF CYCLOPTEROIDEA.

BY

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(With Plates XXVIII-XXX.)

By the older naturalists, *Cyclopterus* and its relatives were placed among the cartilaginous fishes. Cuvier recognized that the forms in question were true bony fishes, but placed them among the Jugular Malacopterygians and in a family to which he gave the name "Disco-boles" and with them associated the Gobiesocids and Echeneidids. More recent authors placed them among the Acanthopterygians, and Günther combined them with the *Cottidæ*, *Scombridæ* and various heterogeneous forms in the division "*Cotto-scombriformes*." None of these recognized any relation between the Cyclopteroids and the mail-cheeked fishes, although the development of a suborbital bone as a stay in *Liparididæ* was recognized long ago—among others by Pallas and Günther.

The osteological characters (not specified, however,) determined Professor Putnam to refer them to the neighborhood of the *Cottidæ*. Says Professor Putnam:

I should with Günther put the family of *Gobiesocidæ* far away, at least a suborder off, from the *Cyclopteridæ* and *Liparididæ*, which are far more closely united to the true *Cottidæ*, represented by *Cottus* and *Hemitripterus*, than to either the *Gobiesocidæ* proper or to the Gobies and Blennies. In fact *Liparis* has as close affinities, as shown by its skeleton, with *Cottus* and *Hemitripterus* as with *Cyclopterus*, and we have in the three groups represented by *Cottus*, *Liparis*, and *Cyclopterus*, well-marked families of the same suborder. The only character by which the *Cyclopteridæ* and *Liparididæ* are closely united consists in the peculiar formation of the ventral disk by the union of the ventral fins, but as this structure is simply brought about by the modification of the rays in a manner common to the several genera, and not by any marked anatomical difference in the structure of the same fins in *Cottus*, I can only look upon it as a generic character common to the known representatives of both families of *Cyclopteridæ* and *Liparididæ*, and the discovery of a representative of either family with ventral fins of the ordinary form would not necessitate the establishment of a family for its reception, as in that case we would simply consider the structure as of generic value.*

* Notes on *Liparis* and *Cyclopterus*. By F. W. Putnam. Proc. Am. Ass. Adv. Sc., v. 22, p. 337, 1874.

Acting on the determination of Professor Putnam, Professors Jordan and Gilbert, in their "Synopsis of the Fishes of North America," associated the *Cyclopteridæ* and *Liparididæ* with the true mail-cheeked fishes, remarking that "the *Chiridæ*, *Scorpenidæ*, *Cottidæ*, *Agonidæ*, *Triglidæ*, *Liparididæ* and *Cyclopteridæ* form a closely related series (*Cataphracti*), and are distinguished from all the other *Acanthopteri* by the presence of the suborbital stay." They even consider that "the relations of *Liparididæ* with the *Cottidæ* are very close and the differences of trivial value."

The examination of the skeletons and external characteristics of *Cyclopterus* and *Liparis* has led to the following conclusions:

(1) The *Cyclopteroidea* are true mail-cheeked fishes most closely related to the *Cottidæ*.

(2) The *Cyclopteridæ* and *Liparididæ* may be associated together in a peculiar superfamily—the *Cyclopteroidea*.

(3) The *Cyclopteridæ* form a peculiar family restricted to the genera *Cyclopterus*, *Eumicrotremus* and *Cycloptericthys*.

(4) The *Liparididæ* form another family typified by the genus *Liparis* and including also *Careproctus*, *Enantioliparis* and *Paraliparis*.

The characteristics of the superfamily *Cyclopteroidea* and the included families are herein given.

DIAGNOSIS OF CYCLOPTEROIDEA.

SUPERFAMILY CYCLOPTEROIDEA.

Synonymy.

Cyclopteroidea Gill, Cat. Fishes E. C. N. Am., p. 8 (name) 1873.

Cyclopteroidea Gill, Proc. U. S. Nat. Mus., v. 11, p. 539 (diagnosis) 1839.

Acanthopterygians with the third infraorbital bone developed as a "stay" obliquely crossing the cheek and connecting with the preoperculum, the mydome suppressed, the post-temporal bifurcate and normally connected with the cranium, the actinosts enlarged and mostly connected with the inner ridge of the proscapula, the hypercoracoid being dislodged upwards and the hypocoracoid downwards on a row with the four actinosts, ribs sessile on the vertebral centra or hæmapophyses, pharyngobranchials reduced to the large epipharyngeal (homologous with the third of typical Acanthopterygians), and ventrals modified to form a suctorial disk supported by six immovable rays on each side converted into osseous tissue and without articulations; etypically suppressed.

They appear to have the branchial apparatus constructed on the same plan as in the Cottoidea; two or three *basibranchials* ossified; *hypobranchials* of three pairs in line with the corresponding *ceratobranchials* of fourth arch suppressed; *ceratobranchials* of all and *epibranchials* (of all or three) arches well developed; *pharyngobranchials* reduced to one

pair of compressed *epipharyngeals*; *hypopharyngeals* divergent and rather compressed. There are three and one-half gills, that is, double branchiæ on all the arches except the fourth which has a single row of filaments. There is no fissure behind the fourth arch.

RELATIONSHIPS.

If we now compare the *Cyclopteroidea* thus defined with other groups, it is only with those of superfamily *Cottoidea* that we find many common characters. The two groups agree with each other, and differ among themselves as follows:

Cyclopteroidea.

Third infraorbital bone developed as a "stay," obliquely crossing the cheek and connecting with the preoperculum.

Mydome suppressed.

Post-temporal bifurcate and normally connected by squamous suture with the cranium.

Actinosts enlarged and mostly connected with the inner ledge of the proscapula, the hypercoracoid being dislodged upwards and the hypocoracoid downwards on a row with the four actinosts.

Ribs sessile on the vertebral centra or hæmapophyses.

Pharyngobranchials reduced to the enlarged epipharyngeals (homogolous with the third of typical Acanthopterygians).

Ventrals modified to form a suctorial disk supported by six immovable rays on each side converted into osseous tissue and without articulations (etically suppressed).

Cottoidea.

Mydome more or less developed.

Ventrals normally developed, entirely separate, and each composed of a spine and (1-5) articulated rays.

When it is remembered that all the characters which are common to the *Cottoideans* and *Cyclopteroideans* differentiate the *Cottoideans* from one or other of those families to which they have been always approximated, the importance of such an aggregate of common characters must be admitted. There can indeed be no doubt that the *Cyclopteroideans* are more closely related to the *Cottoideans* than to any other known fishes. In fact, the former differ from the latter mainly in the suppression of the mydome and the modification of the ventral apparatus. It is true that these differences are supplemented by others, but, on the other hand, the characters enumerated as common to the two are also supplemented by others. There is indeed some justification for Professor Putnam's belief that the difference between the *Liparididae* and *Cyclopteridae* are as important as those between either and the *Cottidae*. I can not, however, admit that the structure of the ventral fins is of as little importance as Professor Putnam urges.*

In view of the radical modification of the ventral rays and the whole pelvic apparatus, "the discovery of a representative of either family with ventral fins of the ordinary form" is almost inconceivable, and, if discovered, such a form would doubtless be found to have other modi-

* See *antea*, p. 361.

fications coördinate, so that "it would * * * necessitate the establishment of a family for its reception." The suppression or loss of the ventral apparatus is another matter, and might have been anticipated without violence to morphological conceptions. In reality, such a type has actually been discovered, for *Paraliparis* or *Amitra* is a form destitute of the ventral sucker and yet, as shown by its skeletal characters, is in all other respects a true Liparidid.

GEOGRAPHICAL DISTRIBUTION.

The geographical range of the *Cyclopteroidea* presents some interesting features, although accordant with those of various other families.

Dr. Günther (Introduction, p. 232, 1830,) has remarked that "the *Discoboli* of the Northern Hemisphere have likewise not penetrated to the south, where they are represented by *Gobiesocidæ*. These two families replace each other in their distribution over the globe."

The *Discoboli* (i. e. *Cyclopteridæ* and *Liparididæ*) occur in the same waters in the British seas and one or more species of *Liparididæ* have been found in the Southern Hemisphere.

Professor Putnam long ago (1873, Proc. Am. Ass. Adv. Sc., p. 310, 1874) formulated the facts representing the geographical distribution of the groups in question:

While the *Cyclopteridæ* and *Liparididæ* have their greatest development in and towards the Arctic [polar*] regions, the *Gobiesocidæ* have theirs towards the Tropics, being found throughout the tropical and temperate regions of the Pacific and Atlantic, and having but one genus, with one or two species only, extending from the Mediterranean to the British and Scandinavian coasts.†

Professor Putnam has further remarked:

The newly discovered species [*Liparis antarctica*] is, however, true to the habits of the group, and comes from the cold waters of the extreme south, while no intermediate forms have yet been found in the wide space between Eden Harbor and San Francisco, though it is probable that other species will be discovered in the cold waters of the South American coast. The representatives of the group are lovers of cold waters, as shown not only by their distribution, but by their habits; for though in the more temperate countries where they are found, as on our coast, they come to the shore in the cold winter months to leave their eggs, they afterwards retire to deeper and colder waters, and in the summer have only been taken on the coast of Massachusetts and Maine by means of the dredge.

This generalization was amply justified by the facts known when Professor Putnam formulated it sixteen years ago and has been still further fortified since.

In 1874, Professor Putnam described a Liparidid from a single specimen 1½ inches long, obtained at Eden Harbor (lat. 48° S.) as *Liparis antarctica*.

* Professor Putnam had on the previous page (339) described the *Liparis antarctica* "from Eden Harbor, about latitude 48° south," and other *Cyclopteroidea* have since been found in Antarctic waters.

† Other species of *Gobiesocidæ* extend the range of the family into the temperate waters of both the Northern and Southern Hemispheres.

The head is contained slightly more than four times in the total length, and equals the height and width of the body. The interorbital space is equal to the distance from the eye to point of the operculum. The dorsal and anal fins are covered by a thick skin anteriorly, the rays being distinctly seen only as they approach the caudal fin, to which both dorsal and anal are united. Color in life was deep yellow; in alcohol it is of a uniform light brown.*

The structure of the pectorals is not made known. Professor Putnam promised that "this species will be fully illustrated and described in the Catalogue of the Agassiz Collection of Fishes," but this great work has not yet been published.

In 1855, Prof. J. G. Fischer made known a *Liparidid* from South Georgia (54° 31 S.) under the name *Liparis Steineni*,† erroneously deeming it to be the first found of the Discoboli in antarctic waters.‡

Professor Fischer especially described the pectorals as destitute of the emargination manifest in the typical species, and the confluence of the vertical fins was also described.§

In 1888, Prof. Leon Vaillant added a third nominal species of *Liparidid* to the Antarctic fauna under the name *Enantioliparis pallidus*; the specimens described were obtained at Orange Bay, Patagonia.||

The genus *Enantioliparis* was differentiated from *Liparis* on account of the continuous vertical fins and the almost entire pectorals.** Besides the *E. pallidus*, *E. Steineni* (= *Liparis Steineni* Fischer) was recognized.

It is possible that the three species of *Liparididæ* so far found in the Antarctic Seas are merely nominal, and may be eventually ascertained to belong to one and the same species, which must then be called *Enantioliparis antarcticus*. In view of the other two *Liparidids* having the pectorals nearly entire, suspicion at least may be entertained that the species described by Putnam has the same structure, and that the describer overlooked it or deferred the description to another time.††

Another supposed cyclopteroidean of another family has been attribu-

* Notes on *Liparis* and *Cyclopterus*. By F. W. Putnam. <Proc. A. A. A. S., v. 22, p. 339, 1874.

† Über Fische von Süd-Georgien. <Jahrb. Hamburg. wissensch. Anst., v. 2, p. 63, 1855.

‡ Die erste in antarktischen Gewässern aufgefundene Form aus der Familie der Discoboli, in auffallender Weise mit ihren nordischen Verwandten übereinstimmend.—Fischer.

§ Eine eigentliche Einbuchtung am Rande dieser Flosse, wie bei anderen Arten, ist nicht vorhanden, doch sind die vier untersten Stralen über die Flossenhaut hinaus verlängert, und namentlich der erst derselben reicht weit über die nächst oberen Stralen nach hinten, wodurch allerdings der Anschein eines Einschnittes im Hinterrande der Flosse entsteht.—Fischer, o. c., p. 64.

|| Mission scientifique du Cap Horn, 1882-1883. Tome VI, Zoologie—Poissons. Par Leon Vaillant, 1888 (p. C. 22).

** *Liparidibus persimilis, nisi impares pinnae continuæ sunt et radii inferiores liberi pectoralibus haud reperiuntur.*—Vaillant, o. c., v. 22.

†† The pertinence of *L. antarctica* to *Enantioliparis* has now been determined by the present writer by examination of the type.

ted to the Antarctic Seas. It is based on a sketch of a fish caught at Telly Bay, Magellan Strait, made by an officer of the mission to Cape Horn, and this sketch was supposed by Professor Vaillant to represent a species of the North Pacific cyclopteroid genus *Cyclopterichthys*—called *C. amissus*.* As the sketch has not been published, it is impossible for another to form a satisfactory opinion as to its value for determination of a species in the ichthyological system. If the ventrals are represented as forming a circular disk, the reference of the fish to the *Cyclopteridæ* may be correct, but if not, a suspicion may be entertained that the fish in question may have no close relation with the cyclopteroideans, and that it may even be, for instance, the *Neophrynichthys marmoratus*, erroneously identified with *N. latus* by Dr. Günther. At any rate the so-called *Cyclopterichthys amissus* has no real standing in the ichthyological system.

Our ignorance of the cyclopteroideans of the southern seas doubtless greatly surpasses our knowledge, but at any rate it has been definitely ascertained that the superfamily is represented there by at least one species of one genus. For further details we must wait.

It is probable that hereafter still other species will be found in the southern hemisphere, and the New Zealand naturalists would do well to institute a search for them in the southern portions of their domain.

SUBDIVISIONS OF CYCLOPTEROIDEA.

The families of the Cyclopteroideans and their subdivisions may now be considered.

CYCLOPTERIDÆ.

Synonyms as family names.

- < *Plecopteres*, Dumèril, Zoöl. Analytique, pp. 103, 109, 1806.
- < *Plecopodia*, Rafinesque, Analyse de la Nature, p. 12e fam. (includes *Cyclopterus* and "*Lepdagasterus*"), 1815.
- < *Discoboles*, Cuvier, Règne Animal, 1re éd., t. 2, p. 224, 1817; 2e éd., t. 2, p. 344, 1829.
- < *Discobola*, Latreille, Fam. Nat. du Règne An., p. 127, 1825.
- < *Cyclopteridæ*, Bonaparte, Giorn. Accad. di Scienze, v. 52, (Saggio Distrib. Metod. Animali Vertebr. a Sangue Freddo, p. 38), 1832; Isis, 1833, col. 1201.
- < *Cyclopteridæ*, Bonaparte, Nuovi Annali delle Sci. Nat., t. 2, p. 132, 1838; t. 4, p. 193, 1840.
- < *Cyclopteridæ*, Swainson, Nat. Hist., and Class. Fishes, etc., v. 2, pp. 197, 338, 1839.
- < *Cyclopodi*, Müller, Archiv f. Naturg., 9. Jg., v. 1, p. 297, 1843.
- < *Cyclopodi*, Müller, Archiv f. Naturg., 11. Jg., v. 1, p. 130, 1845.
- < *Cyclopteridæ*, Adams, Manual Nat. Hist., p. 96, 1854.
- < *Cyclopteridæ*, Girard, Expl. and Surv. for R. R. Route to Pacific Oc., v. 10, Fishes, p. 129, 1858.
- = *Cyclopteroidei*, Bleeker, Enum. Sp. Piscinum Archipel. Indico, p. xxvi, 1859.
- < *Discoboli*, Günther, Cat. Fishes Brit. Mus., v. 3, p. 154, 1861.
- = *Cyclopteridæ*, Gill, Arrangement Families Fishes, p. 5, 1872.
- < *Cyclopteri*, Fitzinger, Sitzungsber. K. Akad. der Wissensch. (Wien), B. 67, 1. Abth., p. 41, 1873.

* Vaillant, *op. cit.*, p. 33.

=*Cyclopteridæ*, Putnam, Proc. Am. Assoc. Adv. Sci., 1873, v. 22, B, p. 337, 1874.

=*Cyclopteridæ*, Collett, Norw. North Sea Exped., 1881.

=*Cyclopteridæ*, Jordan and Gilbert, Syn. Fishes N. Am., p. 744, 1882.

Synonyms as subfamily names.

<*Cyclopterini*, Bonaparte, Nuovi Annali delle Sci. Nat., t. 2, p. 132, 1833; t. 4, p. 193, 1840.

<*Discoboli*, Müller, Archiv f. Naturg., 9. Jg., v. 1, p. 279, 1843.

<*Cyclopterina*, Gill, Cat. Fishes East C. N. Amer., p. 47, 1861.

=*Cyclopterina*, Günther, Cat. Fishes Brit. Mus., v. 3, pp. 145, 1861.

=*Cyclopterina*, Gill, Proc. Acad. Nat. Sci. Phila., (v. 16), p. 189, 1864.

DIAGNOSIS.

Cyclopteroidea with a short ovate body, the abdominal cavity more than half as long as the caudi-trunk, the neural and hæmal spines much deflected backwards and mostly elongated, the interspinals mostly trending in the same direction as the vertebral spines, ribs continued on anterior caudal vertebræ, dorsalis and analis mostly confined to posterior half of body, spinous dorsalis differentiated or obsolete, cranium with the chondrocranium very extensive, and with the stay broad and expanded backwards and connecting with the inner ridge of the preoperculum.

DESCRIPTION.

Body oblong oval, inflated, and with the back typically more or less elevated and with a stout caudal peduncle.

Anus behind the middle.

Skin more or less lax, generally covered with tubercles or spines, but sometimes smooth.

Lateral line indistinct and concurrent with the back or obsolete.

Head rather short, rhombic in profile, little compressed, and covered with skin continuous with the skin of the body, and concealing all the bones, which can only be examined on dissection.

Eyes lateral, mostly in the anterior half of the head.

Nostrils double; the anterior and posterior separated by a moderate bridge.

Mouth terminal or subterminal, small, and with the cleft little oblique.

Jaws normally developed; *intermaxillines* with the ascending pedicles moderate, appressed and laminiiform, separated by a shallow cleft from the compressed lateral processes.

Supramaxillines with the sella extended mesiad behind, and with the posterior limbs expanded backwards into lamelliform portions above suddenly truncated and closing in front of the styliiform or claviform portions into which the limbs are extended.

Lower jaw with a rather deep symphysis, compressed, and with the articular bone extending into a process downwards and forwards.

Teeth acute, in bands on the jaws, but none on the palate.

Lips rather thick.

Tongue fleshy and free all around.

Suborbitals well developed, completely covered by the skin, but on dissection the third is found to be well developed, crossing the cheek and meeting the inner margin of the preoperculum.

Operculum apparatus fully developed; *Operculum* thin, with its upper and posterior portions thin but fortified by upper and lower ribs; radiating from its articular condyle are several less developed intermediate rays of ossification; *Suboperculum* with a slender portion under and below the operculum, and a larger, wider portion below the preoperculum; *Interoperculum* mostly slender, but with an expanded posterior portion.

Preoperculum with two limbs, the upper vertical and somewhat expanded downward, and the lower oblique, tending to horizontal, and with a laminar inferior or external margin.

Branchiotremes restricted to the sides; the branchiostegal membrane more or less joined to the isthmus but with a free marginal fold.

Branchiostegal rays six on each side.

Dorsalis generally double; the anterior variously developed, in the typical forms being small and mostly concealed in the grooves formed by the upraised skin and prominent tubercles of the back, in some well developed and conspicuous, in others obsolete or suppressed; the soft dorsal is behind on the posterior portion of the body and has about eight to twelve rays.

Anal similar to the second dorsal and opposite it.

Caudalis with about nine to eleven well-developed rays and few small rays above and below.

Pectorales with very broad bases procurrent below, and with numerous unbranched rays connected by continuous membrane.

Ventrals modified to form a subcircular or oval suetorial disk; the rays have the basal processes extending mesiad, appressed to the pelvic bones, and immovable; there are six in number on each side, none of which are articulated, they being mostly converted into imperfect bony tissue like the rest of the skeleton.

Branchiæ four, with the slit behind the last arch obsolete or suppressed; gill-rakers developed as slight tubercles.

SKELETON.

The skeleton of *Cyclopterus lumpus* has been noticed by Dr. Günther (Cat. Fishes B. M. v. 3 pp. 156, 157), and inasmuch as his observations disagree with the characters here assigned to the including superfamily and family, the chief discrepancies may be mentioned.

The bones of *Cyclopterus* are distinguished by the small quantity of calcareous salts deposited in them: the latter form thin lamellæ in each of the bones, and the interspaces between these layers are filled with a soft gelatinous substance which is soon dried up, so that the bones shrink together to a shapeless mass. In a fish with the bones so incompletely ossified and semimembranaceous, it is often impossible to find the sutures between them.

The chondrocranium is in great part persistent, but covered in by the bones, which are superficial and can be peeled off, the cartilage bones

coming off *almost* as well as the membrane bones. The separate bones are as well differentiated as in an ordinary fish, although certainly not readily distinguishable in a shrunken skull. In other words, the various bones are entirely distinct and do not coalesce, although from their way of overlapping and meeting, the sutures are frequently quite obscure.

The anterior portion of the infraorbital ring is well developed, and appears to be membranaceous posteriorly.

Nothing is said of the enlarged lamelliform third infraorbital or "stay," although it is very conspicuous, and developed as in the illustration herewith published.

The humerus is long, and composed of two broad lamellæ; the pectoral rays are joined to a long series of *six carpal bones*, the series extending nearly to the lower end of the humerus.

The humerus, or proscapula, is morphologically developed as in the *Cottoidea*. In the "six carpal bones" are confounded the normal number (four) and the hypercoracoid as well as hypocoracoid. In other words, there is no anomalous morphological deviation from ordinary fishes, but a close resemblance to the *Cottoidea*.

There are thirteen abdominal and fifteen caudal vertebræ ...; only the last abdominal and the first caudal vertebræ have short and feeble ribs attached to their neural spines.

In the skeleton now before me there are twenty-nine vertebræ (including the last semivertebra), which are separable into ten abdominal vertebræ and nineteen caudal—*i. e.*, bearing hæmal spines. The eighth to the twentieth bear slender ribs on their *centra near the lower edges* or on their hæmal spines.

The entire skeleton of *Cyclopterus* is so peculiar in some respects and yet morphologically so similar to that of an ordinary cottoidean fish that it would well repay a detailed and critical study. As my only object at present is to point out the characters and relations of the including groups I refrain from further notice, and indeed the want of fresh material would deter me from such a study. It may be hoped that so interesting as well as common a fish may receive attention from some one or other of the numerous zoological stations now existing in Europe. Fresh specimens are indispensable for a successful investigation of its skeleton. It is with reluctance that I submit herewith the accompanying illustrations. The skeleton figured, although preserved in alcohol, collapsed when in the artist's possession, so that the illustrations will be found to disagree with fresh specimens. The chief use of the present illustrations will be to demonstrate that the type is a true mail-cheeked fish and that there is no myodome.

The most noteworthy illustrations of the skeleton of *Cyclopterus* are three, viz:

Cyclopterus lumpus Rosenthal, Tab. Ich. (Ich. Tafeln.), pl. 19, f. 1, 1812-22.

Cyclopterus lumpus Rathke, Archiv f. Phys., v. 7, pp. 498-524, pl. 6, f. 1-4, 6 (ventrals), f. 5 (P.), f. 7 (branchiost.), f. 8-11 (vert.).

Cyclopterus lumpus Borckert, Anat.-phys. Unt. Haftscheibe C. lumpus, pp. 7-34, pl. 1 (sucker and scap. arch), 1839.

GENERA.

Three well-defined genera represent the *Cyclopteridæ*, viz :

1. *Cyclopterus* Linnæus, Syst. Nat., 10. ed., p. 260, 1758=*Lumpus* Cuv.
Type *C. lumpus* Linn.
2. *Eumicrotremus* Gill, Proc. Acad. Nat. Sc. Phila., 1864, p. 190.
Type *E. spinosus*=*Cyclopterus spinosus* Müller.
3. *Cyclopterichthys* Steind., Ich. Beitr., x, p. 14, 1881.
Type *C. ventricosus*=*Cyclopterus ventricosus* Pallas.

LIPARIDIDÆ.

Synonyms.

- = *Liparididæ*, Gill, Arrangement Families Fishes, p. 4 (name), 1872.
- = *Liparididæ*, Putnam, Proc. Am. Assoc. Adv. Sci. 1873, v. 22, B, p. 337 (diagnosis*), 1874.
- = *Liparididæ* Collet, Norweg. North Atlantic Exped., Fishes, p. 50 (name), 1880.
- = *Liparididæ* Jordan and Gilbert, Syn. Fishes N. Am., p. 738, 1882.
- = *Liparidæ* Jordan, Cat. Fishes N. Am., p. 115, 1885.
- Discoboles* gen., Cuvier, *et al.*
- Cyclopteridæ* gen. Bonaparte, Günther, *et al.*
- Gibiesocoidæ* gen., Bleeker, 1859.

DIAGNOSIS.

Cyclopteroidea with an oblong or elongate body, the abdominal cavity very short, the neural and hæmal spines moderately deflected backwards and moderately elongated, the interspinals bent backwards from the vertebral spines, ribs not continued backwards on the caudal vertebræ, dorsalis and analis elongated and commencing forwards near the head, spinous and soft rays not segregated into distinct fins, cranium with the chondrocranium much reduced by ossification and with the stay styliform, elongated, and crossing the preoperculum to connect with its *external* margin.

DESCRIPTION.

Body elongate, antrorsiform, more or less attenuated to the caudal fin.
Scales entirely absent, the body being naked and smooth (except in males during the breeding season) and the skin more or less lax.
Lateralis obsolete.
Head moderate or rather large, covered by skin continuous with that of the body and concealing all the bones.
Eyes lateral, mostly or entirely in the anterior half of the head.
Nostrils double; the anterior and posterior separated by a narrow bridge.

* The union of the suborbital chain into one long bone reaching from the maxillary to the posterior edge of the preoperculum and the long slender ray-like interoperculum overlying the branchiostegal rays are marked characters of the *Liparididæ*. Putnam, *o. c.*, p. 338.

Mouth terminal or subterminal, with the cleft nearly horizontal.

Jaws normally developed; *intermaxillines* with the ascending processes moderate, appressed and laminiform, separated by a shallow cleft from the compressed lateral process; *supramaxillines* with the sella extended mesiad behind and with the posterior limb expanded backwards into a lamelliform portion abruptly terminating in a pointed process with an inward expansion.

Teeth acute or tricuspid, present in the jaws and sometimes on the palate.

Lips rather thick.

Tongue moderate.

Suborbitals entirely concealed by the skin, consolidated and with the third developed as a styliform stay connected behind with the *outer* margin of the preoperculum.

Opercular apparatus much reduced; *operculum* reduced to a bifid plate, one fork curved backwards and the other downwards and forwards on a parallel with the preoperculum; *suboperculum* a strap-like piece under the posterior fork of the operculum; *interoperculum* detached, ray-like, and appended to the lower jaw.

Preoperculum with an upper portion expanded backwards and a lower oblique bar-like portion.

Branchiotremes small and entirely confined to the sides above the pectoral axillæ, the branchiostegal membrane being continuous with the isthmus and scapular arch.

Branchiostegal rays six on each side.

Dorsalis entire, extending from near the nape backwards, with its anterior rays developed as slender spines, and the posterior simply articulated, but without external indication of the division.

Anal elongate.

Caudalis supported by about eight to eleven rays without supplementary smaller ones, sometimes entirely free and in other species more or less connected with the dorsal and anal fins.

Pectorales with wide bases procurrent forwards and numerous rays, the inframedian of which are sometimes much shortened, the posterior borders being then emarginated.

Ventrals modified to form a subcircular suction disk; the rays have basal processes extending mesiad, appressed to the pelvic bones and immovable; there are six on each side, mostly converted into osseous tissue and not articulated.

Branchiæ three and one-half to four, with the slit behind the fourth obsolete or suppressed; *gill-rakers* moderate.

SUBDIVISIONS OF LIPARIDIDÆ.

The family of Liparidids is represented by three well-marked types which deviate from each other in characters which are generally of family value; that is, there is generally much less difference in the

character of the pectorals and in the position of the ventrals in a natural family than is manifested in the present. Therefore, I formerly suggested the isolation of the two then known into distinct subfamilies. A subsequently discovered type—*Paraliparis*—was later recognized by Jordan and Gilbert as the representative of another (*Amitrinæ*) distinguished by the want of the ventral sucker. In the so-called *Amitrinæ*, the complicated ventral sucker, so characteristic of the discobolous fishes, has entirely disappeared, but in the genus *Careproctus*, the sucker has diminished so much in size and importance as to prepare us for its disappearance in forms in which the same lines of degeneration were pushed to an extreme. *Careproctus*, in fact, is intermediate between *Liparis* and *Paraliparis* or *Amitra* in the structure of the pectorals as well as on account of the reduced ventral disk. Nevertheless, the genera of *Liparididæ* are apparently so nearly related in most details of structure and so few in number that it matters little whether subfamilies are admitted or not. If they are admitted, it will only be to bring into relief the general significance of their characters and to harmonize the family with others. The question whether it is best to retain them may await answer until the comparative anatomy of the several types is known. Meanwhile, only two subfamilies are retained, those depending on the presence or absence of the ventral sucker.

LIPARIDINÆ.

Synonymy.

- = *Liparinæ*, Gill, Cat. Fishes, E. Coast N. A., p. 47, 1861.
- = *Liparidina*, Günther, Cat. Fishes, Brit. Mus., v. 3, p. 154-158, 1861.
- = *Liparidinæ*, Gill, Acad. Nat. Sci., Phila., (v. 16.) p. 190, 1864.
- > *Liparidinæ*, Gill, Cat. Fishes, E. Coast N. A., p. 8, 1874.
- > *Careproctinæ*, Gill, Cat. Fishes, E. Coast N. A., p. 8, 1874.
- = *Liparinæ*, Jordan and Gilbert, Syn. Fishes N. Am., p. 739, 1882.
- Cyclopterini*, gen. Bonaparte.

DIAGNOSIS.

Liparididæ with a ventral sucker.

GENERA.

The subfamily is represented by the following genera:

LIPARIS.

Synonymy.

(*Non-binomial.*)

- = *Liparis*, Artedi, Synonymia Piscium, p. 47, 1738.
- = *Cyclogaster*, Gronov., Museum Ichthyologicum, ii, 1756; Zoophylacium, p. 55, 1763.

Binomial.

- = *Liparis*, Scopoli, Int. Hist., Nat., p. 453, 1777.
- < *Liparis*, Cuvier, Règne Animal, 1^{re} éd., t. 2, p. 227, 1817.
- < *Cyclogaster*, Girard, Expl. and Surv. for R. R. Route o Pacific Oc. v. 10, Fishes, p. 131, 1858.

- < *Liparis*, Günther, Cat. Fishes, Brit. Mus., v. 3, p. 154, 1861.
 = *Liparis*, Gill, Proc. Acad. Nat. Sci. Phila., v. 16, p. 190, 1864.
 > *Actinochir*, Gill, Cat. Fishes, E. Coast, N. A., p. 193, 1864 (subgenus).
 > *Neoliparis*, Steindachner, Ich. Beitr., iii, p. 54, 1875 (subgenus).
 Type, *L. liparis* = *Cyclopterus liparis* Linn.

CAREPROCTUS.*Synonymy.*

- = *Careproctus*, Kroyer, Naturhistorisk Tidsskrift, 3. Række, B. 1, p. 253, 1862.
 = *Careproctus*, Gill, Proc. Acad. Nat. Sci. Phila., v. 16, p. 194, 1864.
Liparis, sp., Günther, etc.
 Type, *C. Reinhardii* Kr.

ENANTIOLIPARIS.*Synonymy.*

- = *Enantioliparis*, Vaillant, Miss. Sc. du Cap Horn, Poissons, p. 22, 1888.
Liparis, sp., Putnam, Fischer.
 Type, *E. pallidus* Vaill.

PARALIPARIDINÆ.*Synonymy.*

- = *Amitrimæ*, Jordan and Gilbert, Syn. Fishes N. Am., p. 739, 1882.
Liparidina gen Günther.

DIAGNOSIS.

Liparididæ with the ventral fins suppressed.

GENERA.

Only one genus is known, which was originally based on an injured specimen, very naturally supposed to have had a ventral disk torn off; consequently when perfect specimens were subsequently obtained Dr. Goode was prevented from identifying them with the genus, and therefore proposed a new generic name for his specimens.

PARALIPARIS.*Synonymy.*

- = *Paraliparis*, Collett, Forh. Vid. Selsk. Christiana, No. 14, p. 32, 1878; Norske Nordh. Exped., Fiske, p. 53, 1880.
 = *Amitra*, Goode, Proc. U. S. Nat. Mus, v. 3, p. 478, 1881 (not *Amitrus*, Schönh).
 = *Monomitra*, Goode, Proc. U. S. Nat. Mus., v. 6, p. 109, 1884.
 Type, *P. bathybi* Collett.

NOMENCLATURE OF LIPARIS.

By all authors the names *Liparis* or *Cyclogaster* have been adopted for the genus in question, the former name being attributed to Artedi by Günther, and to Linnæus by Jordan and Gilbert, while the latter has been accredited to Gronovius. A brief notice of the status of the nomenclature will be timely.

I.

Liparis was not given as a generic name by Artedi. That naturalist, after having referred the descriptions and figures of most fishes given by his predecessors to such species and genera as he supposed them to belong to, noticed in an appendix to his "Synonymia nominum" a number of fishes which he was unable to allocate. Such notices he assembled under names which had been given as specific. Among those undeterminable fishes was the one called *Liparis* by authors. The various notices were thus brought together.

"LIPARIS.

"1. LIPARIS.

"*a. Liparis nostras*, Johnson, in append. Willugh., p. 17.

"Raj., p. 74.

"Forte sequentia synonymia huc pertineant.

"*β. Liparis*, Rondel, l. 9, c. 8, p. 272.

"Gesner, p. 483.

"Aldrov., l. 3, c. 11, p. 296.

"Jonston, l. I, tit. 1, c. 2, 3, t. 1, f. 7.

"Willugh., p. 135.

"Raj., p. 74.

"*Anglis Eboracensibus & Dunelinensibus The sea-snail.*"

It is thus evident that Artedi did not use *Liparis* as a generic name. Furthermore, he was not a binomial writer.

The name *Liparis* was not used as a generic designation by Linnaeus, and that naturalist referred the species so called to the genus *Cyclopterus* as *C. liparis*.

By other writers, *Liparis* has been accredited as a generic name to Cuvier, who took it up in the first edition of his "Règne Animal" (1817).

Before 1817, however (in 1810), the name *Liparis* had been used as a generic term by Ochsenheimer for a genus of lepidopterous insects. Therefore its use would have been precluded in ichthyology, had it not been given to the fish genus before.

II.

Cyclogaster was proposed as a generic name for the same fishes by Gronovius in 1763. Girard, in 1858, without giving any reasons for his course, but possibly having become cognizant of the facts about Artedi's status, used the name *Cyclogaster* in place of the generally adopted *Liparis*.

Gronovius, however, was not a binomial author, and before *Cyclogaster* was taken up by Girard, the name had been twice used by other binomial authors, viz, by Macquart for a genus of Dipters in 1834, and by Westwood for a genus of Hemipters in 1837.

III.

If we were dependent on the authors thus cited, neither *Liparis* nor *Cyclogaster* could be used for the fish genus, and the name next in succession would be *Actinochir* proposed for a section of the genus in 1864. These facts would doubtless be soon discovered by some one of the several active investigators of the literature and morphology of ichthyology, and a change might then be proposed without further knowledge. No change will be necessary, however, as in a binomial work universally overlooked, the name *Liparis* was used for the genus in question long before it was employed otherwise.

In 1777, J. A. Scopoli published an "Introductio ad historiam naturalem sistens genera Lapidum, Plantarum, et Animalium hactenus detecta," in which, among others, he defined the genera of fishes. *Liparis* was therein (p. 453) first used generically, though attributed to Artedi, and defined in the following terms:

269. LIPARIS. Arted. Aperturæ branchiales superne tantum hiantes. Membrana branch. nuda, oss. 7). Pinnæ inermes, 5); ventrali spuria, circulari, ut in *Cycloptero*.

Liparis was referred to the second "gens" of fishes characterized by the approximation of the anus to the head, the second "divisio" of the gens (*dentati*) having teeth, and the second "ordo" of the "*dentati*" having teeth in the jaws and throat. *Cyclopterus* was kept by Scopoli, as by Linnæus, in the Amphibia with chondropterygious fishes (p. 465).

It is, therefore, Scopoli who has preserved the genus *Liparis* for ichthyology. The type, of course, is the species mentioned by Artedi.

The facts in the case are summarized in the synonymy already given, (p. 372).

EXPLANATION OF PLATES.

PLATE XXVIII.

Fig. 1. *Cyclopterus lumpus* (reduced from Goode).

3. *Eumicrotremus speirosus* (reduced from Collett).

3. Scapular arch and pelvis of *Cyclopterus lumpus*, the right-hand figures representing the external surface, and the left-hand figures the internal surface of those bones (reduced from Borckert).

EXPLANATION OF LETTERS.

a. Actinosts 1-4.

hype. Hypercoracoid.

hypo. Hypocoracoid.

ic. Interscapula.

p. 1. Anterior pointed process.

p. 2. Anterior broad process.

p. 3. Lateral process.

pcl. Postclavicle.

pri. Posterotemporal.

pt. Posttemporal.

ps. Proscapula.

PLATE XXIX.

Liparis Fabricii.

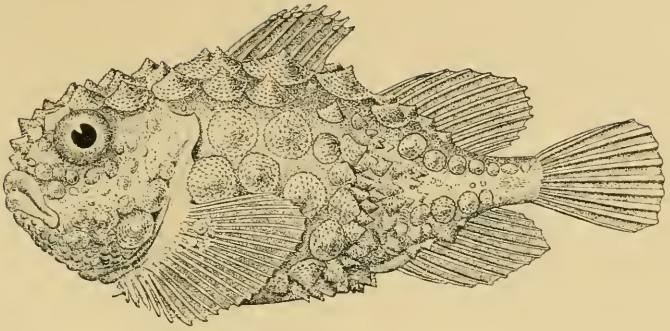
- Fig. 1. An adult individual with papillæ, and with the bases of the dorsal and anal fins concealed by adipose tissue and skin.
2. An immature individual with color markings and with bases of the dorsal and anal fins apparent through the skin.
3. Head, from above, of adult.
4. Head, from below, of adult.
5. Teeth of two individuals (*a*, *b*).
- (All reduced from Lüken's Bidragt., tab. 15, fig. 4-6).

PLATE XXX.

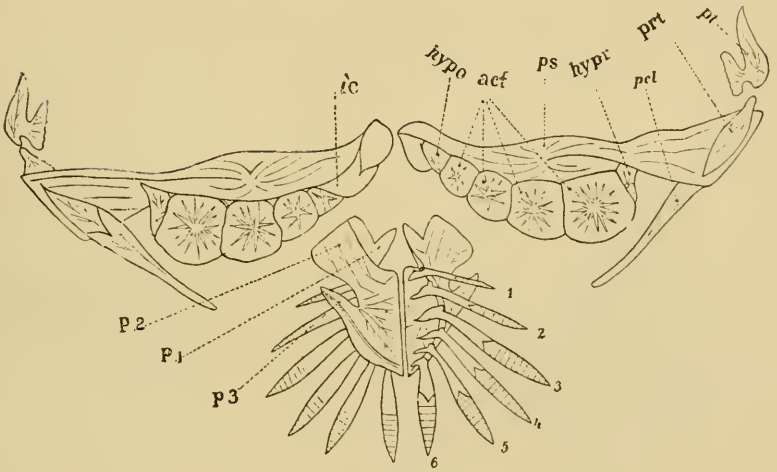
- Fig. 1. Skull and shoulder-girdle of *Cyclopterus lumpus*.
2. Cranium of *Liparis liparis* from side.
3. Cranium of *Liparis liparis* from above.
4. Cranium of *Liparis liparis* from below.
5. Cranium of *Liparis liparis* from behind.

EXPLANATIONS OF LETTERS.

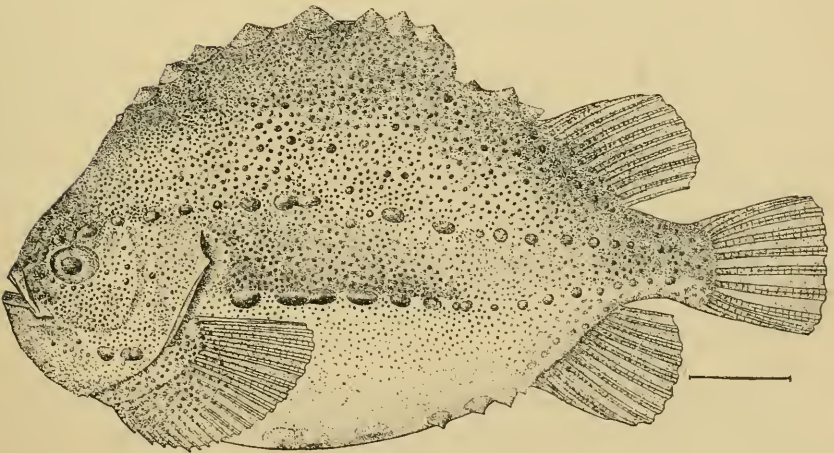
<i>a.</i>	Actinost.	<i>pcl.</i>	Postclavicle.
<i>bas.</i>	Basioccipital.	<i>pfr.</i>	Prefrontal.
<i>eo.</i>	Exoccipital.	<i>po.</i>	Preoperculum.
<i>epo.</i>	Epiotic.	<i>pro.</i>	Prootic.
<i>eth.</i>	Ethmoid.	<i>prt.</i>	Posterotemporal.
<i>fr.</i>	Frontal.	<i>ps.</i>	Parasphenoid.
<i>hym.</i>	Hyomandibular.	<i>psc.</i>	Proscapula.
<i>hypr.</i>	Hypercoraeoid.	<i>pt.</i>	Post-temporal.
<i>hypo.</i>	Hypocoracoid.	<i>ptf.</i>	Postfrontal.
<i>ic.</i>	Interscapula.	<i>pto.</i>	Pterotic.
<i>io.</i>	Interoperculum.	<i>s 1, 2, 3.</i>	Suborbitals.
<i>o.</i>	Operculum.	<i>so.</i>	Suboperculum.
<i>opo.</i>	Opisthotic.	<i>so.</i>	Supraoccipital (cranium).
<i>par.</i>	Parietal.	<i>vo.</i>	Vomer.



2

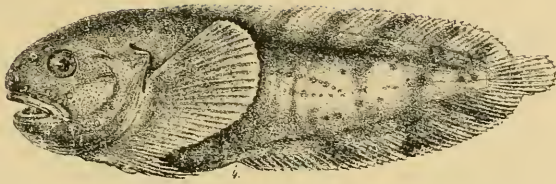


3



1

CYCLOPTERIDÆ.



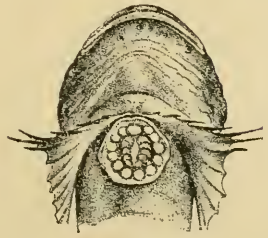
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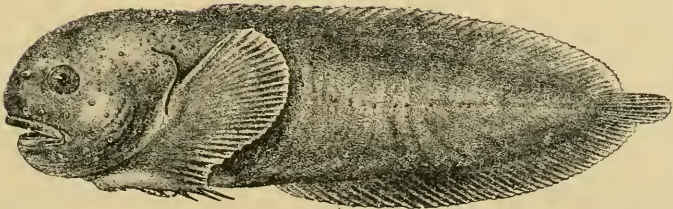
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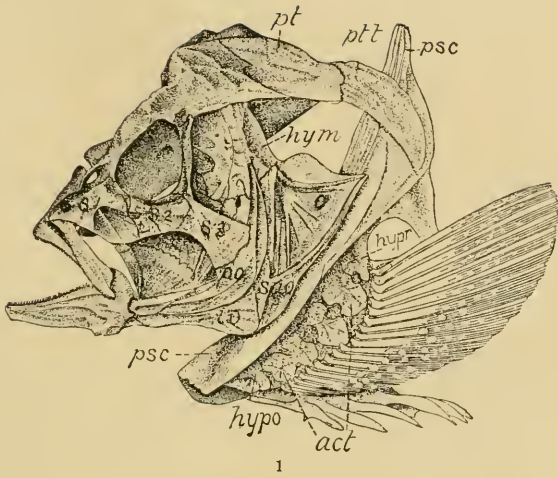


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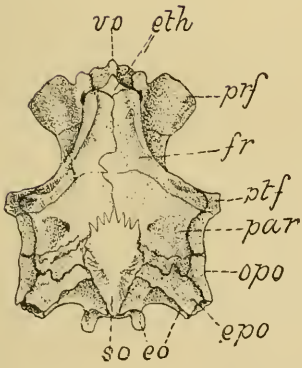


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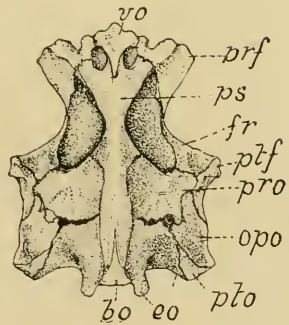
LIPARIDIDÆ.



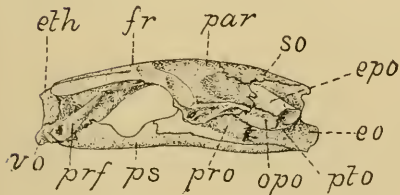
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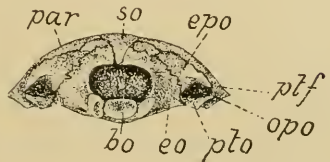
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4



2



5

