

and a more advanced dorsal fin. These will all have to be reconciled or explained away, before Lesueur's name can be adopted for the common cusk.

By Dr. Storer, the Lesueurian name was first unequivocally appropriated for the common *Brosmius*, and this was done without any notice of the discrepancies between the characters mentioned by Lesueur and those exhibited by his specimens. Yet the latter were described, and one figured by Storer, with "a single barbel," "the upper jaw slightly longer than the lower," and the dorsal commencing "on a line above the anterior half of the pectorals." Until it is demonstrated, or rendered nearly certain, that no species exhibiting the characters in a normal condition mentioned by Lesueur exists on our coast, it is not allowable to so apply his name, and, consequently, a new one is required for the *Brosmius flavescens* of Storer.

BROSMIUS BROSME White.

Gadus brosmæ *Fab.*, quasi *Müll.*

Brosmius vulgaris *Reinh.*, quasi *Cuv.*

Brosmius brosmæ pt. *Gill*, *Cat.*

Hab.—Greenland.

I only know this species as a Greenland fish through the works of Fabricius and Reinhardt.

BROSMIUS AMERICANUS Gill.

Brosmius vulgaris *Storer*, *Rep.*, 136.

Brosmius vulgaris ? *Dekay*, p. 289, (not fig.)

Brosmius flavescens. *Storer*, *Syn.*, 221.

Brosmius brosmæ pt. *Gill*, *Cat.*, 49.

Hab.—New England coast northwards to Newfoundland.

BROSMIUS FLAVESCENS Les.

Le Brosme jaune *Les.*, *Mem. Mus.*, v. p. 158, pl. 16, (mid. fig.) 1819.

Brosmius flavescens " " " " " " " " " " " "

Brosmius flavescens *Günther*, *iv.* 369.

Hab.—Massachusetts and banks of Newfoundland.

Descriptions of the Genera of GADOID and BROTULOID FISHES of Western North America.

BY THEODORE GILL.

The object of the present article is more especially to give the characters of the genus *Gadus* as recently restricted, to develop the characteristics and unravel the synonymy of the genus *Merluccius*, concerning which, and particularly the Californian representatives, considerable confusion exists, and to elucidate the genus *Brosmophycis*.

I am disposed to believe that Günther is correct in separating from the family of Gadoids the group of genera which he has called *Brotulina*, but it is more than questionable whether he is right in referring to, and combining in, the same family his groups *Ophiidina*, *Fidrasferina*, *Ammodytina* and *Congrogadina*. It is quite true that Dr. Günther has been unable to find any one character to separate his families Gadidæ and Ophiidiidæ, and that he has entirely based them on the different combinations of characters, but it is at the same time probable that they will be eventually found to be distinguishable by true family characters, based on anatomical differences, such as the form of the cranium, maxillary bones, intestinal canal, &c. The distinctive characters which Günther has employed for his families are the following :

GADIDÆ with "ventral fins composed of several rays, or, if they are reduced to a filament, the dorsal is divided into two. Either the caudal free

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from the dorsal and anal, or, if the vertical fins are united with the dorsal, with a separate anterior portion. Rays of the second dorsal well developed."

OPHIDIIDÆ with "ventral fins rudimentary (reduced to a filament), or absent, jugular.* No separate anterior dorsal. Caudal generally united with dorsal and anal."

From the Gadoids I am disposed to separate the genera *Raniceps* of Cuvier and *Bregmaceros* of Thompson, the former of which has been already considered by Dr. Parnell† as the type of an independent family,—and to similar rank, the latter is probably likewise entitled.

The only diagnosis, then, which I am at present prepared to give, is the following. I trust soon to be able to examine the skeletons of most of the types, when more definite characters can doubtless be given. Only part of the synonymy of the family is given.

Family GADOIDÆ (Cuv.)

Synonymy.

- Gadini *Rafinesque*, Indice d'Ittiologia Siciliana, 1810.
- Gadinea *Rafinesque*, Analyse de la Nature, 1815.
- Metrosomes *Blainville*, Journal de Physique, t. 83, p. 255, 1816.
- Gadoides *Cuvier*, Règne Animal, ed. 2, tome 2, p. 330, 1829.
- Gadites *McMurtrie*, Animal Kingdom Transl., vol. ii. p. 243, 1831.
- Gadoideæ *Richardson*, Fauna Boreali-Americana, vol. iii. p. 241, 1836.
- Gadidæ *Bonaparte*, Systema Vertebratorum, p. 52, 1840.
- Gadidæ *Günther*, Catalogue of the Fishes in the British Museum, vol. iv. p. 326, 1862.
- Blennidia and Gadinea pt. *Raf.*

Elongated fishes behind more or less compressed and conoidal, tapering into the caudal fin, the peduncle convex at its end; anus in advance of the middle of the body; the scales cycloid, smooth and small; very wide branchial apertures, extending far forwards; rays of all the fins articulated or branched, extending along most of the back and forming one, two, or three fins; anal single or double, vertical fins rarely united, and the ventral fins more or less in advance of the pectoral, normally attached to the pubic bones, narrow, and with three to seven branched rays; rarely represented by articulated bifid filaments. Pyloric cæca generally numerous.

The Californian representatives of the family belong to two distinct sub-families and genera, which may be distinguished as follows:

I. Ventral fins well developed, with five to seven rays. Pyloric cæca numerous.

- a. Dorsal fins two; the posterior sinuated, or emarginated behind the middle; anal similar to the second dorsal. Skull with the great frontal bone double, concave towards the middle and between the ridges on each bone diverging from the corresponding branches of the fork of the occipital crest..... MERLUCHINÆ.
Merlucius.
- β. Dorsal fins three; anal two. Skull with the great frontal bone single, and with the occipital crest more or less continued forwards, and single or entire..... GADINÆ.
Gadus.

* "Except in *Brotulophis*."—Günther.
† Magazine of Zoology and Botany, vol. i. 1837.

Subfamily MERLUCIINÆ (Sw.) Gill.

Synonymy.

Merluccia Rafinesque, *Analyse de la Nature*, 1815.

Merlucinae Swainson, *Natural History of Fishes, Amphibians and Reptiles*, vol. ii. p. 300, 1839.

Gadini pt. *Bon.*

Gadinae pt.

The present subfamily has only its type in common with those of *Rafinesque* and *Swainson*,—the former having included in his *Merluccia* the genera *Gadus*, *Merluccius*, *Trisopterus*, *R.*, *Strinsia*, *R.* and *Brosme*, while *Swainson* referred to his *Merlucinae* the genera *Merluccius*, *Lota* and *Motella*.

Only one genus is yet positively known. *Uraleptus* and *Physiculus* appear, however, to be nearly related.

MERLUCIUS Raf.

Synonymy.

Meluceus Rafinesque, *Caratteri di Alcuni nuovi generi e nuovi specie di Animali e Pianti della Sicilia*, 1810.

Onus Rafinesque, *Indice d'Ittiologia Siciliana*, p. 12, 1810.

Merlangus Rafinesque, *op. cit.*, p. 67, 1810.

Stomodon Mitchill, *Report in part on the Fishes of New York*, p. 7, 1814.

Hydronus Mindling, *Lehrbuch der Naturgeschichte der Fische*, p. 83, 1832.

Homalopomus Girard, *Proc. Academy of Natural Sciences of Phila.*, vol. viii. p. 132.

Homalopomus Girard, *Explorations and Surveys for a Railroad Route, &c.*, vol. x. p. 144, *Fishes*.

Merlus Guichenot, *Historia Fisica y Politica de Chile, Zoologia*, t. ii. p. 328, 1848.

Epicopus Günther, *Catalogue of the Acanthopterygian Fishes, &c.*, vol. ii. p. 248, 1860.

Gadus sp. *Linn.*, &c.

Merlangus sp. *Ayres*.

Gadus (*Boreogadus*) sp. *Günther*.

Body elongated and slender, fusiform, highest under the first dorsal fin, tapering into the caudal peduncle, which is slender and compressed; back transversely arched; abdomen not tumid.

Scales small, perlaceous, regularly imbricated.

Lateral line slightly declining from the scapular region, and thence rectilinear, in a groove covered by a membranous linear band.

Head oblong conical in profile, above very gradually narrowed towards the front, rectilinear, flattened at the nape, with a well-defined, oblong triangular excavation at the forehead, bounded by the ridges on the separated frontal bones, which converge backwards into the low occipital crest; snout not extending as far forwards as the maxillars. Eyes rather large, chiefly in the anterior half of the head. Opercula distinct; preoperculum with a channel behind its crest or inner margin, and with short, radiating bars crossing it.

Mouth with its cleft moderately oblique and deep, the supramaxillars extending entirely or under the greater portion of the eyes; their ends are obliquely extended backwards and downwards in a curve from the lower angles; intermaxillars elongated and extending nearly as far back as the supramaxillars.

Lower jaw with no barbel, rounded in front, more or less projecting beyond the upper.

Teeth nearly biserial in the upper as well as lower jaw; the teeth of the inner row moveable, longest, slender, bent or curved inwards, crystalline

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and rather abruptly pointed at the tips. Vomer with teeth like those of the jaws.

Branchiostegal rays seven.

Dorsal fins two, separated by a decided interval; the first behind the vertical of the pectoral fins, pointed in front, triangular, and with nine to fifteen rays; second divided into two portions by a deep sinus behind its middle, and with its posterior part highest.

Anal opposite and similar to the second dorsal.

Caudal fin emarginated, with numerous supplementary rays above and below the peduncle.

Pectoral fins slender, rather long and obliquely rounded behind.

Ventral fins inferior, little distant (about the width of their bases) and moderately in advance of the pectorals, rather long, and with seven rays, of which the fourth to sixth are longest.

D. (9) 10—15 | 36—45. A. 35—51. P. 14. V. 7.

The skull greatly differs from that of *Gadus*, as is indicated by the frontal depression seen through the skin. The great single frontal bone of the cods is in the *Merluccius* represented by two; each is traversed by a crest, which extends towards the front of the orbit, and which is continued from the corresponding branch of the fork of the supraoccipital crest; between the frontal crests thus placed, there exists a great depression of a triangular form, whose length is nearly twice as great as its anterior width; the sides of this depression are steep and even scooped out.

This genus is one of the most trenchant and strongly-marked among fishes, and contains among its representatives some of the most common and widely-distributed species,—all the seas of the Northern hemisphere being provided with them. Those species at the same time are themselves objects of considerable economical importance, and are also famed for the ravages which they commit on the other inhabitants of the sea. Yet this genus, so characteristic and so peculiar, and concerning which less confusion might be supposed to exist than almost any other, has been singularly misunderstood and received, through the misapprehensions of authors, a number of names which require to be ranked among its synonyms.

Rafinesque first proposed to take the Linnæan specific name of its type as the generic designation, but soon afterwards, with accustomed fickleness, substituted the name of *Onus*, and, finally, discovering that such after all was not the true name, corrected it to *Merlangus*;* all this was the fruit of the year 1810!

In the "Report, in part, on the Fishes of New York," Dr. Mitchill gave a description of a "hard-featured fish bought in the New York market, November 4, 1813," conferring on it the new generic as well as specific name of *Stomodon bilinearis*. This is quite a recognizable notice of the common hake of New York and the Eastern coast of the United States; Mitchill has, however, erroneously assigned only four ventral rays; he has hazarded no conjectures as to its affinities. In his subsequent memoirs no allusion is made to this name, but the species reappears in the "Memoir on the Fishes of New York," under the name of *Gadus merluccius*, and again in the "Journal of the Academy of Natural Sciences" as the new species *Gadus albidus*.

For some time after, the genus remained in this condition, no one having erred very widely concerning its affinities, and only one author having referred to a new species. But in 1855, Dr. Ayres, in California, described a species of that coast as a *Merlangus*, and Dr. Girard in the East as a supposed new generic type of *Trachinoids* from the same waters, under the name of *Homalopomus Trowbridgii*; the latter gentleman afterwards discovered that

* "In vece di Onus, sp. 30 [*Onus riati* = *Gadus merluccius*, L.] leggete *Merlangus*."

the species of Ayres and his own were at least "very closely allied," and evidently belonged "to the same genus, whether *Merlangus*, *Merlucius*, or *Homalopomus*:" he stated that "the natural affinities of the genus *Homalopomus* are intermediate between *Merlangus* and *Merlucius*, the dorsal and anal fins being constructed upon the pattern observed in *Merlangus*, whilst the ventral fins are identical in structure with those of *Merlucius*." Had he "not framed the genus under misapprehended affinities" he "would have placed the species in the genus *Merlangus* or *Merlucius*, it was immaterial where, and await further examination upon the Fishes of the North Pacific Ocean."

The reviewer* has referred the type of Girard positively to the genus *Merlucius*, believing that it was not "immaterial" in what one it should be placed, and, after the requisite comparisons, thinking that a great difference existed in the "pattern of the dorsal and anal fins" between the *Homalopomus* and *Merlangus*, while there was none between the former and *Merlucius*.

In the second volume of the "Catalogue of the Acanthopterygian Fishes in the Collection of the British Museum," Dr. Günther has proposed a genus of the group Trachinina of the family Trachinidæ, for a fish in "bad state," identified by him with the *Merlus Gayi* of Guichenot. The new genus was designated *Epicopus*, and to it were attributed "two dorsals, the first with nine or eleven feeble spines; ventrals jugular, with one spine and six soft rays;" "jaws, vomer and palatine bones with strong cardiform teeth;" "branchiostegal rays six." Dr. Günther does not at all object to the figure of "*Merlus Gayi*," as he generally does, in referring to a poor figure; and, as that figure represents a fish with an undivided second dorsal and anal fins scarcely decreasing backwards, almost produced behind, with well-branched rays, three slender anal spines, and the caudal peduncle little produced into the fin, it would have been naturally supposed that those characters existed in the specimen examined by Günther; that gentleman does not allude to any peculiarity of the upper surface of the head. He, finally, referring to Guichenot's reference of this species to *Merlucius*, remarked that he had, "however, convinced (himself) that the first dorsal is composed of rays which are neither articulated nor branched." At the same time, Günther, in a note to the Trachinina, indicated his belief in the pertinence of *Homalopomus* to the Trachinina. Influenced by the positive statements of Günther, the reviewer, in a "Synopsis of the Notothenioids," and an analysis of Günther's family of Trachinidæ, referred *Epicopus* to the family of Latiloidæ, a detachment from the Trachinidæ.†

But, in the fourth volume of the Catalogue of the Fishes in the British Museum, Dr. Günther announced that his *Epicopus Gayi* proved to be the "young" of *Merluccius vulgaris* in "a very bad state of preservation, and without any indication of the locality in which it has been procured. The simple structure of the rays of the first dorsal appears to be peculiar to the young state.‡ The roughness on the palatine bones were caused by calcareous deposits (the specimen was preserved in chloride of zinc), but there are no true teeth."§ The *Merlus Gayi* is then admitted as a species of *Merluccius*. To the same genus is also referred in a foot-note, as a doubtful species, *Gadus fimbria* of

* Gill, in "American Journal of Science and Arts," ser. 2, vol. xxx. p. 279, 1860; and in "Proc. Academy of Natural Sciences of Phila., 1861, p. 514.

† In the paper cited, there is the reference (*) to a foot-note after Latiloidæ, but the note itself was accidentally omitted. In this note, it was remarked that there were provisionally referred to the Latiloidæ the genera *Latilus*, *Pinguipes*, (Latilinae,) *Malacanthus*, (Malacanthini,) *Percopsis*, *Aphritis*, (Aphritinae,) and *Epicopus*, but that each group probably represented a distinct family; and reference was made to the equivocal character of the ventral fins of *Epicopus*, and the very doubtful relations of the genus.

‡ In the smallest specimen of *Merlucius bilinearis* examined, (about six inches long,) the rays of the first dorsal and the first ventral ray were found to be at least as much bifurcated and as decidedly articulated as in the adult.

§ Günther, op. cit., iv. p. 346.

Pallas, a fish of the Northwestern coast of America. This species, however, as is at once evident from the description, has no relation with *Merluccius* more than a large proportion of other fishes, and evidently belongs to the genus *Anoplopoma* of Ayres; it is a true Acanthopterygian, apparently the type of a peculiar family allied to the Chiroids. In this reference, Günther has committed the same error as Girard. On the other hand, Günther has referred to the genus *Gadus* and his subgenus *Boreogadus*, the *Merlangus productus* of Ayres or *Homalopomus Trowbridgii* of Girard, which is without the slightest doubt a genuine *Merluccius*, very closely allied to the Eastern species, as the figure of Girard and the reference to its true genus by the reviewer might have satisfied him.*

The genus *Merluccius* contains at least five species if the *Merlus Gayi* truly belongs to it. These species are distributed in the following manner:

MERLUCIUS VULGARIS Fleming.

Coasts of Europe and the Polar Seas.

MERLUCIUS BILINEARIS Gill ex Mit.

Coasts of Eastern North America from Virginia northwards.

MERLUCIUS PRODUCTUS Gill ex Ayres.

California.

MERLUCIUS ARGENTATUS (Faber) Gthr.

Iceland.

MERLUCIUS GAYI Gthr. ex Gay.

Chili.

If the execrable figure given in Gay's great work on Chili were at all reliable, it would indicate that the *Merlus Gayi* could scarcely be a true *Merluccius*, but since Guichenot says that that species resembles the European type as to the prolonged, little-compressed body, scales, opercula, form of the fins and other characters, it must be at least provisionally retained here. No one would suppose from the figure alone that a *Merluccius* was intended, as the likeness is only a strong analogical one, such as may exist between members of entirely distinct groups.

MERLUCIUS PRODUCTUS Gill.

Synonymy.

Merlangus productus Ayres, Proc. California Academy of Natural Sciences, vol. i. p. 64, 1855.

Homalopomus Trowbridgii Girard, Proceed. Academy of Natural Sciences of Phila., vol. viii. p. 132, 1856.

Homalopomus Trowbridgii Girard, Explorations and Surveys for a Railroad Route, &c., vol. vi. Abbot's Report, Zoology, p. 23.

Homalopomus Trowbridgii Girard, op. cit., vol. x. Fishes, p. 144, pl. xla, figs. 1—4.

Merluccius sp. Gill, American Journal of Science and Arts, ser. 2, vol. xxx. p. 279; Proc. Academy of Nat. Sci. of Phila., 1861, p. 514.

Gadus productus Günther, Catalogue of the Fishes in the British Museum, vol. iv. p. 338, 1862.

* Guenther has also retained, in a foot-note, as a doubtful species of *Merluccius*, the *M. ambiguus* of Lowe, (Proc. Zool. Soc., 1849, p. 37),—a most ambiguous species, certainly, as to its systematic position. The only knowledge of the fish is confined to the facts of the "production into a filament of the second ray of the ventral fins and grooved nape," wherefore supposed to resemble *Motella*, but wanting "the beards and having no trace of any fin within the nuchal groove." "The upper jaw closes over the under." This notice enables us to decide that it decidedly does not apply to a *Merluccius*, but does not distinguish it from the *Uraleptus maraldi*.

Subfamily *GADINÆ* (Bon.) Gill.*Synonymy.*

- Gadini Bonaparte*, Saggio di una Distribuzione Metodico degli Animali Vertebrati, 1831.
Gadinæ Swainson, Natural History of Fishes, Amphibians and Reptiles, vol. ii. pp. 188, 299, 1839.
Gadini Bonaparte, Systema Vertebratorum, p. 52, 1840.
Gadinæ Kaup, Archiv für Naturgeschichte, 1858 b. i. p. 86.
Gadiformes Bleeker, Enumerato specierum Piscium hucusque in Archipelago Indico Observatorum, p. 26, 1859.
Gadinæ Gill, Catalogue of the Fishes of the Eastern Coast, &c., 1860.

I. Vomerine teeth obsolete.

1. Barbel none Gadculus.
 2. Barbel present (*Gadus blennoides* Pallas)..... Leptogadus.

II. Vomerine teeth developed.

A. Lower jaw longest and projecting beyond the upper.

α. Vent nearly below the interspace between the first and second dorsals.

1. Teeth of the upper jaw not or scarcely enlarged in the outer row Pollachius.

2. Teeth of the upper jaw enlarged in the external row..... Boreogadus.

- β. Vent situated at or before the vertical of the origin of the first dorsal; first anal fin very long; second dorsal small Micromesistius.

B. Lower jaw shorter than, and generally received within, the upper.

- α. Barbel of chin obsolete..... Merlangus.

- β. Barbel more or less developed and pendant from chin.

- * Mouth enlarged, the supramaxillars extending more or less under the eyes.

† Snout longer than the eye.

1. Teeth of the outer row of upper jaw and inner of lower scarcely enlarged. Vomer with no elongated teeth..... Gadus.

2. Teeth of the outer row of upper jaw and inner of lower on sides elongated and slender, the first of the upper largest. Vomer with its posterior teeth considerably elongated..... Odontogadus.*

‡ Snout shorter than eye. Abdomen abbreviated..... Brachygadus.

- ** Mouth rather small, the supramaxillars not extending as far as the eyes..... Melanogrammus.

Genus *GADUS* Artedi.*Synonymy.*

Gadus Artedi, Genera Piscium, p. 18, 1738.

* *Odontogadus Gill*,—a genus established on the *Gadus euzinus* of Nordmann. The teeth of the lower jaw are nearly biserial. The skull is much like that of *Gadus*, but the great frontal is wider in front, and the base of the cranium more flattened and bulging outwards, &c. Five specimens of this rare species, obtained by the Hon. Geo. P. Marsh at Constantinople, are in the Smithsonian Institution. They evidently belong to the species named *Gadus euzinus* by Günther, on whose identification with Nordmann's species I rely, being unacquainted with the memoir of the latter author. The species, although covered by the technical character of *Morrhua* of Cuvier, is apparently at least as nearly allied to *Merlangus (vulgaris)*.

Callarias *Klein*, *Historiæ Piscium Naturalis promovendæ Missus quintus et ultimus*, p. 5, 1749.

Morrhua *Cuvier*, *Regne Animal*.

Gadus *Nilsson*, *Prodromus Ichthyologiæ Scandinaviæ*, pp. 39, 41, 1832. Adopt Bon.

Gadus } *Swainson*, *Natural History of Fishes, Amphibians and Reptiles*, vol.
Cephus } ii. pp. 188, 299, 300, 1839.
Tilesia }

Gadus *Gill*, *Proc. Academy of Natural Sciences of Phila.*, 1862.

Gadus *Günther*, *Catalogue of the Fishes in the British Museum*, vol. iv. pp. 326, 327, 1862.

Morrhua *Putnam*, *Bulletin of the Museum of Comparative Zoology of Cambridge*, 1863.

Body elongated, subfusiform in profile, but highest under the first dorsal fin, tapering into the moderately slender caudal peduncle, which is compressed; back compressed and oblique, and abdomen prominent and rather tumid beneath the first dorsal.

Scales minute and regularly imbricated.

Lateral line slightly convex from the scapular region to the middle of the body, and thence rectilinear, in a groove covered by a membranous linear band.

Head scaly, oblong conical in profile, above gradually narrowed towards the front, transversely arched at the nape, nearly flat at the forehead, and with the snout protuberant and longer than the eye. Eyes moderate, mostly or entirely in the anterior half of the head. Opercula almost concealed by the skin; operculum acute at the angle. Nostrils in front of eye; the anterior with a posterior flap; the posterior patulous or subtubular.

Mouth with the cleft moderately oblique and rather deep; the supramaxillars extending at least under the anterior half of the eyes, their ends produced downwards and truncated behind; intermaxillars ceasing far in front of the ends of the supramaxillars. Lower jaw received within the upper, broadly rounded in front.

Lower jaw with a moderate barbel persistent on the bone.

Teeth pauciserial in each jaw; those of the outer row in the upper, and of the inner in the lower, enlarged.

Branchiostegal rays seven.

Dorsal fins three, separated by decided interspaces, invested in a naked skin; the first shortest, more or less behind the vertical of the pectoral fins, rounded or angular in front, and rapidly declining in a more or less convex line decurved backwards; second oblong and longest.

Anal fins two, opposed to the second and third dorsals and nearly equal in size and form.

Caudal fin moderate, subtruncated, concave or convex, with numerous supplementary rays above and below.

Pectoral fins moderate, obliquely rounded behind.

Ventral fins inferior, moderately approximated, inserted moderately in advance of the pectorals, narrow and provided with seven rays, the second of which is more or less prolonged.

D. 12—14 | 16—21 | 17—22. A. 18—26 | 17—24.

Artesi, in his "*Genera Piscium*," establishing this genus in the manner of the moderns, gave the following diagnosis:

"*Membrana branchiostega utrinque septem ossicula subteretia continet.*

"*Dorsum jam tripterygium, jam dipterygium.*

"*Caput plerumque cathetoplateum, interdum plagioplateum.*"

To the genus were referred the following species:

1. *Merlangus vulgaris Flem.*

2. *Pollachius carbonarius* Bon.
3. " *typus* Bon.
4. *Gadus morrhua* L.
5. *Melanogrammus æglifinus* Gill.
6. *Brachygadus luscus* Gill.
7. " *minutus* Gill.
8. *Merlucius vulgaris* Flem.
9. *Molva vulgaris* Flem.
10. *Lota vulgaris* Cuv.
11. *Onos mustela* Gill.

Klein, in his fifth and last "Missus," (1749,) substituted the name *Callarias*, and restricted the genus to species with three dorsal fins, the head trochiform, the tail coniform and girdled by the caudal.

The species were distributed among two sections.

CALLARIAS, barbatus, cirro unico, pendulo e mento.

1. *Gadus morrhua* L.
2. *Melanogrammus æglifinus* Gill.
3. *Brachygadus luscus* Gill.
- 4.* *Gadus morrhua* L.
- 5.* " "
- 6.* " "
- 7.* " "
8. " " ?
9. " " ?
10. *Brachygadus minutus* Gill.

CALLARIAS, imberbis.

1. *Pollachius typus* Bon.
2. " *carbonarius* Bon.
- 3.* *Merlangus vulgaris* Cuv.
4. *Trachurops macarellus* Gill ex C. et V.?

This genus is surprisingly natural and well defined, compared with most of Klein's genera, and is co-equal with Günther's *Gadus* or Cuvier's *Morrhua* and *Merlangus* combined. The name cannot, however, be retained, as it is a synonym of *Gadus*.

Cuvier accepted the name *Gadus* in nearly its Artedean sense, distributed the species among smaller groups, called by him subgenera, and did not apply the name itself to one of them, but conferring an independent one on each—called one of his subgenera *Morrhua*, characterizing it by the three dorsals, two anals and a barbel at the chin. To it were referred the species of *Gadus*, *Brachygadus* and *Melanogrammus*.

Nilsson, in his "Prodromus Ichthyologiæ Scandinaviæ," (1832,) modified the subgenus *Morrhua*, including under it only *Gadus* and *Brachygadus*, while *Melanogrammus* formed part of his *Merlangus*. He gave the following diagnosis:

"Corpus forma elegantiore; pinnis dorsi tribus; ani duabus & cirro mentali; rostro extra maxillas procedente; corpore maculis variegato; cauda subæquali."

Bonaparte has adopted Nilsson's arrangement.

Swainson, in 1839, proposed for the Cuvieran *Morrhua* three genera,—*Gadus*, really equivalent to *Morrhua*; *Cephus* for the *Gadus macrocephalus* of Tilesius and *Tilesia* for the *Gadus gracilis* of the same author. These genera are due to mistaken ideas, and the distinctions signalized do not exist.

The reviewer has lately limited the genus as here adopted.

Finally, Mr. Putnam, some time afterwards, being apparently unacquainted with the different applications of the name by Nilsson, Bonaparte and the

reviewer, restricted the name *Gadus* to the genus named *Melanogrammus* and retained Cuvier's *Morrhua* for the present genus.

The genus *Gadus* as here defined does not embrace a number of species referred to it by previous authors, for from it, by the terms of the description, are excluded the *Gadus oglifinus* of Linnæus, or the common baddock, which now is the type of the genus *Melanogrammus*; the *Gadus minutus* and *G. luscus* of Linnæus belonging to *Brachygadus*.

The species, or at least the nominal species, of authors which appear to be really congeneric and members of the same genus—*Gadus*—are the following. Those whose claims to specific rank are most doubtful and require to be confirmed, are indicated by an asterisk placed after their respective names.

§ I.

Anus under the anterior portion of the second dorsal fin.

GADUS MORRHUA Linn.

Northern European and Polar Seas.

GADUS ARENOSUS Mitchill.*

Coast of Middle and Eastern United States northwards to Hudson's Bay.

GADUS OJAC Richardson.*

Greenland.

GADUS NAVAGA Kœlreuter.

Coasts of Northern Russia.

GADUS GRACILIS Tilesius.(*)

Kamtschatka.

GADUS MACROCEPHALUS Tilesius.

Kamtschatka. *

§ II.

Anus under the hinder portion of first dorsal.

GADUS TOMCODUS Walbaum.

Middle and Eastern States northwards to Newfoundland.

GADUS PROXIMUS Girard.

California and Oregon.

It is very doubtful, from the slight description, whether the *Gadus pygmaeus* of Pallas belongs to this genus: it is said to have five (?) branchiostegal rays, the lateral line obsolescent behind, and the following number of fin rays: D. 16 | 16 | 19. A. 18 | 15. C. 28, very much crowded. P. 17. V. 6. The specimen described, about seven inches long, was obtained by Dr. Merk at Cape Elias in Russian America. It is asked by Pallas whether it may not be the *Gadus minutus* of Linnæus? Such cannot be the case.

GADUS GRACILIS Tilesius.

Synonymy.

Gadus wachna Pallas, Zoographia Rosso-Asiatica, vol. iii. p. 182, 1831.

Gadus gracilis Tilesius, in Zoographia Rosso-Asiatica, vol. iii. p. 182, 1831.

“ “ “ Mémoires de l'Académie Impériale des Sciences de St.

Petersbourg, tome ii. p. 354, tab. 18. (1808) 1810.

Tilesia gracilis Swainson, Natural History of Fishes, Amphibians and Reptiles, vol. ii. p. 300, 1839.

Hab.—Kamtschatka and Kurile Islands (and Oregon?)

(*) The position of the anus in this species is doubtful, but it probably belongs to this section.
1863.]

GADUS PROXIMUS Girard.

Synonymy.

- Gadus proximus* Girard, Proc. Academy of Natural Sciences of Phila., vol. vii. p. 141, 1854.
Gadus proximus Girard, op. cit., vol. vii. p. 151.
Morrhua californica Ayres, Proc. California Academy of Natural Sciences, vol. i. p. 9, 1854.
Morrhua proxima Girard, Explorations and Surveys for a Railroad Route, &c., vol. vi. Abbot's Report, *Zoology*, p. 22.
Moarhua proxima Girard, op. cit., vol. x. *Fishes*, p. 142, pl. xl.a, figs. 5—8.
Morrhua proxima Girard, op. cit., vol. x. Whipple's Report, *Zoology*, p. 50.
 " " " op. cit., vol. x. Williamson's Report, *Zoology*, p. 86.
Gadus proximus Gill, Proc. Academy of Natural Sciences of Phila., 1862.
 " *californicus* Günther, Catalogue of the Fishes in the British Museum, vol. iv. p. 332.
Hab.—California and Oregon.

Family BROTULOIDÆ Blkr.

Synonymy.

- Brotuloidei* Bleeker, Enumeratio specierum Piscium hucusque in Archipelago Indico Observatorum, &c., p. xxv. 1859.
Ophidiidæ (*Brotulina*) Günther, Catalogue of the Fishes in the British Museum, vol. v. pp. 370, 371, 1862.
Gadidæ pt. auct.

Elongated fishes, compressed and regularly tapering behind, with tail generally more or less subtruncated, with the anus submedian; scales either absent or cycloid and minute, imbedded in a lax skin, which more or less envelopes the fins; very large branchial apertures; vertical fins united, or contiguous, the dorsal commencing not far from the nape, the caudal narrow or pointed, the ventral fins replaced by simple or bifid filaments attached to the humeral arch and more or less in advance of the pectoral. Pyloric cæca few (1 or 2), rarely obsolete or in increased number (12).

The supramaxillars are generally enlarged behind and produced towards their upper angle.

The genera referred to the group *Brotulina* by Günther may be provisionally retained in this family and distributed in the following manner. The sub-families, perhaps, do not follow in natural order.

I. Ventral fins inserted considerably in advance of the pectoral fins.

Ia. Body scaly, moderately long.

A. Pyloric cæca none, one or two.

α. Lateral line continuous.

- | | |
|---|-----------------|
| 1. Snout and lower jaw with barbels. Cæca 1 or 2. | BROTULINÆ. |
| * Ventral filaments bifid..... | Brotula. |
| ** Ventral filaments entire..... | Nematobrotula.* |
| 2. Head without barbels. Cæca 2..... | BROSOMPHYCINÆ. |
| * Head naked..... | Brosomphycis. |
| ** Head scaly..... | Dinematikthys. |
| 3. Head without barbels. Cæca none..... | LUCIFUGÆ. |
| * Palatine bones without teeth..... | Lucifuga. |
| ** Palatine bones with teeth..... | Stygicola.† |
| β. Lateral line interrupted or double..... | BYTHITINÆ. |

* Type. *Brotula ensiformis* Günther.

† *Lucifuga dentatus* Poey.

- * Lateral line interrupted. Vomerine and palatine teeth..... Bythites.
- ** Lateral line double behind. Vomerine teeth... Pteridium.
- AA. Pyloric cæca in moderate number (about 12). Ventral fins inserted under or nearly under eyes..... SIREMBINÆ.
- * Preoperculum unarmed..... Siremba.
- ** Preoperculum with three spines..... Hoplobrotula.*
- ?B. Body naked, very long and compressed. Vertical fins confluent..... XIPHASINÆ.
- Xiphasia.
- ?II. Ventral fins under the pectoral. Vertical fins confluent, (Kaup)..... BROTULOPHINÆ.
- Brotulophis.

BROSMOPHYCINÆ Gill.

Synonymy.

Brosomphycinæ Gill, Proc. Academy of Natural Sciences of Phila., 1862.

Brotuloids with a moderately elongated, scaly body, a more or less distinct caudal fin, two closely-approximated ventral filaments, a continuous lateral line, no barbels and (typically) two pyloric cæca.

The typical genera are *Brosomphycis*, represented in the Californian waters, and *Dinematchthys* of Bleeker, whose single species is found in the seas of the East Indian Archipelago. The Lucifugeæ are, however, very closely related to those genera, and the difference in the posterior parts is rather one of degree than kind: they perhaps form a group of the subfamily.

Genus *BROSMOPHYCIS* Gill.†

Synonymy.

Brosomphycis Gill, Proc. Academy of Natural Sciences of Phil., 1861, p. 168.
Halias Agres, Proc. Californian Academy of Natural Sciences, vol. ii. p. 52, 1861.

Brosmius sp. *Agres*, 1854.

Dinematchthys sp. *Günther*, 1862.

Body moderately elongated, thick and with the abdomen more or less dilated, in front of the anus and behind compressed, and uniformly tapering to its truncated end. Anus rather behind the middle, with a scarcely raised margin and unarmed; second aperture behind and also little raised.

Scales minute, scarcely imbricated and imbedded in the skin, which is lax, and invests the dorsal and anal fins.

Lateral line inconspicuous, slightly convex above the abdomen and recitilinear behind.

Head naked, moderate, oblong conical in profile, moderately compressed and above nearly uniformly wide, with the snout longer than the eye, blunt and subtruncated, with deep pits in and near the margin of the skin above the maxillars. Eyes moderate, covered by the skin, situated nearly in the middle of the anterior half of the head. Nostrils nearly equidistant from the snout and eyes. Opercula covered by the skin; the operculum with a spine at its angle, terminating a bar on its inner surface, near the upper margin. Chin with two deep pits, one on each side.

* Type. *Brotula armata* T. Schlegel.

† A second species of this genus was discovered at Cape St. Lucas by Mr. Xantus. Its height is scarcely less than a sixth of the length. The head enters $4\frac{2}{3}$ times in the total; the jaw equals half of the head's length; the snout equals nearly a fifth of the same. The dorsal fin commences with the second fourth of the length; the anal commences a third nearer the snout than the opposite end; the pectoral equals about half the length of the head; and the ventral filament is only about a fifth shorter than the head. The color is reddish-brown. The species may be named *B. ventralis*.

Branchiostegal rays six.

Mouth with its cleft scarcely oblique, quite deep, the supramaxillars extending behind the eyes, expanded towards their ends, especially at the upper angle. Teeth small, stout and rather blunt, in a band on each jaw, interrupted at the symphysis and narrowed on the sides behind. Vomer and front of palatines with similar teeth.

Dorsal fin rather low, and nearly even, with its origin behind the vertical of the pectorals, and almost connected to the base of the caudal behind.

Anal fin much shorter, but similar in form to the dorsal, and partly connected behind to the caudal.

Pectoral fins moderate, obliquely and convex nearer the lower rays, in an adipose skin.

Ventral filaments inserted under the preoperculum, compressed, closely annular, but not articulated like the rays of Phycis, &c.

The branchial arches have transverse scabrous ridges on each side of their concave surfaces, except the middle portion of the first below the bend, where the ridges of the outer side are replaced on the margin by about three produced, scabrous, subcylindrical processes. The cleft behind the fourth arch is moderate. There are no pseudo-branchiæ.

The stomach is large and sacciform, and, at the pyloric extremity, there are two short cæca, one on each side.

This genus is most nearly allied to *Dinematichthys* of Bleeker, but distinguished by the scaleless head, dentition and the absence of claspers to the anal papilla, &c.

BROSMOPHYCIS MARGINATUS Gill.

Synonymy.

- Brosmius marginatus* Ayres, Proc. California Academy of Natural Sciences, vol. i. p. 13, 1854.
Brosmius marginatus Girard, Explorations and Surveys for a Railroad Route, &c., vol. x. *Fishes*, p. 141.
Brosmophycis marginatus Gill, Proc. Academy of Natural Sciences of Phila.; vol. xiii. p. 168, 1861.
Halias marginatus Ayres, Proc. California Academy of Natural Sciences, part 2, p. 52, 1861.
Brosmophycis marginatus Gill, Proc. Academy of Natural Sciences of Phila., 1862, p. 280.
Dinematichthys marginatus Günther, Catalogue of the Fishes in the British Museum, vol. iv. p. 375.
Hab.—California.

Synopsis of the Family of LYCODOIDÆ.

BY THEODORE GILL.

In the present article, it is desired to draw the attention of American marine zoologists to the species of this family, to call forth the search for any species of two of the genera hitherto only known from Greenland, or high northern seas; and also to embody the views regarding the affinities of the several genera, which have been widely scattered in the different ichthyological systems, and yet which appear to be connected by the closest ties.

Only the different species of *Enchelyopus* and *Gymnelis* are known to the author; acquaintance with *Lycodes* being confined to the descriptions and excellent figures of Reinhardt, Kroyer and Richardson.

Family LYCODOIDÆ (Günther).

Synonymy.

Zoarchidæ Swainson, Natural History and Classification of Fishes, Amphibians and Reptiles, vol. ii. pp. 184, 283, 1839.

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