

## 9.—A PRELIMINARY REVIEW OF THE APODAL FISHES OR EELS INHABITING THE WATERS OF AMERICA AND EUROPE.

BY DAVID STARR JORDAN AND BRADLEY MOORE DAVIS.

In the present paper is given the synonymy of fishes of the order of Apodes, commonly known as Eels, Morays, or Congers, which are known to inhabit the North Atlantic and the waters of America and Europe.

Few groups of fishes are less thoroughly known than the eels. They are not so easily obtained by collectors as fishes of most other types, and they have been less satisfactorily studied. Many of the species currently recognized are doubtful or based on insufficient or imperfect material.

The division into families is still a provisional one, for the osteology of only a few of the genera has been critically examined. It is hoped that the present paper may help in some degree to fix our knowledge and to prevent further confusion.

The work of making a critical review of the eels was begun in 1888 by the late Charles Harvey Bollman. Much of the synonymy of the species was collected by him, and several analytical keys to the species were prepared. His manuscript has been entirely rewritten by the present authors, who wish however to express their acknowledgment of the help received from it. We are also largely indebted to Dr. Charles H. Gilbert, who has placed the *Albatross* collections at our disposal and has freely given us the use of his unpublished descriptions and determinations.

This paper is based on the collections in the Museum of the University of Indiana and on material collected for the U. S. Fish Commission by the steamer *Albatross*. Most of the specimens in the U. S. National Museum have also been examined by us. Of the 128 species here recognized, 53 have not been studied by us.

We accept the order of Apodes as limited by Dr. Gill, including in it the *Enchelycephali* and *Colocephali* of Professor Cope. Of eel-shaped fishes we exclude the *Gymnotidae* (*Glanencheli*), *Monopteridae* (*Ichthyoccephali*), *Symbranchidae* (*Holostomi*), and *Saccopharyngidae* (*Iyomeri*), which form each a separate order or suborder of Physostomous fishes, and among which we should probably look for the ancestry of the Apodes.

The order of *Apodes* has been succinctly defined by Dr. Gill (Century Dictionary, p. 262) in the following words:

Teleost. fishes with the intermaxillaries atrophied or lost, the supermaxillaries lateral, and the body anguilliform and destitute of ventral fins.

The most striking feature is the absence of the premaxillaries, taken in connection with the elongate form and the little development of the scapular arch, which is not attached to the cranium. Other characters not confined to the Apodes are the following: The absence of the symplectic bone, the reduction of the opercular apparatus and of the palatopterygoid arch, the absence of ventral fins, and the reduction or total absence of the scales. There are no spines in the fins, the gill-openings are comparatively small, and there are no pseudobranchiæ. The vertebrae are in large number, as is shown in the following table:

*Numbers of vertebrae in Apodes.*

<i>Muraenox coniceps</i> .....	40+ 71=111	<i>Gymnothorax unicolor</i> ....	65+ 71=136
<i>Anguilla anguilla</i> .....	46+ 70=116	<i>Muraena helena</i> † .....	70+ 71=141
<i>Echidna catenata</i> † .....	65+ 51=116	<i>Ophichthus gomesi</i> .....	45+ 96=141
<i>Gymnothorax meleagris</i> † ..	60+ 60=120	<i>Gymnothorax ocellatus</i> ....	48+ 94=142
<i>Gymnothorax nebulosus</i> † ..	65+ 57=122	<i>Gymnothorax moringa</i> † ...	65+ 79=144
<i>Gymnothorax undulatus</i> † ..	64+ 68=132	<i>Synaphobranchus pinnatus</i> †	31+115=146
<i>Ophichthus ocellatus</i> .....	52+ 82=134	<i>Leptocephalus conger</i> .....	55+ 99=154
<i>Echidna zebra</i> † .....	97+ 38=135	<i>Gordiichthys irretitus</i> .....	125+100=225

The *Apodes* are naturally divisible into two series or suborders, typified respectively by the Eels and Morays. These groups have been called *Enchelycephali* and *Colocephali* by Cope. The American and European Morays belong to a single family, *Muraenidæ*, but the proper subdivision of the true Eels is very unsettled. In the present paper we have recognized twelve families among the American genera, but until their skeletons are fully studied, the position and value of some of these groups is problematical. If any subdivisions are made among the Congroid Eels, we see no alternative but to recognize the chief groups as distinct families.

To those who prefer not to give such rank to groups like *Ophisuridæ*, *Echelidæ*, etc., the following arrangement might be found acceptable:

COLOCEPHALI.

*Muraenidæ*.

ENCHELYCEPHALI.

*Congridæ*.

Ophisurinae.

Echelinae.

Stilbiscinae.

Muraenesocinae.

Nettastominae.

Nemichthyinae.

Heterocongrinae.

Congrinae.

*Anguillidæ*.

Anguillinae.

Simenchelyinae.

Ilyophidinae.

Synaphobranchinae.

† According to Günther.

But the mutual relations and value of these groups can only be ascertained by a thorough study of the anatomy of the various genera, and until such studies are made these groups may stand as separate families. As Cope has observed, there is no more propriety in putting all Eels in one family because of their agreement in form than there would be in putting in a similar family all fishes which agree in being "fish-shaped."

The following analytical key gives the salient characters of the families included in the present paper:

ANALYSIS OF THE FAMILIES OF APODES FOUND IN EUROPE AND AMERICA.

- A. Opercular bones present and at least one osseous branchial arch; pharyngeal jaws developed; ceratohyal present. (**Apodes.**)
- a. \* Gill-openings small, roundish, leading to restricted interbranchial slits; tongue wanting; pectoral fins (typically) wanting; opercles feebly developed; fourth gill arch modified, strengthened and supporting pharyngeal jaws. (Suborder **COLOCEPHALI.**)
- b. Scapular arch obsolete or represented by cartilage; heart not far back; pectorals wanting; (skin thick; coloration often variegated.)  
**MURENIDÆ, I.**
- aa. Gill-openings larger, leading to larger interbranchial slits; tongue present; opercles and branchial bones better developed; scapular arch present. (Suborder **ENCHELYCEPHALI.**)
- c. Scales wholly wanting; eggs (so far as known) of moderate size, much as in ordinary fishes.
- d. Tip of tail without rays, projecting beyond the dorsal and anal fins (not filiform); posterior nostril on the edge of the upper lip; anterior nostril near tip of snout, usually in a small tube; tongue usually adnate to the floor of the mouth. (Coloration frequently variegated.) . . . . . **OPHISURIDÆ, II.**
- dd. Tip of tail with a more or less distinct fin, the dorsal and anal fins confluent around it; the tail sometimes ending in a long filament. (Coloration almost always plain, brownish, blackish, or silvery, the fins often black-margined.)
- e. Posterior nostril close to the edge of the upper lip; tongue more or less fully adnate to the floor of the mouth; teeth subequal.  
**ECHOLIDÆ, III.**
- ee. Posterior nostril without tube, situated entirely above the upper lip.
- f. Tongue narrow, adnate to the floor of the mouth or only the tip slightly free; vomerine teeth well developed, sometimes enlarged.
- g. Jaws not attenuate and recurved at tip; gill-openings well separated; anterior nostrils remote from eye.
- h. Pectoral fins well developed; skin thick; skeleton firm; snout moderate; tail not ending in a filiform tip.  
**MURENESOCIDÆ, IV. •**
- hh. Pectoral fins wholly wanting; snout and jaws much produced, the upper longer; jaws straight; skin thin, the skeleton weak; tail ending in a filiform tip; gill-openings small, sub-inferior; teeth sharp, subequal, recurved; a long series on the vomer; deep-sea eels, soft in body, black in color.  
**NETTASTOMIDÆ, V.**

\* This diagnosis is chiefly taken from Gill, Proc. U. S. Nat. Mus., 1890, 166.

*gg.* Jaws long and slender, tapering to a point, recurved at tip; nostrils large, both pairs close in front of eye; gill-openings convergent forward, separate or confluent; pectorals and vertical fins well developed; membranes of fins thin, not enveloping the rays; skeleton well developed; deep-sea eels.

NEMICHTHYIDÆ, VI.

*ff.* Tongue broad, largely free anteriorly and on sides; vomerine teeth moderate.

*i.* Pectoral fins wholly wanting; snout obtuse, very short; body and tail excessively elongate; cleft of mouth oblique, the lower jaw projecting; mouth small; teeth small, sharp, in narrow bands on jaws and vomer; nostrils very small, in front of eye; dorsal beginning just behind gill-opening, the fins rather low; gill-openings lateral.

HETEROCONGRIDÆ, VII.

*ii.* Pectoral fins well developed; body not excessively elongate; lower jaw not projecting; anterior nostril remote from eye.

CONGRIDÆ, VIII.

*cc.* Skin covered with rudimentary imbedded scales, usually linear in form, arranged in small groups, and placed obliquely at right angles to those of neighboring groups; pectorals and vertical fins well developed, the latter confluent about the tail; lateral line present; posterior nostril in front of eyes; tongue with its margins free.

*i.* Gill-openings well separated; branchiostegals long, bent upwards behind.

*j.* Gill-openings lateral and vertical; snout conic, the jaws not very heavy; gape linear; lips thick; lower jaw projecting; teeth in cardiform bands on jaws and vomer; eggs minute.

ANGUILLIDÆ, IX.

*jj.* Gill-openings horizontal, inferior.

*k.* Snout very blunt, with very strong jaws; gape transverse; lips obsolete; teeth blunt, in one series, on jaws only.

SIMENCHELYIDÆ, X.

*kk.* Snout conical and slender, the jaws of moderate strength; gape lateral; lips suppressed; tongue but little developed; teeth acute, in bands on jaws and vomer.

ELYOPHIDÆ, XI.

*ii.* Gill-openings inferior, very close together, apparently confluent; branchiostegal rays abbreviated behind; head conical; tongue small; posterior nostrils in front of eye.

SYNAPHOBANCHIDÆ, XII.

Family I.—MURÆNIDÆ.

(MORAYS.)

The *Murænida* represent the most degenerate type of eels so far as the skeleton is concerned, and they are doubtless the farthest removed from the more typical fishes from which the eels have descended. The essential characters of the family are thus stated by Dr. Gill:

Colocephalous Apodals with conic head, fully developed opercular apparatus, long and wide ethmoid, posterior maxillines, pauciserial teeth, roundish, lateral branchial apertures, diversiform vertical fins, pectoral fins (typically) suppressed, scaleless skin, restricted interbranchial slits, and very imperfect branchial skeleton, with the fourth branchial arch modified, strengthened, and supporting pharyngeal jaws.

The Morays may be readily distinguished from the other eels by their small round gill-openings and by the absence of pectorals. The body and fins are covered by a thick, leathery skin, the occipital region is elevated through the development of the strong muscles which move the lower jaw, and the jaws are usually narrow and armed with knife-like or else molar teeth.

The Morays inhabit tropical and subtropical waters, being especially abundant in crevices about coral reefs. Many of the species reach a large size, and all are voracious and pugnacious. The coloration is usually strongly marked, the color cells being highly specialized. We exclude from the *Murænida* the genus *Myroconger*, from St. Helena, which has pectoral fins, and is probably a type of a distinct family. The remaining species are referable to ten or twelve genera, most of which are found in America.

ANALYSIS OF THE AMERICAN GENERA OF MURÆNIDÆ.

- a. Vertical fins rudimentary, confined to the end of the tail (often appreciable only on dissection, or altogether wanting); teeth rather small, pointed, subequal, in several series; posterior nostril round, with a short tube or none.
  - b. Cleft of the mouth short, not half length of head; snout moderate, about half the gape; tail about as long as trunk ..... UROPTERYGIUS, 1.
  - bb. Cleft of the mouth long, nearly half head; snout very short, less than one-fourth the gape; tail very short, about half rest of body... CHANNOMURÆNA, 2.
- aa. Vertical fins well developed, the dorsal beginning before the vent.
  - c. Posterior nostril an oblong slit; anterior in a short tube; teeth all pointed; dorsal beginning above the gill-opening; canine teeth strong; tail moderate ..... ENCHELYCORE, 3.
  - cc. Posterior nostril circular, with or without tube; tail moderate, not twice as long as trunk; body not excessively elongate.
    - d. Teeth all, or nearly all, acute, none of those in the jaws obtuse or molar-like.
      - e. Anterior nostrils without tube; vomerine teeth in many series; lips with a free fold..... PYTHONICHTHYS, 4.
      - ec. Anterior nostrils each with a long tube; vomerine teeth in one or two series; lips continuous with skin of head.
        - f. Posterior nostrils without tube, the margin sometimes slightly raised.
          - GYMNOTHORAX, 5.

*ff.* Posterior nostrils as well as anterior each in a conspicuous tube.

MURÆNA, 6.

*dd.* Teeth mostly obtuse, molar-like; anterior nostrils only tubular; cleft of mouth rather short; dorsal beginning before the gill-opening.

ECHIDNA, 7.

### Genus 1.—UROPTERYGIUS.

*Gymnomuræna* Lacépède, Hist. Nat. Poiss., v, 648, 1803 (*doliata*; *marmorata*). (Restricted first by Kaup, in 1856, to *doliata*, which is a species of *Echidna*.)

*Iothyophis* Lesson, Voyage de la Coquille, II, 129, 1830 (*pantherinus* = *marmoratus*, not of Fitzinger, 1829, a genus of Reptiles.)

*Uropterygius* Rüppell, Neue Wirbelthiere, Fische, 1838, 83 (*concolor*).

*Murænoblenna* Kaup, Apodal Fishes, 97, 1856 (*tigrina*), (not of Lacépède, 1803, which is *Myxine*).

*Gymnomuræna* Bleeker, Günther, etc. (not of Lacépède, as restricted by Kaup).

Type: *Uropterygius concolor* Rüppell.

Etymology: *ὀπρά*, tail; *πτερόξ*, fin.

This genus contains several species of small Morays, distinguished by the apparent absence of fins.

Of the various names applied to this group, only one, *Uropterygius*, is available, for reasons indicated above. Our species (with *U. tigrinus*) differs from the type of the genus *U. concolor* in the presence of a small tube on the anterior nostril. This hardly seems to justify further generic division.

#### ANALYSIS OF THE AMERICAN SPECIES OF UROPTERYGIUS.

*a.* Anterior nostril with a short tube; posterior nostril without tube, situated directly over the eye.

*b.* Body dark brown above; below paler with small dark freckles and pale spots; under side of lower jaw light-colored with brownish and whitish blotches; teeth in jaws biserial, outer teeth small, close together; inner row composed of long depressible canines, not close set; vomerine teeth uniserial; a pore situated just above the posterior nostril; tail rather acute with a very slight dorsal fold, more conspicuous in old specimens, its tip, in young specimens, white; caudal fin obsolete; eye 2 to 2½ in snout; cleft of mouth 2½ to 2¾ in head; head 3¾ in trunk; tail ½ longer than rest of body. . . . NECTURUS, 1.

### 1. UROPTERYGIUS NECTURUS.

*Gymnomuræna nectura* Jordan and Gilbert, Proc. U. S. Nat. Mus., 356, 1882 (Cape San Lucas).

*Murænoblenna nectura* Jordan, Cat. Fish N. A., 51, 1885.

Habitat: Gulf of California.

Etymology: *Νηξτερο*, a swimmer; *ὀπρά*, tail.

This species is not rare in the Gulf of California. Besides the original type, we have examined several specimens obtained from near the entrance to the Gulf by Dr. Gilbert, another (43103, U. S. National Museum) probably also taken at Cape San Lucas by Mr. John Xantus, and a much larger specimen (6319), 10½ inches long, without locality. The large example is much more compressed in form, and it seems to

have a caudal fin, but all probably belong to one species. The specimens taken by Dr. Gilbert (4 to 5½ inches in length) are nearly terete, the tail sharp, and with no appreciable fin. The rays, if any exist, can not be found even on dissection. There is considerable variation in the size of the eye.

### Genus 2.—CHANNOMURÆNA.

*Channo-Muræna* Richardson, Voyage Erebus and Terror, 96, 1844 (*Vittata*.)

Type. *Ichthyophis vittatus* Richardson.

Etymology: *Χάννη* (from *ζάνω*, to yawn); *Muræna*.

This genus is near *Uropterygius*, differing chiefly in the large size of the gape. Two species are known, *C. bennetti*, from Mauritius, and *C. vittata*.

#### ANALYSIS OF THE AMERICAN SPECIES OF CHANNOMURÆNA.

- a. Color pale yellowish-brown with about 15 irregular broad chocolate-colored cross bands, varying in width, sometimes interrupted, sometimes bifurcated, some of them forming complete rings, the pale interspaces usually edged with lighter yellowish; fins wanting; lower jaw projecting; teeth slender, subequal, directed backward; teeth in lower jaw in two series, pointed backwards, the inner teeth the largest, and movable; teeth in upper jaw in three series, the two inner series larger and more or less movable; vomerine teeth in a band, thick-set anteriorly, posteriorly biserial; eye 1½ in snout, situated in the anterior third of gape; snout 4½ in gape; gape 2 in head; head about 4 in trunk, 2½ in tail.. VITTATA, 2.

### 2. CHANNOMURÆNA VITTATA.

*Raro* Parra, Dif. Piezas Hist. Nat., 66, lam. 30, fig. 3, 1780 (Havana).

*Ichthyophis vittatus* Richardson, Voy. Sulph., Fish., 114, pl. 53, figs. 7-9, 1844 (locality uncertain, said to be from China).\*

*Nectastoma* or *Channomuræna vittata* Richardson, Voyage Erebus and Terror, Fishes, 96, 1844 (West Indies).

*Channomuræna vittata* Kaup, Apodes, 97, 1856; Poey, Enumeratio, 160, 1875.

*Gymnomuræna vittata* Günther, VIII, 134, 1870 (Cuba).

*Channomuræna cubensis* Poey, Repertorio, II, 266, lam. 3, fig. 6, 1867 (Cuba); Poey, Synopsis, 428, 1868.

Habitat: West Indian fauna.

Etymology: *Vittatus*, striped; but *zonatus* or *fasciatus* would have been more correct.

This singular species is known to us only from a single large specimen (24962, U. S. National Museum), 31½ inches long, sent by Professor Felipe Poey, from Havana. It is said to reach a length of 3 feet. Its peculiar coloration gives it a remarkably snake-like appearance.

### Genus 3.—ENCHELYCORE.

? *Enchelynassa* Kaup, Apodes, 72, 1856 (*bleckeri*).

*Enchelycore* Kaup, l. c. (*euryrhina*).

Type: *Enchelycore euryrhina* Kaup = *Muræna nigricans* Bonnaterre.

Etymology: *Ἐγγελοσ*, eel; *κόρη*, girl; the application not evident.

This genus contains a single species from the West Indies.

The genus *Enchelynassa* is based on a single specimen from unknown locality. Günther considers it "not improbable that this fish is identical with or closely allied to *Enchelycore*," but the description of Kaup is insufficient for the determination of this point.

#### ANALYSIS OF THE SPECIES OF ENCHELYCORE.

- a. Snout narrow, rather produced,  $2\frac{2}{3}$  in gape; the jaws can not be shut in adult examples. Teeth of upper jaw biserial, the inner series of very long and slender depressible canines; long canines not movable in front of each jaw; lateral teeth of lower jaw slender, subequal, sharp, and recurved; vomerine teeth small, uniserial, developed posteriorly; eye moderate, 2 in snout; gape 2 in head; dorsal beginning above the gill opening; tail slightly longer than rest of body; head 3 to  $3\frac{1}{2}$  in trunk. Uniform black or dark brown, sometimes faintly marbled with darker; angle of mouth slightly darker; gill-opening pale.

NIGRICANS, 3.

### 3. ENCHELYCORE NIGRICANS.

*Murana unicolor maxillæ elongatis teretiusculis, inferiore longiore, etc.*, Gronow, Zoophyl., 163, 1763 (South America).

*Murana nigricans* Bonnaterre, Encycl. Méth. Ichth., 34, 1788 (after Gronow).

*Muranophis nigricans* Lacépède, Hist. Nat. Poiss., v, 389, 1803 (after Bonnaterre).

*Enchelycore nigricans* Günther, VIII, 135, 1870 (Dominica; Grenada; Barbadoes).

*Murana anguina* Gronow, Cat. Fish. Brit. Mus., 18, 1854 (rivers of South America).

*Enchelycore euryrhina* Kaup, Apodes, 73, 1856 (no habitat).

*Gymnothorax nigrocastaneus* Cope, Trans. Amer. Phil. Soc., 483, 1870 (St. Martin's).

*Gymnothorax umbrosus* Poey, Ann. Lye. Nat. Hist. N. Y., 1874, 67 (Havana).

Habitat: Caribbean Sea.

Etymology: Latin, blackish.

This species is not uncommon in the Caribbean Sea. We have examined three specimens in the U. S. National Museum, 6026, collected by Dr. Gill at Barbadoes, 6124, without locality, and 33090, sent from Cuba by Poey. The latter specimen is doubtless the type of *Gymnothorax umbrosus* Poey, which he states has been sent to the Smithsonian Institution.

Cope's *nigrocastaneus* is evidently an *Enchelycore* and agrees with *nigricans* except that the tail is said to be slightly shorter than rest of body..

### Genus 4.—PYTHONICHTHYS.

? *Enchelynassa* Kaup, Apodes, 72, 1856 (*bleekeri*).

*Pythonichthys* Poey, Reportorio Fis. Nat. Cuba, II, 265, 1867 (*sanguineus*).

Type: *Pythonichthys sanguineus* Poey.

Etymology: *Πύθων*, a large snake; *ἰχθύς*, fish.

This genus is based on a single West Indian species, which apparently differs from *Gymnothorax* only in the entire absence of nasal tubes. In *Enchelynassa* the posterior nostrils are represented as oval with raised margins. That genus may possibly be identical with *Pythonichthys*, rather than with *Enchelycore*.



## ANALYSIS OF THE SPECIES OF PYTHONICHTHYS.

- a. [ Body terete, slim; the depth contained 40 times in the total length; nostrils in a line between eye and tip of snout, about as long as eye; lips full, each with a fold; dorsal commencing a little before gill-opening; teeth in jaws biserial; those of upper jaw small and numerous, sharp-pointed; outer row of teeth a little larger and less numerous than inner; inner row of teeth in lower jaw granular; teeth on vomer pluriserial, small; eye very small, 6 in snout, 12 in gape; gape 3 in head; head 2 in trunk; tail  $2\frac{1}{2}$  times rest of body; color, uniform blood-red] (*Poey*).

SANGUINEUS, 4.

## 4. PYTHONICHTHYS SANGUINEUS.\*

- Pythonichthys sanguineus* Poey, Repertorio, II, 265, lam. 2, fig. 7, 1867 (Matanzas, Cuba);  
Poey, Synopsis, 428, 1868; Poey, Enumeratio, 160, 1875.  
*Muræna sanguinea* Günther, VIII, 126, 1870 (copied).

Habitat: West Indies, Cuba.

Etymology: Latin, blood-colored.

This species, which probably inhabits rather deep water, is known to us only from the accounts given by Poey.

## Genus 5.—GYMNOTHORAX.

- Gymnothorax** Bloch, Ichthyologia, 1795 (*reticularis*).  
**Thærodontis** McClelland, Apodal Fishes of the Ganges, 1843 (*reticulata*).  
**Lycodontis** McClelland, l. c. (*literata*).  
**Sidera** Kaup, Apodes, 70, 1856 (*psiffieri*).  
**Eurymyctera** Kaup, l. c., 72 (*crudelis*).  
**Polyuranodon** Kaup, l. c., 96 (*kukli* = *polyuranodon*).  
**Priodonophis** Kaup, Aalenähnliche Fische Hamburg. Museum, 22, 1859 (*ocellatus*).  
**Neomuræna** Girard, U. S. Mex. Bound. Surv., Fishes, 76, 1859 (*nigromarginata* = *ocellatus*).  
**Pseudomuræna** Johnson, Proc. Zool. Soc., 167, 1860 (*madrænsis*).  
**Tæniophis** Kaup, Aale Hamburg. Mus., Nachtrage, 1, 1859 (*westphali* = *funcbris*).  
**Gymnothorax** Günther, VIII, 100 (*reticularis*, etc.).  
**Sidera** Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882 (*psiffieri*, etc.).  
**Rabula** Jordan & Davis, subgenus nova (*aqua-dulcis*).

- Type: *Gymnothorax reticularis* Bloch.

Etymology: *ἄρατος*, bare; *ὄραξ*, breast; from absence of pectoral fins.

This genus, as here understood, comprises the great bulk of the *Murænidae*, including all the species with sharp teeth, the body normally formed, and with the anterior nostrils only tubular. *Priodonophis* with serrated teeth has been recognized as a distinct genus by Bleeker, but the character in question disappears by degrees and seems not to be suitable for generic distinction.

The name *Gymnothorax*, first associated with a species of this genus and restricted to it by Dr. Günther, seems to be available for the group, rather than *Sidera* or *Thærodontis*. The name has, however, been usually regarded as synonymous with *Muræna*, rather than as a distinct genus.

The Morays of this genus are everywhere abundant in the tropical seas, where some of them reach a great size. For those species, some 8 or 10 in number, which have the dorsal fin inserted behind the head,

we have suggested the new subgeneric name of *Rabula*. Apparently, these species have not enough in common to justify the recognition of *Rabula* as a distinct genus.

## ANALYSIS OF AMERICAN AND EUROPEAN SPECIES OF GYMNOTHORAX.

- a. Dorsal fin beginning over or behind the gill-opening (*Rabula* Jordan & Davis).
- b. Dorsal fin inserted far back, nearer vent than gill-opening. Eye moderate, over middle of gape; lower teeth uniserial, with canines in front; upper teeth biserial, the outer teeth small; vomer with strong canines in front, the posterior teeth small, uniserial; posterior nostril nearer eye than anterior one. Insertion of dorsal  $1\frac{1}{2}$  lengths of the head before vent, much nearer vent than gill-opening. Tail longer than rest of body by the length of the jaw. Head 3 in trunk; gape  $2\frac{3}{4}$  in head; eye 2 in snout. Color much as in *Gymnothorax mordax*, dark brown with irregular diffuse yellowish spots smaller than eye, which run together into irregular marblings; gill opening small, slightly dark; fins nearly plain; belly without dark cross-lines; teeth entire. . . . . AQUÆ-DULCIS, 5.
- bb. Dorsal inserted over or slightly behind gill-opening.
- c. [Teeth in upper jaw uniserial; (dorsal fin in figure beginning a short distance behind gill-opening); color yellowish brown with dark reticulations, the longitudinal branching streaks studded with oblong yellow spots; spots on belly large, those on throat confluent; dorsal and anal yellowish brown with darker clouds; teeth all uniserial]. (*Kaup.*) . . . . . MARMOREUS, 6.
- cc. Teeth of upper jaw biserial; tail longer than rest of body; color purplish brown, nearly plain.
- d. Jaws not capable of being completely closed; some of the teeth serrate; outer teeth of jaws thickish, bent abruptly backward at tip, the posterior margin below distinctly serrate; lower jaw strongly bent upward towards the tip, the largest teeth on the bent anterior part of the jaws; teeth of the inner row above long, slender, and movable, twice as large as the outer teeth; teeth of inner row of lower jaw slender (all lost in specimen examined); vomerine teeth small, uniserial, blunt (slender and sharp according to Steindachner); head small, bluntish,  $7\frac{1}{2}$  in body; tail a little longer than rest of body; gape  $2\frac{1}{2}$  in head; eye  $1\frac{1}{2}$  in snout; dorsal beginning over gill-opening; color dark bluish black, brownish on tail; pores on jaws whitish . . . . . PANAMENSIS, 7.
- dd. Jaws with straightish\* commissure and hence completely closing; teeth all entire.
- e. Tail about half longer than rest of body; dorsal beginning a little behind gill-opening; vomerine teeth slender and rather long; teeth in two series in each jaw, those of the inner series largest and movable; anterior canines enlarged; outer teeth of upper jaw bluntish and turned backward as in *G. panamensis*; snout short, bluntish; eye large; head  $2\frac{1}{2}$  in trunk,  $8\frac{3}{4}$  in total; gape short; color purplish brown, finely mottled with darker, the markings faint. . . . . LONGICAUDA, 8.
- ee. [Tail but little longer than rest of body; dorsal beginning over gill-opening; vomerine teeth blunt and rounded; teeth in two series in each jaw, those of the inner series longest, movable, and readily lost; anterior canines large; mouth large, the gape  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in head; head 8 to  $8\frac{1}{2}$  in length; eye small, 3 in snout, inserted over middle

\* Character not verified in *G. porphyreus*.

of gape; color mottled purplish brown; on a clear brown ground many small dark-brown and whitish specks.] (*Steindachner*). . . . . PORPHYREUS, 9.

aa. Dorsal beginning before gill-opening.

e. Teeth all entire, with no serrations anywhere. (GYMNOTHORAX).

f. Teeth simple, none of them with basal lobes.

g. Body without black transverse bands, or very large irregularly placed black spots.

h. Body without small, round, bluish-white or yellow spots, the spots, if any, blackish or dull grayish.

i. Dorsal with a distinct pale margin; anterior nasal tube very short; eye small, smaller than gill-opening; teeth on upper jaw and vomer and front of lower jaw, biserial; vomerine teeth blunt and rounded; canines small, bluntish, not much larger than other teeth; head  $2\frac{1}{2}$  to  $2\frac{2}{3}$  in trunk,  $4\frac{1}{2}$  in tail; snout short and bluntish; cleft of mouth  $3\frac{1}{2}$  in head; eye 3 in snout; tail longer than rest of body by about a head's length; color nearly uniform brown; sides of head and trunk often with brown angular markings forming an indistinct network; margin of dorsal and anal distinctly white; no dark streaks on dorsal; gill-opening small, somewhat dark; lips pale-edged; (color markings sometimes faint in old examples). . . . . UNICOLOR, 10.

ii. Dorsal without distinct paler margin, or with merely the very edge whitish.

j. Dorsal with a distinct black margin; anal with a pale edge.

k. Color nearly plain brown, finely freckled; teeth uniserial, about 13 on side of lower jaw; vomerine teeth small, in a short row posteriorly; eye near angle of mouth, 3 in snout; head  $3\frac{1}{2}$  in trunk; tail about equal to head and trunk; color light chestnut-brown, finely freckled, but without distinct spots; dorsal with a conspicuous edge of blackish, the margin narrowly white; anal edged with white . . . . . VERRILLI, 11.

kk. Color brownish, finely mottled with darker brown; teeth uniserial; lower jaw with about 22 teeth on each side; canines well developed; gill-openings narrower than the eye; eye large, 2 in snout, which is long, narrow, and pointed; mouth capable of being completely closed; cleft of mouth 2 to  $2\frac{1}{2}$  in head; head long, about half length of trunk; tail longer than rest of body by about  $\frac{2}{3}$  length of head; brown everywhere, finely mottled with darker brown or purplish; angle of mouth dusky; dorsal with a dusky edge, the fin marked with dark streaks as in *G. funebris*; anal edged with whitish; black spot at gill-opening faint or obsolete. . . . . VICINUS, 12.

jj. Dorsal without distinct darker margin, its border colored like the fin (or slightly darker in deeply colored specimens).

l. (Body and tail with close set dark points; teeth uniserial; gill-opening larger than eye; tail longer than rest of body; depth of body  $13\frac{1}{2}$  in length; head 3 in trunk; cleft of mouth not quite half head; olivaceous; head and tail with close-set dark points most distinct about gill-opening; snout chestnut; dorsal mottled with gray and yellow; anal with a yellow border.) (*Pocoy*). . . . . VIRESCENS, 13.

- ll. Body and tail not covered with close-set dark points.
- m. Color olivaceous or blackish, with conspicuous markings, either paler or darker than the ground color; belly without distinct transverse lines.
- n. Ground color yellowish or brownish, reticulated, marbled or spotted with brown or black.
- o. Belly marbled or spotted like the back and sides.
- p. Dark markings forming narrow reticulations, never rounded spots; body and tail light olive, everywhere covered with reticulations of dark lilac, the patches of ground color inclosed by the ultimate reticulations, mostly smaller than pupil; some of the reticulations more conspicuous and inclosing irregular polygons or squares considerably larger than eye; the lines are so branched that these markings are not easily traceable; margin of anal broadly yellowish; a trace of a pale line on edge of dorsal; teeth uniserial, stout, and strong, not close set; eye  $2\frac{1}{2}$  in snout; cleft of mouth 2 to  $2\frac{1}{2}$  in head; head  $2\frac{1}{2}$  in trunk,  $3\frac{1}{2}$  in tail, the tail slightly longer than rest of body.

## POLYGONICUS, 14.

- pp. Dark markings in the form of rounded spots, which are more or less confluent, sometimes reducing the pale ground color to narrow reticulations on a surface of black; ground color yellowish, the body covered with brown or black spots of varying size, never much smaller than the pupil of the eye, and sometimes so largely confluent as to make the ground color appear as yellow reticulations on a face of black; relative extent of light and dark markings subject to very great variations; spots on head and snout generally smaller; each pore on lower jaw generally placed in a large pale spot; dorsal and anal fins spotted like the body; margin of anal fin narrowly yellowish, this marking obliterated in dark specimens; teeth uniserial, irregular in size in the jaws, those in the front of the mouth, long, slender canines; vomer with one or two large, depressible teeth in front and usually a row of small teeth behind; eye rather large, about 2 in snout ( $2\frac{1}{2}$  to 3 in dark specimens, the pigment encroaching on the cornea, so that the eye seems notably smaller); cleft of mouth  $2\frac{1}{2}$  in head; head 2 to 3 in trunk; tail usually a little longer than the head and trunk. . . MORINGA, 15.
- oo. Belly nearly or quite immaculate. [Tail as long as rest of body; color, yellowish brown with darker marblings, very irregular; nasal tube short, scarcely half length of eye; muzzle obtuse, truncate; eye small, 3 in snout and 14 in head; gill-opening larger than eye; tail as long as rest of body; dorsal and anal low.] (*Saurage*.)

## WIENERI, 16.

nn. Ground color brownish-black, with irregular pale-grayish spots; anal fin without distinct pale margin.

q. Cleft of mouth more than one half of head. [Snout produced, narrow, subspatulate; eye nearer to the end of snout than the angle of mouth; teeth irregularly biserial in jaws, uniserial on vomer; cleft of mouth very wide, rather more than one-half the length of head; eye,  $2\frac{1}{2}$  in snout; head a little less than half of trunk; tail rather longer than rest of body; brownish black, with small, irregular, pale-grayish spots in moderate number and longitudinally arranged, the largest sometimes twice the size of the eye, the smallest mere dots; each spot marbled with darker; head brownish yellow, with indistinct yellow dot above.] (*Günther.*)

ANATINUS, 17.

qq. Cleft of mouth, less than half of head; [teeth of jaws irregularly biserial; vomerine teeth biserial; snout rather produced and narrow; eye situated above the middle of gape,  $2\frac{1}{2}$  in snout; cleft of mouth contained  $2\frac{1}{2}$  in head; head  $2\frac{1}{2}$  in trunk; tail longer than rest of body; brownish black, with numerous, rather irregular pale-grayish spots, the largest about the size of the eye, the smallest mere dots; each spot again marbled with darker, the smaller and larger spots mixed together.] (*Günther.*) SANCTÆ-HELENÆ, 18.

mm. Color dark brown, dark green, or blackish, either plain or with faint markings.

r. Belly with black, wavy transverse lines; no dark lines along dorsal fin; body with obscure paler spots and marblings; teeth of upper jaw biserial; teeth in the inner row very large and movable; teeth of lower jaw uniserial, close set, compressed, recurved, like outer teeth of upper jaw; vomerine teeth small, uniserial, preceded by very large, depressible canines. Eye small,  $3\frac{1}{2}$  in snout, midway between tip of snout and angle of mouth; cleft of mouth  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in head; head  $2\frac{3}{4}$  to  $3\frac{1}{2}$  in trunk; tail shorter than rest of body. Dark brown, vaguely reticulated, with narrow, paler streaks and spots, the markings very obscure; belly with dark cross streaks; a dark blotch around gill-opening ..... MORDAX, 19.

rr. Belly without black transverse lines.

s. Tail a little longer than head and trunk. Teeth uniserial in the jaws in the adults; teeth on vomer uniserial (var. ? *erchus*), or biserial (*fanchris*); long depressible canines on front of vomer; eye 2 to  $2\frac{1}{2}$  in snout, above

middle of gape; cleft of mouth  $2\frac{1}{2}$  in head; head  $2\frac{1}{2}$  in trunk; color dark olive-brown, nearly plain, paler on throat, sometimes with very faint darker marblings; dorsal and anal fins with dark lines running longitudinally; jaws not completely closing . . . . . FUNEBRIS, 20.

ss. [Tail considerably shorter than head and trunk. Teeth of maxillary and the anterior of mandible biserial, the others uniserial; jaws completely closing; eyes small, somewhat nearer to the end of the snout than to the corner of the mouth; cleft of mouth  $2\frac{1}{2}$  in head; head 3 in trunk. Color, coffee-brown, irregularly marbled with darker.] (*Günther.*) . . . . . CHILENSIS, 21.

hh. Body with distinct small blue, white, or yellow spots.

t. Dorsal and anal without a distinct colored margin; pale spots on body usually smaller than eye.

u. Teeth of upper jaw uniserial.

r. Vomerine teeth uniserial. Teeth all uniserial, those on lower jaw small, compressed, directed backwards; front of lower jaw with several canines; upper with some fixed canines among the other teeth; head 2 to  $2\frac{1}{2}$  in trunk; cleft of mouth 2 to  $2\frac{1}{2}$  in head; tail longer than body. Brownish or blackish, with small round bluish or yellowish spots, ocellated or not, these spots scattered, irregular in position, and smaller than eye; dorsal colored like the back DOVII, 22.

rv. [Vomerine teeth biserial; mandible with about 17 teeth on each side. Head  $2\frac{1}{2}$  in trunk; tail but little longer than rest of body; entire body covered with small blue dots one-sixth the diameter of the eye, the distance between them being equal to the diameter of eye; front and top of head without dots; dorsal with vertical crossstreaks of bluish.] (*Poey.*) . . . . . CONSPERSUS, 23.

uu. Teeth of upper jaw biserial; body with many small yellow spots.

- w. Vomerine teeth uniserial, mostly small and rounded.
- x. [Color nearly uniform from head to tail; brown or black, entirely covered with innumerable yellowish dots, the largest the size of a small pin head. Teeth biserial, except on vomer and the side of mandible; canines small; mouth can be shut completely; gill-opening as wide as eye; eye 2 in snout; cleft of mouth  $2\frac{1}{2}$  in head; head  $2\frac{1}{2}$  in body; tail rather longer than rest of body.] (Günther.) . . . . . MILLARIS, 24.
- xi. [Color not uniform from head to tail; tail black with innumerable round yellow spots smaller than eye; towards the trunk the yellow spots are more densely crowded and irregular in shape, and on the head the yellow becomes the ground color and the black appears in the form of reticulations. Teeth biserial, except on vomer and side of mandible; the mouth can not be completely shut; gill-opening rather wider than eye; eye less than one-half of snout; head  $2\frac{1}{2}$  in trunk; tail rather longer than the rest of body.] (Günther.) . . . FLAVOPICTUS, 25.
- xii. Vomerine teeth biserial, small, and bluntly rounded. Mouth not closing completely; teeth of upper jaw biserial, those of the inner series larger; teeth of the lower jaw biserial anteriorly; eye over middle of gape,  $2\frac{1}{2}$  in snout; head  $2\frac{1}{2}$  in trunk,  $4\frac{1}{2}$  in tail, which is a little longer than rest of body; gill-opening large. Color, dark brown, faintly mottled with darker, the whole body, including fins, covered with points of clear yellow, those on the head close-set and minute, like needle points, but as large as a pin's head on the tail; (middle of body with intricate markings of yellow in the form of linear dashes according to Poey; none shown on our specimen.)

*tt.* Dorsal with a blackish border, interrupted with white; anal with a white margin. [Anterior teeth of upper jaw long and sharp, the rest small and in one series; vomerine teeth in one row, three large canines in front, the rest small; teeth on lower jaw small, with two longer ones on each side in front; head  $2\frac{1}{2}$  in trunk; cleft of mouth 2 in head; tail a head's length longer than the rest of the body. Body marbled with brown on a greenish ground, dark enough to almost obscure the marblings, which are composed of close-set spots as large as the pupil, often bordered on one side with a white edging, the spots sometimes being all white; dorsal fins with a blackish border, sometimes interrupted with white; anal all black, with a white border.] (*Poey.*) . . . . . **OBSCURATUS, 27**

*gg.* Body with black transverse bands, or large irregularly placed black spots.

*a.* [Color brown, with large black spots irregularly dispersed over the body; fins yellowish; teeth 16 in outer row, 7 in inner; vomerine teeth 10, in 2 rows with an anterior and posterior larger tooth; teeth biserial; tail a little longer than rest of body.] (*Kaup.*)

**IRREGULARIS, 28.**

*aa.* Color pale yellowish brown with about 20 blackish rings, which are usually three times the breadth of the interspaces; these rings broadest above, extending over the fins; tip of tail black; head with  $3\frac{1}{2}$  rings which do not meet below; tip of snout in one ring, the top and front of snout on median line pale; upper teeth biserial, the rest uniserial; dentary with about 14 teeth on each side; eye 2 in snout, midway between tip of snout and angle of mouth; head  $2\frac{3}{8}$  in trunk; head and trunk a little shorter than tail; mouth completely closing . . . . . **CHELEVASTES, 29.**

*ff.* [Teeth, some or all of them with basal lobe. Teeth all uniserial; 12 teeth on each side of lower jaw; snout short, obtuse; eye small,  $\frac{2}{3}$  the length of the snout; tail rather shorter than rest of body. Brown, with irregular blackish venules.] (*Kaup per Günther.*)

**MODESTUS, 30.**

*cc.* Teeth serrate, more or less. (*Priodonophis Kaup.*)

*b.* [Color uniform blackish brown; anterior part of body with short undulating lines. Gill-opening scarcely larger than the eye; vomer toothless; teeth of both jaws in single series, each



tooth slightly serrate behind; tail shorter than rest of body; head  $3\frac{1}{2}$  in trunk.] (*Günther*.)

MADEIRENSIS, 31.

- bb.* Color brown above; lighter below, with irregular light-yellowish spots, variable in size and sometimes so thickly placed that the ground work appears as brown reticulations; dorsal fin with large dark spots on the edge, the spots often running together so as to form a black band (or sometimes obsolete); anal fin with a dark edge. Teeth all uniserial in jaws, rather large and strong, the posterior edge of the larger teeth serrate, like the teeth of a shark; vomer with few small teeth or none; jaws nearly or quite closing; head 2 to  $2\frac{1}{2}$  in trunk,  $3\frac{1}{2}$  to  $4\frac{1}{2}$  in tail; eye  $1\frac{1}{4}$  to  $1\frac{1}{2}$  in snout; cleft of mouth  $2\frac{1}{2}$  to 3 in the head; tail a little longer than rest of body.... *OCELLATUS*, 32.
- x.* Edge of dorsal and anal with confluent black blotches, forming a dark margin to the fin, the anal chiefly black.
- y.* Dark ground color forming reticulations around roundish and polygonal pale spots of various sizes, these larger on the tail, the spots everywhere much wider than the interspaces.<sup>9</sup>
- Var. *Saxicola*, 32b.
- yy.* Dark ground color covered with rounded whitish spots, which are not so wide as the interspaces, the spots subequal.
- z.* Spots of moderate size, much larger than pupil; rounded and yellowish; cheeks coarsely spotted.... Var. *Ocellatus*, 32a.
- zz.* Spots very small, stellate, not much larger than pupil; spots whitish; cheeks finely spotted like the rest of the body; body slender, a dusky shade along sides; fins chiefly black.
- Var. *Nigromarginatus*, 32c.
- xx.* Edge of dorsal and anal without black; body dark, with small rounded whitish spots, much as in var. *ocellatus*.
- Var. *Januarius*, 32d.

## 5. GYMNOTHORAX AQUÆ-DULCIS.

*Murana aqua-dulcis* Cope, U. S. Geol. Survey Montana, etc., 471, 1872. (Rio Grande, Costa Rica.)

*Rabula aqua-dulcis*, Jordan & Davis.

Habitat: Pacific coast of Tropical America.

Etymology: *Aqua dulcis*, fresh water.

We refer to this species a specimen (6673, U. S. N. M.) said to have been collected at San Diego, California, by Dr. J. G. Cooper. It probably came from farther south. This specimen differs somewhat from Cope's description, but, like Cope's fish, it differs remarkably from all other known species of the genus in the insertion of the dorsal. We have not much doubt of the correctness of our identification.

The species resembles the young of *G. mordax*, and it may have been overlooked by San Diego collectors on account of this resemblance. It probably does *not* occur in fresh waters.

## 6. GYMNOTHORAX MARMOREUS.

*Murænophis marmorcus* Valenciennes, Voy. Venus, Zool., 347, 1855, pl. 10, fig. 1 (Galapagos Islands).

Habitat: Galapagos Islands.

Etymology: Latin, marbled.

This species is known only from the accounts given of the original type, a stuffed example, 21 inches long, obtained by Freminville at the Galapagos. It may be identical with *G. aqua-dulcis*, or even with *Murana lentiginosa*, but this is less likely.

## 7. GYMNOTHORAX PANAMENSIS.

*Murana panamensis* Steindachner, Ichth. Beit., v, 19, 1876 (Panama).

*Sidera panamensis* Jordan & Gilbert, Proc. U. S. Nat. Mus., 623, 1882 (Pearl Islands).

Habitat: Pacific coast of Central America.

Etymology: From Panama.

This species is known to us from a specimen taken at the Pearl Islands, near Panama, by Prof. Frank H. Bradley, and from another (6015, U. S. N. M.) said to be from "South America." From this specimen our description is taken. It differs from Steindachner's account in having the vomerine teeth blunt and the lower teeth in one row. This species is one of the most strongly marked in the genus, being well distinguished by the form of its teeth, its curved lower jaw, and posterior dorsal.

## 8. GYMNOTHORAX LONGICAUDA.

*Muraena longicauda* Peters, Monatsber. Kön. Acad. Wiss. Berlin, 850, 1876 (Atlantic Ocean, 15° 40' N., 0° 5' W.).

Habitat: Tropical Atlantic (same locality as *Sphagebranchus anguiformis*).

Etymology: *Longus*, long; *cauda*, tail.

This species is known from Dr. Peters's account of an individual taken in the open Atlantic, between the West Indies and Europe. Our description is taken from a small example from unknown locality, numbered 20515 in the Museum register. The species is near *panamensis*, from which it differs in the form of its mouth and some of its teeth. The tail is also very long, longer than in related species.

## 9. GYMNOTHORAX PORPHYREUS.

*Muraena porphyrea* Guichenot (Chile); Steindachner, Ichthyol. Beitr., II, 22, 1875 (rocky coasts of Juan Fernandez).

Habitat: Coasts of Chile.

Etymology: *Πορφύρεος*, purple.

This species is known to us only from Steindachner's description. It is said to be common and to reach a considerable size.

## 10. GYMNOTHORAX UNICOLOR.

*Muraenopsis unicolor* De la Roche, Ann. Mus., XIII, 359, fig. 15, 1809 (Ivica) (*vide* Günther).

*Muraena unicolor* Lowe, Trans. Zool. Soc., 192 (Madeira) (*vide* Günther); Costa, Faun. Nap. Pesc. (*vide* Günther); Günther, VIII, 125, 1870 (Algiers, Madeira, St. Helena).

*Thyrsoidea unicolor* Kaup, Apodes, 91, 1856 (Ivica, Madeira, Madagascar).

*Muraena cristini* Risso, Ich. Nico, 368, 1810 (Nico).

*Muraena monaca* Cocco (*vide* Kaup).

*Thyrsoidea microdon* Kaup, Apodes, 89, fig. 64, 1856 (no locality).

Habitat: Mediterranean fauna and Madeira Islands.

Etymology: Latin, one-colored.

Of this species we have examined one specimen taken at Athens, Greece, by Prof. Horace A. Hoffman, and two from Madeira, collected by Dr. Stimpson. The species has remarkably short nasal tubes.

## 11. GYMNOTHORAX VERRILLI.

*Sidera verrilli* Jordan & Gilbert, Proc. U. S. Nat. Mus., 623, 1882 (Panama); Jordan & Gilbert, Proc. U. S. Nat. Mus., 210, 1883; Jordan, Proc. U. S. Nat. Mus., 369, 1885 (Panama).

Habitat: Panama.

Etymology: Named for Prof. Addison E. Verrill.

This species is known from the typical example in the Museum of Yale College, collected by Professor Bradley at Panama.

## 12. GYMNOTHORAX VICINUS.

*Muraenophis vicina* Castelnau, Anim. Amér. Sud, Poiss., 81, pl. 42, fig. 4, 1855 (Bahia).

*Murana vicina* Günther, VIII, 121, 1870 (Bahia).

*Thyrsoidea maculipinnis* Kaup, Apodes, 83, 1856 (Gold Coast); Duméril, Arch. Mus., x, 260, pl. 23, fig. 1 (*vide* Günther); Bleeker, Verh. Holl. Maatsch. Haarl., 129, tab. 27, 1862 (*vide* Günther); Troschel, Wieg. Arch., 237, 1866 (*vide* Günther).

*Murana maculipinnis* Günther, VIII, 124, 1870 (Cape Verde Isl.; Fernando Po; Mexico).

*Gymnothorax maculipinnis* Jordan, Proc. U. S. Nat. Mus., 1890 (Bahia).

*Thyrsoidea cormura* Kaup, Aale Hamb. Mus., 23, 1859 (*vide* Günther).

*Taniophis cormura* Kaup, l. c., tab. 3, fig. 2 (*vide* Günther).

*Thyrsoidea marginata* Kaup, l. c., 24 (*vide* Günther).

*Taniophis marginata* Kaup, l. c., tab. 4, fig. 1 (*vide* Günther).

*Gymnothorax versipunctatus* Poey, Enumeratio, 156, 1875 (Cuba).

Habitat: Atlantic Ocean, West Indies to Cape Verde Islands and Africa.

Etymology: Latin, *vicinus*, near (to *Gymnothorax moringa*).

A specimen, collected by the Albatross at Bahia, seems to be identical with *Murana vicina* of Castelnau, which was obtained in the same locality. This seems to be the same as the *maculipinnis* of Kaup, and we have therefore adopted the name *vicinus* instead of the latter name. Another specimen before us (6737, U. S. N. M., without locality) evidently belongs to the same species. We refer the names *cormura* and *marginata* to this species on the authority of Dr. Günther.

## 13. GYMNOTHORAX VIRESCENS.

*Gymnothorax virescens* Poey, Enumeratio, 156, 1875 (Cuba).

Habitat: West Indian fauna.

Etymology: *Virescens*, greenish.

This species is known only from Poey's account.

## 14. GYMNOTHORAX POLYGONIUS.

*Gymnothorax polygonius* Poey, Ann. N. Y. Lyc. Nat. Hist., 68, 1872 (Cuba); Poey, Enumeratio, 158, 1875.

*Sidera vicina* Jordan, Proc. U. S. Nat. Mus., 34, 1886 (Havana). (Not *Muraenophis vicinus* Castelnau.)

Habitat: West Indian fauna.

Etymology: Latin, marked with polygons.

Of this species we have two examples. One of these was obtained by Dr. Jordan at Havana. It was at first identified as *Gymnothorax vicinus*, but Castelnau's species seems to be different from this. There is no doubt that this is the original of Poey's *G. polygonius*, although the polygonal markings are very obscure. The other specimen (9825 U. S. N. M., 28 inches long) was sent from Cuba by Poey. It agrees perfectly with our specimen, and it may be Poey's original type.

## 15. GYMNOTHORAX MORINGA.

(COMMON MORAY; HAMLET.)

- Murana maculata nigra* (the Black Moray) Catesby, Nat. Hist. Carolina, tab. 21, 1738 (Bahamas, etc.).
- ?? *Gymnothorax afer* Bloch, Ichth., pl. 417, 1795 (Africa).
- Murana moringa* Cuvier, Règne Animal, ed. II, 1828 (after Catesby); Günther, VIII, 120, 1870 (Bahia; Cuba; Jamaica; Dominica; St. Croix; Bouacca; St. Helena).
- Gymnothorax moringa* Goode, Bull. U. S. Nat. Mus., v, 72, 1876 (Bermuda); Goode & Bean, Proc. U. S. Nat. Mus., 240, 1882.
- Sidera moringa* Jordan, Proc. U. S. Nat. Mus., 1864, 111 (Key West); Bean & Dresel, ibid., 169 (Jamaica); Jordan, Cat. F. N. A., 52, 1885; Jordan, Proc. U. S. Nat. Mus., 34, 1886 (Havana); Jordan, ibid., 566.
- Gymnothorax rostratus* Agassiz, Spix, Pisc. Bras., 91, tab. 50 a, 1830 (Brazil); Poey, Repertorio, II, 259, 1868 (Cuba); Poey, Synopsis, 427, 1868; Cope, Trans. Amer. Phil. Soc., 433, 1876 (St. Martin's; St. Kitts; New Providence).
- Muranophis rostratus* Castelnau, Anim. Amér. Sud, 80, pl. 42, fig. 1, 1855 (Rio Janeiro).
- Murana rostrata* Poey, Conspectus, 386, 1868 (Cuba).
- Murana moringua* Richardson, Voy. Erebus and Terror, Fishes, 89, 1844 (Jamaica).
- Thyrsoidea moringua* Kaup, Apodes, 79, 1856.
- Murana punctata* Gronow, Cat. Fish., 18, 1854 (rivers of North America).
- Muranophis curvilineata* Castelnau, Anim. Amér. Sud, Poiss., 81, pl. 42, fig. 2, 1855 (Rio Janeiro).
- Muranophis caramuru* Castelnau, Anim. Nouv. Rares, Amérique du Sud, 85, pl. 43, fig. 1, 1855 (Bahia).
- Gymnothorax flavoscriptus* Poey, Enumeratio, 158, 1875 (Cuba).
- Gymnothorax picturatus* Poey, Anal. Soc. Esp. Hist. Nat., 257, 1880 (Cuba).

Habitat: West Indian fauna, ranging from Pensacola to Rio Janeiro and St. Helena.

Etymology: Moringa, a West Indian corruption of *Murana* (Moray, Morena, etc.).

This large moray is the commonest species of the group in the West Indies, where it is everywhere abundant. The specimens before us are from Key West, Havana, and the Snapper Banks near Pensacola. The species varies considerably in shade of coloration and extent of the dark markings. The general pattern is, however, very uniform. The specimens before us vary in such a way as to suggest at first examination the existence of four distinct species. Besides the ordinary form of *moringa*, there are specimens from coral sand at Key West, very pale, with the pale markings predominating over the dark spots. This form is known to the fishermen as "Hamlet." A specimen from Havana is almost black, with no pale margin to the anal, and the eye appears very much smaller,  $3\frac{1}{2}$  in the snout. This is, however, due to the encroachment of the black pigment on the eye, as the pupil itself is as large as in the others. Two large specimens from the Snapper Banks are also very dark, and in one the dorsal and anal fins are distinctly dusky towards and on the edge. In these the black markings reduce the ground color to narrow streaks and disconnected reticulations. There is, however, no reason to doubt that all belong to a single variable species. The dentition is alike in all.

16. GYMNOTHORAX WIENERI.

*Gymnothorax wieneri* Sauvage, Bull. Soc. Philom., VII, 161, 1883 (Chile or Peru).

Habitat: Pacific coast of South America.

Etymology: Named for the person who first obtained the type.

This is a doubtful species of uncertain relations. It may be identical with the equally doubtful *marmoratus*.

Following is Sauvage's original description of *Gymnothorax wieneri*:

Dents du maxillaire et de l'intermaxillaire en une seule rangée; dents palatines plus longues que celles du maxillaire, au nombre de 3 ou 4; deux ou trois fortes dents au vomer; pas de canines; tube nasal court, n'ayant guère que la moitié du diamètre vertical de l'œil. Museau obtus, tronqué; œil petit, le diamètre étant compris près de trois fois dans la longueur de la tête, situé au-dessus du milieu de la longueur de la bouche. Ouverture branchiale plus grande que le diamètre de l'œil. Queue de la même longueur que l'espace compris entre l'extrémité du museau et l'anus. Dorsale et anale basses. Jaune brunâtre avec des marbrures foncées, très irrégulières; ventre blanc jaunâtre sans taches. Longueur m. 0.760. Chili ou Pérou. *Wiener*.

17. GYMNOTHORAX ANATINUS.

*Muræna anatina* Lowe, Trans. Zool. Soc. Lond., II, 192, 1842 (Madeira); Günther, VIII, 115, 1870 (Madeira).

Habitat: Madeira.

Etymology: *Anatinus*, duck-like.

This species is known to us from descriptions.

18. GYMNOTHORAX SANCTÆ-HELENÆ.

*Muræna sanctæ-helenæ* Günther, VIII, 115, 1870 (St. Helena); Bean, Proc. U. S. Nat. Mus., 113, 1880 (Bermuda Islands); Günther, Proc. Zool. Soc. Lond., 239, 1881.

Habitat: Tropical Atlantic.

Etymology: From St. Helena.

This species we know only from the accounts given by Günther and Bean. It is certainly very close to *Gymnothorax anatinus*.

19. GYMNOTHORAX MORDAX.

(CALIFORNIA CONGER EEL.)

*Muræna mordax* Ayres, Proc. Acad. Nat. Sci. Cal., 30, 1859 (Cerro Island); Jordan & Gilbert, Proc. U. S. Nat. Mus., 457, 1880 (San Pedro, San Diego); Jordan & Gilbert, Syn. F. N. A., 356, 1883; Jordan & Gilbert, Proc. U. S. Nat. Mus., 36, 1881 (Point Conception to Santa Barbara Islands); Smith, Proc. U. S. Nat. Mus., 233, 1883 (Todos Santos Bay).

*Gymnothorax mordax* Jordan, Proc. U. S. Nat. Mus., 30, 1880.

*Sidera mordax* Jordan & Gilbert, Proc. U. S. Nat. Mus., 210, 1883.

Habitat: Pacific coast from Point Conception to Cerros Island.

Etymology: *Mordax*, prone to bite.

This large Moray is common among the rocks on the coast of southern California. The numerous specimens before us are from Santa Barbara and San Diego.

20. GYMNOTHORAX FUNEBRIS.

(BLACK MORAY; MORENA VERDE.)

- Muraena maculata nigra et viridis* (The Moray), Catesby, Nat. Hist. Carolina, tab. 20, 1738 (Bahamas).
- Gymnothorax funebris* Ranzani, Nov. Comm. Ac. Sc. Inst. Bonon., IV, 76, 1840 (Brazil).
- Sidera funebris* Bean & Dresel, Proc. U. S. Nat. Mus., 169, 1884 (Jamaica); Jordan, Proc. U. S. Nat. Mus., 110, 1864 (Key West); Jordan, Cat. F. N. A., 52, 1885.
- Muraena lizeopinnis* Richardson, Voy. Erebus and Terror, Fish., 89, 1844 (Puerto Cabello).
- Thyrsoidea lincopinnis* Kaup, Apodes, 82, 1856.
- ? *Muraena prasina* Richardson, Voy. Erebus and Terror, Fish., 93, 1844 (Australia) (*vide* Günther).
- ? *Muraena boschii* Bleeker, Verh. Bat. Gen. Mur., XXV, 52, 1853 (Sumatra) (*vide* Günther).
- ? *Gymnothorax boschii* Bleeker, Atlas Ichth. Mur., 105, pl. 46, fig. 3, 1864 (Sumatra and Java).
- ? *Muraena monochrous* Bleeker, Nat. Tyds. Ned. Ind., 384, 1856 (Ternate).
- ? *Gymnothorax monochrous* Bleeker, Atlas Ichth. Mur., 116, pl. 47, fig. 2, 1864 (Singapore; Sumatra; Ternate; Amboyna) (*vide* Günther).
- Taniopsis westphali* Kaup, Aale Hamburg. Mus., Nachtrag, 1, 1859 (*vide* Günther).
- Thyrsoidea aterrima* Kaup, Aale Hamburg. Mus., 22, 1859 (*vide* Günther).
- Muraena aterrima* Kaup, l. c., tab. 3, fig. 1, 1859.
- Muraena aterrima* Günther, VIII, 124, 1870 (Dominica).
- Muraena infernalis* Poey, Memorias, II, 347, 354, 1860 (Cuba).
- Gymnothorax infernalis* Poey, Repertorio, II, 278, 1863; Poey, Synopsis, 426, 1868.
- Thyrsoidea concolor* Abbott, Proc. Acad. Nat. Sci. Phila., 479, 1860 (Vera Cruz).
- Muraena erebus* Poey, Memorias, II, 426 (Cuba).
- Gymnothorax erebus* Poey, Repertorio, II, 258, 1828; Poey, Synopsis, 427, 1868; Poey, Enumeratio, 155, 1875.
- ? *Gymnothorax jacksoniensis* Bleeker, Versl. Med. Akad. Wet. Amsterd., 450, 1863 (*vide* Günther).
- ? *Muraena aspera* Günther, VIII, 123, 1870 (not of Bloch).
- Sidera castanea* Jordan & Gilbert, Proc. U. S. Nat. Mus., 647, 1882 (Mazatlan); Jordan & Gilbert, Proc. U. S. Nat. Mus., 210, 1883 (Mazatlan).

Habitat: Tropical America on both coasts. Florida to Brazil; Mazatlan to Panama. Also recorded from the East Indian Archipelago and Australia.

Etymology: *Funebris*, funereal, from its dark color.

This large Moray is one of the commonest and most widely distributed of the American species, being found in abundance on both coasts in tropical America. If we can trust to the synonymy of Dr. Günther the same species is also widely distributed in the East Indies, but we have had no opportunity to compare specimens of the Old World form called *prasinus*, *boschi*, or *monochrous* with the American *funebris*.

We have not adopted the name *asper*, used for the species by Günther, because the figure of *Gymnothorax asper* given by Bloch by no means represents the color of our species and was probably intended for something else. It is, in fact, as Poey has suggested, much more like *moringa*. There is no doubt of the identity of *funebris*, *concolor*; *castanea*, and *infernalis*. The *erebus* of Poey is said to agree in color, but to differ in the dentition of the vomer. The vomerine teeth are

uniserial in *erebus*, biserial in *infernalis*. This is probably dependent on age, or perhaps the variation of individuals. *Gymnothorax funebris* is one of the largest of the Morays, reaching a length of 4 or 5 feet and a diameter to correspond. The examples examined by us are from Key West, Bahia, St. Lucia, and Mazatlan.

## 21. GYMNOTHORAX CHILENSIS.

*Murana chilensis* Günther, Proc. Zool. Soc. Lond., 674, 1871 (Chile).

Habitat: Chile.

Etymology: From Chile.

This species is known to us only through Dr. Günther's description.

## 22. GYMNOTHORAX DOVIL.

(ANGUILLA PINTITA.)

*Murana dovii* Günther, Cat. Fish., VIII, 103, 1870 (Panama); Jordan & Gilbert, Proc. U. S. Nat. Mus., 378, 1882 (Espiritu Santo Island; Galapagos Islands).

*Sidera dovii* Jordan, Bull. U. S. Fish Com., 106, 1882 (Mazatlan); Jordan & Gilbert, Proc. U. S. Nat. Mus., 209, 1883.

*Murana pintita* Jordan & Gilbert, Proc. U. S. Nat. Mus., 346, 1881 (Mazatlan).

Habitat: Pacific coast of tropical America.

Etymology: Named for Capt. John W. Dow.

This species is not rare on the Pacific coast of tropical America. It varies somewhat in the number and arrangement of its pale spots. An examination of several examples has convinced us of the identity of *pintita* and *dovii*.

## 23. GYMNOTHORAX CONSPERSUS.

*Murænophis punctata* Castelnau, Anim. Nouv. Rares Amer. Sud, 82, 1855 (Rio Janeiro). (Not *Gymnothorax punctatus* Bloch.)

*Gymnothorax conspersus* Poey, Repertorio, II, 259, 1868 (Cuba); Poey, Synopsis, 427, 1868; Poey, Enumeratio, 159, 1875.

*Murana conspersa* Günther, 102, 1870.

Habitat: West Indian fauna.

Etymology: Latin, *conspersus*, speckled.

This species is known to us only from descriptions. The earlier name, *punctatus*, is preoccupied.

## 24. GYMNOTHORAX MILIARIS.

*Thyrsoidea miliaris* Kaup, Apodes, 90, 1856 (Martinique).

*Murana miliaris* Günther, VIII, 100, 1870 (Cuba).

*Gymnothorax miliaris* Cope, Trans. Amer. Phil. Soc., 482, 1870 (St. Martin's); Poey, Enumeratio, 159, 1875 (Cuba).

† *Murana multiocellata* Poey, Memorias, II, 324, 1860 (Havana).

‡ *Gymnothorax multiocellatus* Poey, Repertorio, II, 260, 1868 (Havana).

*Gymnothorax scriptus* Poey, Repertorio, II, 261, 1868 (Cuba); Poey, Synopsis, 427, 1868.

Habitat: West Indian fauna.



Etymology: *Mille*, thousand; from the number of spots.

This species is known to us only from descriptions.

*Gymnothorax multiocellatus* of Poey seems to be nearly or quite identical with *G. miliaris*, differing apparently only in the smaller spots. It agrees fairly with *elaboratus*, but the vomerine teeth are said to be uniserial. They are biserial in *elaboratus*.

#### 25. GYMNOTHORAX FLAVOPICTUS.

*Thyrsoidea flavopicta* Kaup, Apodes, 90, 1856 (Brazil).

*Murana flavopicta* Günther, VIII, 101, 1870 (St. Helena).

Habitat: Coast of Brazil to St. Helena.

Etymology: Latin, *flavus*, yellow; *pictus*, painted.

This species is known to us only from descriptions.

#### 26. GYMNOTHORAX ELABORATUS.

*Murana elaborata* Poey, Memorias, II, 323, 1860 (Cuba).

*Gymnothorax elaboratus* Poey, Repertorio, II, 262, 1868; Poey, Syn., 427, 1868; Poey, Enumeratio, 159, 1875 (Cuba).

Habitat: Coast of Cuba.

Etymology: Latin, *elaborate*, from the markings.

This species is known to us from a single specimen (24961) sent from Cuba by Poey. The coloration of this specimen shows few or none of the linear dashes described by Poey. Its color agrees better with Poey's *multiocellatus*, but it has the dentition ascribed to *elaboratus*.

#### 27. GYMNOTHORAX OBSCURATUS.

*Gymnothorax obscuratus* Poey, Ann. N. Y. Lyc. Nat. Hist., IX, 320, 1870 (Cuba); Poey, Enumeratio, 159, 1875.

Habitat: Cuba.

Etymology: Latin, *obscured*.

This species is known only from Poey's description.

#### 28. GYMNOTHORAX IRREGULARIS.

*Thyrsoidea irregularis* Kaup, Apodes, 95, 1856 (Brazil).

*Murana irregularis* Günther, VIII, 115, 1870 (copied).

Habitat: Coast of Brazil.

Etymology: Latin, *irregular*.

This species is only known from Kaup's scanty description.

#### 29. GYMNOTHORAX CHLEVASTES.

*Sidera chlevastes* Jordan & Gilbert, Proc. U. S. Nat. Mus., 208, 1883 (Galapagos Islands).

Habitat: Galapagos Islands.

Etymology: *Χλεουστῆς*, a harlequin.

This strongly marked species is known only from the original type from the Galapagos Archipelago.

### 30. GYMNOTHORAX MODESTUS.

*Murana modesta* Kaup, Aale Hamburg. Mus., 21, tab. 4, fig. 2, 1859 (*vide* Günther) (Valparaiso); Günther, VIII, 126, 1870.

Habitat: Coast of Chile.

Etymology: Latin, modest.

This species is known only from Kaup's scanty description.

### 31. GYMNOTHORAX MADEIRENSIS.

*Pseudomurana madeirensis* Johnson, Proc. Zoöl. Soc. Lon., 167, 1860 (Madeira).  
*Murana madeirensis*, Günther, VIII, 125, 1870 (Madeira).

Habitat: Madeira Islands.

Etymology: From Madeira.

This species is known to us only from descriptions.

### 32. GYMNOTHORAX OCELLATUS.

(a) Var. *Ocellatus*.

*Gymnothorax ocellatus* Agassiz, Spix. Pisc. Brasil, 91, tab. 50b, 1828 (*vide* Günther). Schomburgk, Reis. Brit. Guiana, 639, 1842; Goode & Bean, Proc. U. S. Nat. Mus., 154, 1879 (West Florida); Goode & Bean, *ibid*, 344 (Clear Water Harbor).

*Murana ocellata* Jenyns, Voy. Beagle, 145, 1842 (Rio Janeiro); Richardson, Voy. Erebus and Terror, 82, pl. 47, figs. 6-10, 1844; Günther, VIII, 102, 1870; Jordan & Gilbert, Syn. Fish. N. A., 356, 1883 (description).

*Muranophis ocellatus* Castelnau, Anim. Amérique Sud, Poiss., 82, 1855 (Bahia).

*Prionodonphis ocellatus* Kaup, Aale Hamburg. Mus., 22, 1859; Kuer, Novara Fische, 383, 1857 to 1859 (Rio Janeiro); Poey, Repertorio, II, 262; Poey, Syn. 427, 1868; Poey, Enumeratio, 159, 1875.

(b) Var. *Saxicola*.

*Murana meleagris* Quoy & Gaimard, Voy. Freycinet, Zoöl., 245, pl. 52, fig. 2 (*vide* Günther) (not of Shaw).

*Prionodonphis meleagris* Poey, Repertorio, II, 262, 1867; Poey, Syn., 428, 1868 (Cuba).

*Murana ocellata* Jordan & Gilbert, Proc. U. S. Nat. Mus., 260, 1882 (Pensacola, Fla.).

*Sidera ocellata* Jordan & Gilbert, Proc. U. S. Nat. Mus., 209, 1883; Jordan, Proc. Acad. Nat. Sci. Phila., 42, 1884 (Egmont Key); Jordan, Proc. U. S. Nat. Mus., 34, 1886 (Havana).

*Gymnothorax ocellatus saxicola* Jordan & Davis, var. nov. (Snapper Banks at Pensacola).

(c) Var. *Nigromarginatus*.

*Neomurana nigromarginata* Girard, U. S. and Mex. Bound. Surv., 76, pl. 41, 1859 (St. Joseph Island, Texas).

*Sidera nigromarginata* Jordan & Evermann, Proc. U. S. Nat. Mus., 473, 1886 (Pensacola, Fla.).

(d) Var. *Januarius*.

*Gymnothorax variegatus* Castelnau, Annu. Amér. Sud, Poiss. (not *Muraena variegata* Lacépède), 83, pl. 43, fig. 2, 1855 (Rio Janeiro) (said to have the dorsal without dark spots).

*Gymnothorax ocellatus januarius* Jordan & Davis (after Castelnau).

Habitat: West Indian fauna, Pensacola to Rio Janeiro.

Etymology: Latin, ocellate.

This small moray is rather common in the West Indies and northward to the coast of Florida. The numerous specimens before us are from Havana and the Snapper Banks, Cedar Keys, and Pensacola. This species differs from most of the other eels in having serrated teeth; this character seems to pass by degrees into the ordinary type and does not apparently justify the retention of a distinct genus (*Priodonophis* = *Neomuraena* = *Pseudomuraena*). This species varies considerably in color, a fact which has given rise to the recognition of some of its forms as distinct species. These forms seem to be absolutely alike in every respect except the coloration, and their differences are probably due to differences in the surroundings.

The form with very large spots, the ground color being reduced to reticulations, called by Poey *meleagris*, abounds about the Snapper Banks among rocks at a considerable depth. The name *meleagris* being preoccupied, we have called this form var. *saxicola*, and we regard it as a deep-water form. The two known specimens of the fine-spotted form, *nigromarginatus*, are from very shallow water on sandy bottom. The form called *variegata* by Castelnau we have not seen. As the name is preoccupied we have substituted that of *januarius*.

#### Genus 6.—MURÆNA.

*Muræna* Artedi, Gen. Pisc., 23, 1738 (in part; includes all eels).

*Muræna* Klein, Hist. Pisc. Nat., 28, 1742 (in part; includes all eels without pectoral fins).

*Muræna* Linnæus, Syst. Nat., ed. x, 243, 1758 (*helena*, etc., includes all eels).

*Muræna* Thunberg & Ahl, De Muræna et Ophichtho, 6, 1789 (restricted to *helena*, etc.; includes species without pectoral fins).

*Muræna* Günther and of authors generally (not of Bleeker).

*Gymnothorax* Bloch, Ichthyologia, 1795 (in part, not type).

*Murænophis* Lacépède, Hist. Nat. Poiss., v, 630, 1803 (*helena*, etc.).

*Limamuræna* Kaup, Apodes, 95, 1856 (*guttata*).

Type: *Muræna helena* L.

Etymology: *Μόρανα* (Moray), ancient name of *Muræna helena*.

This genus as now restricted contains some ten species of the tropical seas, distinguished from *Gymnothorax* and from the rest of the family by the presence of two nasal barbels.

The name *Muræna*, originally applied to all eels, should be restricted to the type of *Muræna helena* as we have already shown. It was first limited by Thunberg & Ahl in 1789 to the eels without pectoral fins, those with such fins being set off as *Ophichthus*.

The restriction of *Muræna* to *Muræna anguilla* is much later.

## ANALYSIS OF AMERICAN AND EUROPEAN SPECIES OF MURENA.

- a. Teeth of sides of upper jaw\* in one series; all the teeth uniserial in the adult (sometimes biserial in young, in upper jaw).
- b. Mouth capable of being completely closed, the jaws being nearly straight along the commissure.
- c. Body without sharply defined round pale spots. Ground color leather-brown, with large, irregular whitish or yellowish blotches inclosing brown spots; head and neck freckled with whitish spots; spots on tail smaller and more definite; anal fin with whitish spots. Teeth all uniserial, those of jaws large and strong, three canines in the front of vomerine series; eye  $2\frac{1}{2}$  in snout, placed over middle of gape; head  $2\frac{1}{4}$  to 3 in trunk; tail  $\frac{1}{2}$  longer than rest of body.....HELENA, 33.
- cc. Body with round pale spots most numerous on the belly and tail. Teeth all uniserial, entire, directed backwards, most of them movable; lower teeth 12 on each side rather remote and comparatively large; no larger canines in front of upper jaw; teeth of upper jaw subequal, about 12 on each side, those in front smallest; vomerine teeth small, uniserial, directed backward; posterior nasal tubes well developed, nearly as large as anterior; dorsal beginning before gill-opening; eye over middle of gape,  $2\frac{1}{2}$  in snout; snout  $2\frac{1}{2}$  in gape; head  $2\frac{1}{2}$  in trunk; gape  $2\frac{1}{4}$  in head; head and trunk a trifle shorter than tail. Color very dark leather-brown or almost black; throat marbled with paler; a black spot around gill-opening; dorsal mottled with grayish; posterior part of body with a few scattered round grayish spots about as large as pupil; these irregular in size and position and rather faint, most numerous around vent and on anal fin; sides of tail nearly or quite plain; angle of mouth dark.....INSULARUM, 34.
- ccc. [Body with three rows of diffuse yellowish blotches including fine spots. Color clear brown with a reddish tinge; very small yellow spots covering head, body, and fins, mixed here and there with larger spots; large yellowish blotches arranged in three rows along the body; the lower row fainter than upper. Teeth all uniserial; those of upper jaw strong, sharp-pointed, recurved; vomerine teeth much smaller, preceded by two long canines; head  $6\frac{1}{2}$  in total length; eye  $2\frac{1}{2}$  in snout; snout  $5\frac{1}{2}$  in head.] (Steindachner).....ARGUS, 35.
- bb. Jaws curved along the gape so that they can not be completely closed. Body covered by well-defined reticulations, inclosing light yellowish-brown spots, which posteriorly are arranged in groups of 5 to 8; gill-opening largely black, within a conspicuous dark blotch; angle of mouth with a dark spot; inside of mouth with yellowish brown spots; vomerine teeth small, sharp; teeth all uniserial, large and strong in the jaws; those in front not enlarged; head  $2\frac{1}{4}$  to 3 in trunk; tail a little longer than rest of body.....RETIFERA, 36.
- aa. Teeth of sides of upper jaw biserial, those of the inner series larger and farther apart.
- d. Jaws capable of being completely closed.
- e. Body profusely spotted; angle of mouth with little or no black; gill-opening dusky; general color brown, the body with light yellow, distinctly brown-edged spots, which are about as large as pupil of eye, sometimes larger; towards the end of tail the dark edgings form brown spots; snout, jaws, and belly spotted, as also the dorsal and anal; a faint, dusky bar from base of dorsal to behind cleft of mouth; spots more numerous around gill-openings; teeth of upper jaw biserial, the inner

\* Not verified in *Murana argus*, which may belong to aa.

- series of depressible canines; teeth on lower jaw and vomer uniserial; eye 2 to 2½ in snout, situated over the middle of gape; cleft of mouth 2½ to 3 in head; head 2 to 2½ in trunk ..... LENTIGINOSA, 37.
- ee. Body scantily spotted; angle of mouth black; a large black spot about gill-opening; cleft of mouth 2½ to 2¾ in head; head 2½ to 2¾ in trunk; tail a little longer than rest of body; teeth of upper jaw anteriorly in two rows; canines moderate; color dark brown, with many small obscure whitish spots, these sometimes over whole body, sometimes confined to head and back anteriorly; belly plain brown; dark spot on gill-opening and at angle of mouth always conspicuous; a pale spot on base of lower jaw before the dark one ..... MELANOTIS, 38.
- dd. Jaws curved along the gape so that they can not be completely closed; lateral teeth of upper jaw biserial, the teeth of the inner series longer than those of the outer; vomerine teeth uniserial; the anterior vomerine teeth longest, nearly twice as long as any of the others; mandibular teeth sometimes with two or three long teeth forming an inner mandibular series; cleft of mouth very wide, its width contained 2½ in length of head; length of head 2½ in trunk; eye 2½ in snout; tail longer than rest of body; brownish black (in spirits); tail with numerous bluish-white dark-edged dots the size of a pin's head, disappearing on anterior part of body; inside of mouth brown with similar white dots. (Günther.)

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### 33. MURÆNA HELENA.

(MORAY.)

- Muræna pinnis pectoralibus carens* Artedi, *Genera Piscium*, 25, 1738 (Rome and Livorno).  
*Muræna helena* Linnæus, *Syst. Nat.*, ed. x, 244, 1758 (based on Artedi); Günther, VIII, 96, and of authors generally.  
*Gymnothorax muræna* Bloch & Schneider, *Systema Ichthyol.*, 525, 1801 (after Linnæus).  
*Muræna romæna* Shaw, *Gen. Zool.*, iv, 26, 1803 (after Linnæus).  
*Muræna variegata* Rafinesque, *Caratteri*, etc., 67, 1810 (Sicily).  
*Muranophis fulva* Risso, *Ich. Nice*, 367, 1810 (Nice).  
*Muræna guttata* Risso, *Eur. Mérid.*, III, 191, 1826 (Mediterranean Sea).

Habitat: Mediterranean Sea and adjacent shores.

Etymology: From Helena; the allusion not clear.

This species, the longest known of any in the family, is generally common in the waters of southern Europe. The specimens before us are from Palermo (Professor Doderlein), Madeira (Dr. W. Stimpson), Athens (Prof. H. A. Hoffman), and Naples (Prof. W. W. Norman).

### 34. MURÆNA INSULARUM.

*Muræna insularum* Jordan & Davis, sp. nov. (Chatham Island).

Habitat: Galapagos Archipelago.

Etymology: Latin, of the islands.

This species is based on No. 38300, U. S. National Museum, 20 inches long, collected by Dr. W. H. Jones at Chatham Island, of the Galapagos. The species resembles *M. helena*, but differs much in color.

## 35. MURÆNA ARGUS.

*Gymnothorax (Limamuræna) argus* Steindachner, Ich. Notizen, x, 17, tab. iv, 1870 (Altata, Mexico).

Habitat: Pacific Coast of Mexico.

Etymology: *Argus*, hundred-eyed, from the coloration.

This species is known to us from the description and figure of Steindachner.

## 36. MURÆNA RETIFERA.

*Muræna retifera* Goode & Bean, Proc. U. S. Nat. Mus., 435, 1882 (Charlestown, S. C.); Jordan & Gilbert, Syn. F. N. A., 894, 1883 (Charleston); Jordan, Cat. F. N. A., 51, 1885 (Charleston).

Habitat: South Atlantic coast of United States.

Etymology: *Rete*, net; *fero*, I bear.

This species is known only from two or three large specimens obtained in the market at Charleston, South Carolina. The individual before us was sent by Mr. Charles C. Leslie.

## 37. MURÆNA LENTIGINOSA.

(MORENA PINTA; SPOTTED MORAY.)

*Muræna lentiginosa* Jenyns, Voy. Beagle, Zool., 143, 1842 (Galapagos Islands); Günther, VIII, 99, 1870 (Central America).

*Muræna pinta* Jordan & Gilbert, Proc. U. S. Nat. Mus., 277, 1881 (Amortajada Bay, San Josef Island (name only); Jordan & Gilbert, *ibid*, 345, 1881 (Mazatlan); Jordan & Gilbert, Proc. U. S. Nat. Mus., 371, 1882 (Colima); Jordan & Gilbert, *ibid*, 381 (Panama); Jordan, Bull. U. S. Fish Com., 106, 1882; Jordan, Proc. U. S. Nat. Mus., 369, 1885 (Mazatlan).

Habitat: Pacific coast of America from the Gulf of California to the Galapagos.

Etymology: *Lentiginosus*, freckled.

This species is rather common on the Pacific coast of tropical America. The specimen is from Colima. Another specimen, without locality, is much brighter in color with larger spots, but it apparently belongs to the same species. There is not much room for doubt that *lentiginosa* is identical with the common form later described as *pinta*.

## 38. MURÆNA MELANOTIS.

*Limamuræna melanotis* Kaup, Aale Hamb. Mus., 27, tab. 4, fig. 3, 1859 (*sic* Günther). *Muræna melanotis* Günther, VIII, 98, 1870 (Cape Verde Islands; Pacific coast of Panama); Steindachner, Fische Afrikas, 33, 1881 (Gorea); Jordan & Gilbert, Proc. U. S. Nat. Mus., 624, 1882 (Panama); Jordan & Gilbert, Syn. F. N. A., 355, 1883 (copied); Jordan, Proc. U. S. Nat. Mus., 369, 1885.

Habitat: Tropical parts of the Atlantic.

Etymology: *Μέλαις*, black; *ὄτος*, ear.

Of this species we have three specimens from "South America." A large specimen from Panama was identified by us in 1882 with this species, but without further comparison we do not feel sure of the identity of this individual with the original *melanotis* from the Atlantic.

39. MURÆNA AUGUSTI.

*Muræna guttata* (Banks & Solander mss.) Lowe, Trans. Zool. Soc., II, 192 (Madeira); Richardson, Voy. Erebus and Terror, Fish., 90, 1842 (Madeira) (not of Risso, which is *Muræna helena*; nor of Forskål, which is a *Haliophis*).  
*Limamuræna guttata* Kaup, Apodes, 96, 1856 (in part).  
*Thyrsoidea augusti* Kaup, Apodes, 88, 1856 (Madeira) (after Richardson).  
*Muræna augusti* Günther, VIII, 97 (Madeira); Vinciguerra, Pesci del Corsaro, 619 (Ter-riffe).  
*Thyrsoidea atlantica* Johnson, Proc. Zool. Soc. Lou., 168, 1860 (Madeira) (*sic* Günther).

Habitat: Islands of the Eastern Atlantic.

Etymology: A personal name.

This species is known to us only by the descriptions.

Genus 7.—ECHIDNA.

*Echidna* Forster, Enchiridion, 31, 1778 (*variegata*).  
*Gymnomuræna* Lacépède, Hist. Nat. Poiss., v, 648, 1803 (*doliata*=*marmorata*).  
*Molari* Richardson, Voyage Erebus and Terror, 79, 1844 (*ophis*=*nebulosa*).  
*Pæcilophis* Kaup, Apodes, 98, 1856.  
*Gymnomuræna* Kaup, Apodes, 98, 1856 (*variegata*=*nebulosa*).

Type: *Echidna variegata* Forster.

Etymology: Ἔχιδνα, viper.

This well-marked genus is distinguished from the other Morays by the blunt teeth. The name *Echidna* was suggested for this group of eels long before its application by Cuvier to a genus of Australian Monotremes. It must, therefore, be retained in preference to *Gymnomuræna*, *Molari*, or *Pæcilophis*, and the mammalian genus should not be called *Echidna*.

There are some 12 or 15 species of *Echidna*, most of them belonging to the Western Pacific.

ANALYSIS OF THE AMERICAN SPECIES OF ECHIDNA.

- a. Color dark, with small round yellow spots; teeth subequal, bluntish, less obtuse than in *E. catenata*, mostly uniserial; dorsal high, beginning over gill-opening; head short and blunt, the small eye half the snout; head  $2\frac{1}{2}$  in trunk; cleft of mouth 3 in head; tail about a snout's length shorter than rest of body. Color, dark brown, with small round yellow spots, smaller than pupil, like pin points, scattered evenly and sparsely over the body; spots with blackish margins; lower jaw mottled.....NOCTURNA, 40.
- aa. Color brownish, marbled and barred with paler; head 3 to  $3\frac{1}{2}$  in trunk,  $3\frac{1}{2}$  in tail; eye small,  $1\frac{1}{2}$  to 2 in snout; cleft of mouth 3 to  $3\frac{1}{2}$  in head; tail a trifle longer than rest of body; teeth of upper jaw more or less biserial. Color, brownish black, marbled or reticulated with light yellow or white, the light markings sometimes forming narrow irregular cross-bars; under the jaw and on the belly the light yellow often predominates, inclosing dark spots .....CATENATA, 41.

40. ECHIDNA NOCTURNA.

*Pæcilophis nocturnus* Cope, U. S. Geol. Surv. Mont. and Adj. Terr., 474, 1871 (Rio Grande, Costa Rica).

Habitat: Pacific Coast of Tropical America.

Etymology: Latin, nocturnal.

This species is known from the single specimen described by Professor Cope, and from a small specimen (43102, U. S. N. M.), of doubtful locality, supposed to have been taken by Mr. Xantus at Cape San Lucas. Cope says the anal fin is a little more than one-third the total length. This statement does not agree with our specimen.

#### 41. ECHIDNA CATENATA.

*Murana seu conger brasiliensis* Seba, Thesaurus, II, 72, tab. 69, fig. 4, 5, 1738 (*vide* Bleeker).  
*Gymnothorax catenatus* Bloch, Ausl. Fische, XII, 74, tab. 415, fig. 1, 1795; Bloch & Schneider, 528, 1801 ("Coromandel").

*Murana catenata* Richardson, Voy. Erebus and Terror, Fishes, 95, 1844 (*vide* Günther);  
 Günther, VIII, 130, 1870 (Surinam, Puerto Cabello, Trinidad, Dominica, St. Croix, Barbadoes).

*Pacilophis catenatus* Kaup, Apodes, 100, 1856 (Bermudas, Caribbean Sea).

*Echidna catenata* Bleeker, Ned. Tyds. Dierkunde, II, 242, 1865 (Surinam); Cope, Trans. Amer. Phil. Soc., 482, 1870 (St. Martin's); Poey, Enumeratio, 160, 1875; Goode, Bull. U. S. Nat. Mus., v, 73, 1876 (Bermuda); Jordan, Proc. U. S. Nat. Mus., 647, 1889 (St. Lucia).

*Murænohis catenula* Lacépède, Hist. Nat. Poiss., v, 628 and 641, 1803 (after Bloch).

*Murænohis undulata* Lacépède, Hist. Nat. Poiss., v, 629, tab. 19, f. 2, 1803.

*Murana sordida* Cuvier, Règne Animal, ed. 1, 233, 1817 (based on Seba, LXIX, 4).

*Muræna aluis* Bleeker, Act. Soc. Sc. Ind. Neerl., 67, 1855 (*vide* Bleeker).

*Echidna fuscocaulata* Poey, Repertorio, II, 263, 1868 (Cuba); Poey, Synopsis, 428, 1868.

*Echidna flavoscripta* Poey, Repertorio, II, 264 (Cuba); Poey, Synopsis, 428, 1868.

Habitat: West Indian fauna.

Etymology: Latin, chained, from the markings.

This species is rather common in the West Indies and Caribbean Sea. The specimens before us are from Port Castries, St. Lucia.

## Family II.—OPHISURIDÆ.

(THE SNAKE EELS.)

We adopt for the present the family *Ophisuridæ*, in the sense in which (under the name *Ophisuroidei*) it is defined by Bleeker. It includes those Enchelycephalous eels which are scaleless, and have the end of the tail projecting beyond the dorsal and anal fins and without even the rudiment of a caudal fin. The anterior nostrils are placed in the upper lip, opening downwards, the gill-openings are not confluent, and the tongue is more or less fully adnate to the floor of the mouth. The species are, for the most part, moderate or small in size, and they are very abundant in the tropical seas, especially about the coral reefs. The eggs are numerous, of moderate size, similar to those of ordinary fishes. Most of the known genera are found in America, but less than half the species. Many of the species are singularly colored, the bands or spots heightening the analogy between them and the serpents.



ANALYSIS OF THE AMERICAN AND EUROPEAN GENERA OF OPHISURIDÆ.

- a. Body without traces of fins anywhere; teeth all small, conical; gill-openings near together, subinferior; anterior nostril tubular; tongue scarcely free in front; mouth small..... SPHAGEBRANCHUS, 8.
- aa. Body with distinct fins, at least on the back.
  - b. Anal fin wholly wanting; no pectoral fin; dorsal fin high, beginning on the head; gill-openings subinferior, converging; anterior nostrils tubular; tongue slender, somewhat free in front.
    - LETHARCHUS, 9.
  - bb. Anal fin well developed; anterior nostril usually in a short tube near tip of snout.
  - c. Teeth blunt, mostly granular or molar; vomer with teeth; pectoral fins present, small.
  - d. Dorsal fin rather high, beginning on the head, before the gill-opening.
    - MYRICHTHYS, 10.
  - dd. Dorsal fin low, beginning well behind the head .....[PISOODONOPHIS.]
  - cc. Teeth all pointed, none of them molar; vomer with teeth.
    - e. Dorsal fin beginning before nape, on anterior part of head; pectoral fin small or wanting.
    - f. Pectoral fins wholly wanting; body compressed, the dorsal fin high.
      - CALECHELYS, 11.
    - ff. Pectoral fins small, but present; body elongate, subterete, the dorsal fin moderate..... BASCANICHTHYS, 12.
    - ee. Dorsal fin beginning more or less behind the gill-opening.
      - g. Pectoral fins wholly wanting; gill-openings inferior, transverse, close together; mouth small, with small subequal teeth.
        - CÆCULA, 13.
      - gg. Pectoral fins reduced to a small flap, not longer than eye; teeth small, mostly uniserial; gill-openings lateral.
        - QUASSIREMUS, 14.
      - ggg. Pectoral fins well developed, much longer than eye; gill-openings usually lateral, sometimes subinferior.
      - h. Snout moderate or short, less than one-fourth head, the jaws not produced into a slender beak.
        - i. Lips not fringed.
        - j. Teeth subequal, with no elongate canines on jaws or vomer.
          - OPHICHTHYS, 15.
        - jj. Teeth unequal, some of them long canines, either on vomer or on sides of one or both jaws; mouth large, the snout short, and the eyes more or less superior..... MYSTRIOPHIS, 16.
        - ii. Lips with a conspicuous fringe of papillæ; canines present; jaws rather long; head depressed; eyes superior; lower jaw projecting..... BRACHYSOMOPHIS, 17.
        - hh. Snout very long, attenuate, clavate at tip, its length more than one-fourth head; jaws slender and elongate; canine teeth strong; tail much longer than trunk; head compressed, the eyes lateral ..... OPHISURUS, 18.

Genus 8.—SPHAGEBRANCHUS.

*Sphagebranchus* Bloch, *Ichthyologia*, ix, 88, pl. 419, 1795 (*rostratus*).  
*Cæcilia* Lacépède, *Hist. Nat. Poiss.*, ii, 135, 1800 (*branderiana*=*cæcus*); (not *Cæcilia* L., a genus of *Batrachia*).  
*Aptérichthe* Duméril, *Zoologie Analytique*, 1806 (*cæcus*).

*Apterichthys* De la Roche, Ann. Mus., XIII, 325, 1809 (*cæcus*).

*Ichthyapus* Brisout de Barneville, Revue Zoölogique, 219, 1847 (*acutirostris*).

*Ophisuraphis* Kaup, Apodes, 29, 1856 (*gracilis*).

Type: *Sphagebranchus rostratus* Bloch.

Etymology: Σφαξ, throat; σφάγγα, gills,

This genus contains several little-known species of small eels remarkable for showing no trace of fins in the adult stage. The name *Sphagebranchus* is based on a species which evidently belongs to the genus, and has, therefore, clear priority over *Ichthyapus* and *Apterichthys*.

ANALYSIS OF THE SPECIES OF SPHAGEBRANCHUS.

- a. [Eyes invisible; tail longer than rest of body; body very slender; mouth small; snout pointed, depressed; uniform brown, speckled with black on the head.] (*Risso*) ..... CÆCUS, 42.
- aa. Eyes externally visible.
- b. Tail nearly one-half longer than head and trunk.
- c. [Head 6 in trunk, 17 in total length; flesh-colored with small black spots.] (*Peters*) ..... ANGUIFORMIS, 43.
- cc. Head a little more than 4 times in trunk; tail sharp-pointed; snout sharp; cleft of mouth 2½ to 3 in head; gill-slits almost horizontal, converging forwards, the isthmus equal to eye, which is 2 in snout. General color light brown, slightly dusky on the back and more dusky along the lateral line; head mottled with dusky spots ..... SELACHOPS, 44.
- bb. Tail but little longer than head and trunk.
- d. Head more than ½ length of trunk.
- c. [Head 4½ in trunk, 11½ in total length; eye over middle of jaw; body slender; tail rounded, a little longer than head and trunk; anterior nostril on lower side of snout, its border denticulate.] (*Günther*) ..... ACUTIROSTRIS, 45.
- ee. [Head about 2 in trunk, 5 in total length; snout very sharp; eye moderate, over middle of gape; tail scarcely as long as rest of body; color plain brown.] (From Bloch's figure.) ..... ROSTRATUS, 46.
- dd. Head less than ½ of trunk, contained 7½ in trunk, 9½ in tail; snout sharp; cleft of mouth 4 in head; gill-slits small, inferior, directly transverse as in *Cæcula imberbis*, the isthmus very narrow, not as wide as eye, which is 2 in snout; tail sharp-pointed; eye before middle of gape; plain-brownish, speckled ..... KENDALLI, 47.

42. SPHAGEBRANCHUS CÆCUS.

*Muræna cæca* Linnæus, Syst. Nat., x, 245, 1758 (Mediterranean Sea).

*Sphagebranchus cæcus* Bloch & Schneider, Syst. Ich., 535, 1801 (and of various authors).

*Apterichthys cæcus* De la Roche, Ann. Mus., XIII, 325, 1809 (*vide* Günther).

*Ophichthys cæcus*, Günther, VIII, 89, 1870 (copied).

*Cæcula apterygia* Vahl, Skrivter af Naturh. Selskabet, 1794, 150 (after Linnæus).

*Cæcilia branderiana* Lacépède, Hist. Nat. Poiss., II, 135, 1800 (after Linnæus).

*Sphagebranchus spallanzanii* Costa, Fauna Nap., Pesc., tav. 32, f. 1 (*vide* Günther).

Habitat: Mediterranean Sea.

Etymology: *Cæcus*, blind.

This species is known to us from descriptions only.

43. SPHAGEBRANCHUS ANGUIFORMIS.

*Ophichthys (Sphagebranchus) anguiformis* Peters, Monat. Kön. Akad. Wiss., 849, 1876 (open Atlantic).

Habitat: Atlantic Ocean, 15° 40' 1" N., 23° 5' 8" W.

Etymology: *Anguis*, the slow-worm; from Latin, *anguis*, snake.

This doubtful species is known only from the account given by Peters. It is very likely identical with *S. acutirostris*.

44. SPHAGEBRANCHUS SELACHOPS.

*Aptericthys selachops* Jordan & Gilbert, Proc. U. S. Nat. Mus., 356, 1882 (Cape San Lucas).

*Ichthyapus selachops* Jordan, Proc. U. S. Nat. Mus., 369, 1885; Jordan, Cat. Fish. N. A., 52, 1885.

Habitat: Cape San Lucas.

Etymology: *Σελαχί*, shark; *ὄψ*, face.

This species is thus far known from the rocks about Cape San Lucas. Two specimens lately obtained by Dr. Gilbert in that locality are before us.

45. SPHAGEBRANCHUS ACUTIROSTRIS.

? *Sphagebranchus rostratus* Bloch, Ichth., ix, 88, tab. 419, f. 2, 1795 (Surinam).

*Ichthyapus acutirostris* Barneville, Rev. Zool. 219, 1847 (open Atlantic); Kaup, Apodes, 29, 1856 (copied).

*Ophichthys acutirostris* Günther, VIII, 90, 1870 (copied).

Habitat: Open sea under the equator.

Etymology: *Acutus*, sharp; *rostrum*, snout.

This species is known only from a single specimen taken in the open Atlantic. This is very likely the same as the poorly figured *Sphagebranchus rostratus* of Bloch.

46. SPHAGEBRANCHUS ROSTRATUS.

*Sphagebranchus rostratus* Bloch, Ichthyologia, ix, 88, pl. 419 (Surinam); Bloch & Schneider, Syst. Ichth., 535, tab. 103, 1801 (copied).

Habitat: West Indian Fauna.

Etymology: *Rostratus*, long-nosed.

This species is known only from the description and figure of Bloch. It is perhaps the same as *S. acutirostris* of Barneville.

47. SPHAGEBRANCHUS KENDALLI.

*Sphagebranchus kendalli* Gilbert, Proc. U. S. Nat. Mus., 1891 (coast of Florida)

Habitat: Gulf of Mexico.

Etymology: Named for Mr. Kendall, who obtained the species.

This species is known from one specimen 7 inches long, dredged by the U. S. Fish Commission schooner *Grampus*, at station 5080, off the coast of Florida. It is well distinguished from *S. selachops* (the only

other species in the genus which has been fully described) by the transverse gill-openings.

### Genus 9.—LETHARCHUS.

*Letharchus* Goode & Bean, Proc. U. S. Nat. Mus., 437, 1882 (*velifer*).

Type: *Letharchus velifer* Goode & Bean.

Etymology: *Ληθάρμα*, to forget; *ἀρχύς*, anal.

This well-marked genus is represented by a single species, found in the Gulf of Mexico.

#### ANALYSIS OF THE SPECIES OF LETHARCHUS.

- a. Teeth uniserial on jaws and vomer, small and directed inward and backward; snout long and pointed, projecting two-thirds its length beyond the lower jaw; gill-openings subinferior, almost horizontal, equal to lower jaw, three times the breadth of the isthmus; nostrils not prominent, without tube; anterior under the tip of snout; lateral line distinct, extending forward in a curve, ending in a pore on the top of head, just in front of the beginning of the dorsal fin; head  $1\frac{1}{2}$  in trunk; tail pointed,  $1\frac{1}{2}$  in total length; cleft of mouth 4 in head; snout 9 in head and twice the diameter of the eye. Plum-colored, head lighter, throat pale; dorsal fin white, edged with a broad band of black.....VELIFER, 48.

#### 48. LETHARCHUS VELIFER.

*Letharchus velifer* Goode & Bean, Proc. U. S. Nat. Mus., 437, 1882 (West Florida).  
Jordan & Gilbert, Syn. F. N. A., 896, 1883 (copied); Jordan, Proc. U. S. Nat. Mus., 33, 1884 (Pensacola).

Habitat: West coast of Florida.

Etymology: *Velum*, sail; *fero*, I bear.

Several specimens of this species have been obtained, all of them from the Snapper Banks between Pensacola and Tampa. The specimen before us was brought from Pensacola by Dr. Jordan.

### Genus 10.—MYRICHTHYS.

*Pisoodonophis* Kaup, Apodes, 15, 1856 (in part; not type, as restricted by Bleeker, which is *P. cancrivorus*).

*Myrichthys* Girard, Proc. Acad. Nat. Sci. Phila., 1859, 58 (*tigrinus*).

*Ophisurus* Swainson, Bleeker, Jordan & Gilbert, etc., not of Lacépède, nor of Risso nor Kaup, who restrict the name to *O. serpens*.

Type: *Myrichthys tigrinus* Girard.

Etymology: *Μύρος*, Myrus; *ἰχθύς*, fish.

This genus contains numerous species, some of which are found in most tropical seas. It is well distinguished from *Ophichthus* by its blunt teeth, bearing the same relation to *Ophichthus* that *Echidna* does to *Gymnothorax*. The Old World genus *Pisoodonophis* has also molar teeth, but in that group the dorsal is inserted much farther back, behind the gill-openings, as in *Ophichthus*.

We adopt for this genus the name *Myrichthys*, instead of *Ophisurus*, because the name *Ophisurus* was originally given to two species, neither

of which belongs to the present genus, and because it had been properly restricted to *O. serpens* before it was connected with the present group. The confusion arose from the supposition of Cuvier that *Ophisurus ophis* Lacépède was an eel with blunt teeth, unlike the *ophis* of Linnæus.

A careful comparison of specimens of *Ophichthus xysturus* with the original description of *Myrichthys tigrinus* leaves no doubt of the identity of the two species. We have furthermore before us a specimen (8810) from the National Museum, of which the record has been lost, but evidently going back to Girard's time. This specimen is undoubtedly the original type of *Myrichthys tigrinus*, and agrees fully with *Ophichthus xysturus*.

ANALYSIS OF AMERICAN SPECIES OF MYRICHTHYS.

- a. Spots on body large, blackish, without pale centers.
  - b. Spots on anterior part of body near lateral line oblong, those on head rather large; dorsal with dark spots; anal immaculate; dark spots on sides in 3 or 4 rows; a row of 3 spots from gill-opening to above eye; 4 spots in a series below this; 3 to 5 spots on each side of snout; lower jaw with 3 large spots; head 4 in trunk; cleft of mouth 3 in head. (*Valenciennes*). . . . . **PARDALIS**, 49.
  - bb. Spots on sides of body all circular or nearly so; those on anterior part of head small and numerous; general color brown, lighter below; belly almost plain; 4 longitudinal rows of round black blotches on each side of body, the two middle series often forming one irregular row, the central row very close to the median and consisting of small spots not much larger than the eye, spots in the uppermost row often running up on the dorsal fin, each dorsal row running forward terminating in the snout; 8 or 9 spots in each dorsal row from the tip of snout to vertical from gill-opening; a row of 5 to 6 spots from gill-opening to above eye; two other rows running diagonally downwards and backwards from the eye; 7 to 8 spots on each side of snout; jaw with about a dozen spots on each side; dorsal with dark margin; anal plain. Head  $3\frac{1}{2}$  in trunk, 11 in total length; eye  $2\frac{1}{2}$  in snout, situated a little back of middle of gape, which is 3 in the head; snout  $5\frac{1}{2}$  in head; pectoral, measured from top of base, about equal to eye . . . . . **TIGRINUS**, 50.
  - aa. Spots on body large, dark, most of them with a distinct pale center. Body dark gray above, white below; on each side two series of large roundish dark spots, with pale centers, one row lying along the dorsal fin, the other a little below the lateral line; about 35 spots in each row; a large spot in front of dorsal fin; snout with about 5 spots on each side; lower jaw with small dusky spots; dorsal fin with a dusky edge and with faint dusky blotches; anal plain. Eye 2 in snout; snout 6 in head, and 4 in the distance from the tip of the snout to the beginning of the dorsal fin; cleft of mouth  $3\frac{1}{2}$  in head; head 4 in the trunk, and a little more than 8 in the tail . . . . . **OCULATUS**, 51.
  - aaa. Spots on body large, nearly round, and whitish in color; ground color dark brown, pale below; two series of round whitish blotches on each side of body, about 40 spots in each series; spots somewhat larger and more distinct anteriorly, where their diameter is nearly equal to the length of snout; head with irregular, round, whitish spots on each side; dorsal brownish, margined with dusky; other fins pale. Snout  $5\frac{1}{2}$  in head and twice the diameter of the eye; cleft of mouth 3 in head; head 4 in trunk; head and trunk  $1\frac{1}{2}$  in tail; dorsal beginning at a point slightly nearer the base of pectorals than eye; body extremely elongate, the diameter about  $\frac{1}{2}$  length of head . . . . . **ACUMINATUS**, 52.

## 49. MYRICHTHYS PARDALIS.

*Ophisurus pardalis* Valenciennes, in Webb & Berthelot, Îles Canaries, Poiss., 90, pl. 16, fig. 2, 1836-1844; Richardson, Erebus and Terror, Fishes, 99, 1844 (not of Günther).

† *Ophisurus breviceps* Richardson, Voy. Erebus and Terror, 99, 1844-1848 (locality unknown); (not of Cantor, 1850).

‡ *Pisoodonophis breviceps* Kaup, Apodes, 20, 1856 (same type).

? *Ophichthys breviceps* Günther, VIII, 82, 1870 (same type).

*Pisoodonophis coronata* Kaup, Aale Hamb. Mus., 14, tab. 2, fig. 1, 1859 (*vide* Günther).

Habitat: Tropical parts of the Atlantic.

Etymology: Latin, marked like a leopard.

We know this species only from the description of Valenciennes. We have ventured to refer to the Atlantic *pardalis*, the descriptions of *M. breviceps*. They agree equally well with *pardalis* and *tigrinus*, and the specimen from an unknown locality named *breviceps* by Richardson is at least as likely to have come from the Atlantic as the Pacific Ocean. Possibly *pardalis* and *tigrinus* may prove to be identical, but the markings of *tigrinus* differ from those shown in Valenciennes' figure.

## 50. MYRICHTHYS TIGRINUS.

?? *Ophisurus breviceps* Richardson, Voyage Erebus and Terror, Fishes, 99, 1844 (locality unknown).

*Myrichthys tigrinus* Girard, Proc. Acad. Nat. Sci. Phila., 58, 1859 ("Adair Bay, Oregon").

*Ophisurus xysturus* Jordan & Gilbert, Proc. U. S. Nat. Mus., 346, 1881 (Mazatlan).

*Pisoodonophis xysturus* Jordan, Bull. U. S. Fish Comm., 106, 1882 (Mazatlan).

Habitat: Pacific coast of Tropical America.

Etymology: Latin, like a tiger (in color).

This species is rather common on the west coast of Mexico. We have adopted the name *tigrinus* instead of *xysturus*, as there seems to be no doubt that Girard's type, said to be from "Adair Bay, Oregon," belongs to this tropical species. This locality is, however, very doubtful, and probably Girard's specimen came from the coast of Mexico. A specimen before us from the old collections of the Museum is, as already stated, probably Girard's original type. It may be that Richardson's *breviceps* is also identical with *xysturus*, but it is on the whole more likely to be the Atlantic species *pardalis*. Besides the types of *M. tigrinus* and *M. xysturus*, we have before us a specimen taken by Dr. Gilbert in the Gulf of California.

## 51. MYRICHTHYS OCULATUS.

*Pisoodonophis oculatus* Kaup, Apodes, 22, 1856 (Curaçoa).

*Ophisurus latimaculatus* Poey, Repertorio, II, 252, tab. 3, fig. 1, 1867 (Cuba); Poey, Synopsis, 425, 1868.

*Pisoodonophis latimaculatus* Cope, Trans. Amer. Phil. Soc., 482, 1870 (St. Martin's); Poey, Enumeratio, 153, 1875.

*Ophichthys latimaculatus* Poey, Anal. Soc. Esp. Hist. Nat., 252, 1880; Poey, Ann. Soc. Esp. Hist. Nat., 345, 1881 (Porto Rico).

*Ophichthys pardalis* Günther, VIII, 82, 1870 (Lanzarote, Canary Islands, Cape Verde Islands, West Indies); (not *Ophisurus pardalis* Valenciennes.)

Habitat: West Indies and islands of eastern Atlantic.

Etymology: Latin, having eye-like markings.

This species, generally distributed through the tropical Atlantic, is well distinguished by its coloration, most of the dark spots having conspicuous white centers. This is undoubtedly the *oculatus* of Kaup and the *latimaculatus* of Poey, but the *pardalis* of Valenciennes must be different, being similar in coloration to *tigrinus*. The specimen before us is from Barbadoes.

## 52. MYRICHTHYS ACUMINATUS.

*Muraena acuminata* Gronow, Fishes Brit. Mus., 21, 1854 ("In Insula Divi Eustachii in America").

*Ophichthys acuminatus* Günther, VIII, 83, 1870 (Cuba, Barbadoes).

*Ophisurus acuminatus* Jordan, Cat. Fish. N. A., 53, 1885.

*Pisoodonophis guttulatus* Kaup, Apodes, 21, fig. 10, 1857 (Martinique).

*Ophisurus longus* Poey, Repertorio, II, 254, 1867 (Cuba); Poey, Synopsis, 425, 1868.

*Ophisurus longus* Poey, Anal. Soc. Esp. Hist. Nat., 253, 1880.

*Pisoodonophis longus* Jordan & Gilbert, Syn. F. N. A., 899, 1883 (Florida).

*Ophichthys pisavarius* Poey, Anal. Soc. Esp. Hist. Nat., 196, 1875 (Cuba); Poey, l. c., 253, 1880.

Habitat: West Indian fauna, north to Florida Keys.

Etymology: Latin, acuminate.

This species, well distinguished by its pale spots, is not rare in the West Indies. Our description is taken from a specimen in the National Museum from the Florida Keys.

The name *acuminatus* seems to belong to this species, and has priority over *longus*.

We have referred the nominal species, *longus*, *guttulatus*, and *pisavarius* to the synonymy of *acuminatus*, thinking that the alleged differences are matters of individual variation. *Longus* is said to have, in the center of each pale spot, a yellow speck, surrounded by a dark circle. The others are said to lack this central spot, but it may be that it fades in alcohol. *Longus* is said to have the edge of the dorsal darker than the fin. In *guttulatus* and *pisavarius* it is said to be paler.

## Genus PISOODONOPHIS.

*Pisoodonophis* Kaup, Apodal Fishes, 1854, 17 (*boro*).

*Pisodontophis*, Günther, VIII, 55, 1870 (*boro*: corrected orthography).

Type: *Ophisurus boro* Hamilton-Buchanan.

Etymology: *Πισον*, pea; *ὀδών*, tooth; *ὄφις*, snake.

Small eels, mostly of the Old World, intermediate between *Myrichthys* and *Ophichthys*, having the blunt teeth of *Myrichthys* and the backward dorsal of *Ophichthys*. The species are slender, plainly colored, and rather small. One of them is doubtfully recorded from the West Indies.

## PISOODONOPHIS Species.

Dr. Güntber (VIII, 78) mentions a half-grown eel from Grenada, West Indies, which he regards as closely allied to *Pisoodonophis boro* of the Chinese and East Indian seas. "At present I do not think myself justified in separating this single specimen from *P. boro*, which varies rather considerably in the relative proportion of the parts of the body." If the specimen really came from the West Indies, it will be probably found to be different from *P. boro*.

Of *P. boro* we have one specimen from Swatow, China. The species has the head contained about four times in the very long trunk, and the vertical fins are very low. Color, plain brown.

## Genus 11.—CALLECHELYS.

*Callechelys* Kaup, Apodes, 23, 1856 (*guichenoti*).

Type: *Callechelys guichenoti* Kaup.

Etymology: *καλός*, beautiful; *ἔρχεσθαι*, eel.

This genus contains one American and three East Indian species, agreeing in the elongate, compressed body, absence of pectoral fins, and anterior insertion of the dorsal. In other respects *Callechelys* is close to *Ophichthus*.

The American species, *Callechelys muræna*, considerably resembles the East Indian *marmoratus* and may be considered as a typical *Callechelys*. The other American species hitherto referred to *Callechelys* diverge widely from this type and should apparently constitute a distinct genus, which we have called *Bascanichthys*, though in the development of the pectorals one of these (*scuticaris*) is distinctly intermediate.

## ANALYSIS OF THE AMERICAN SPECIES OF CALLECHELYS.

- a. Depth of body at gill-openings a little more than length of upper jaw, which is 3 in head; head 8 in trunk, about 14 in total length; eye small, 2 in snout, placed over the middle of upper jaw; tip of lower jaw extending a little before the front of eye; gill-openings small, inferior, sublongitudinal, the distance between them about half the height of one of them; dorsal fin beginning on the head, at a distance behind the angle of the mouth, a little more than half the length of upper jaw. Dark olive, closely mottled and spotted with confluent blotches of darker olive and blackish, the spots more distinct anteriorly, posteriorly confluent, so that the tail is nearly plain dusky; belly scarcely paler, dorsal and anal chiefly blackish with pale margins. . . . . MURÆNA, 53.

## 53. CALLECHELYS MURÆNA.

*Callechelys muræna* Jordan & Evermann, Proc. U. S. Nat. Mus., 466, 1886 (Snapper Banks off Pensacola, Fla.).

Habitat: Deep waters of the Gulf of Mexico.

Etymology: *Muræna*, from the general resemblance of the species to a young Moray.

This species is known from a single specimen taken at the Snapper



Banks near Pensacola. It considerably resembles the East Indian *Callechelys marmoratus*.

Genus 12.—BASCANICHTHYS.

*Bascanichthys* Jordan & Davis, gen. nov. (*Bascanium*).

Type: *Cacula bascanium* Jordan.

Etymology: *Bascanion*, the black snake, from *Βασκανός*, malignant; *ἰχθός*, fish.

This genus is very close to *Callechelys*, from which it differs in the presence of pectorals, the long subterete body, lower fins and plain coloration. Two species are known.

ANALYSIS OF SPECIES OF BASCANICHTHYS.

- a. Pectoral fin a slender rudiment about as long as eye; head moderate; body terete, the trunk a little longer than the tail; teeth short, bluntish, recurved, uniserial\* in each jaw, biserial on vomer; head  $8\frac{2}{3}$  to  $9\frac{2}{3}$  in head and trunk, 6 in tail; snout 6 to 7 in head; eye 2 in snout, a little behind the middle of cleft, which is contained in the head  $3\frac{2}{3}$  times; lower jaw extending forward to middle of snout; distance from tip of snout to beginning of dorsal contained a little over two times in head; gill-openings vertical, their length about equal to breadth of isthmus; lateral line curved over the opercular region, the pores distant and well separated. Color brown above, lighter below, front of head more or less mottled; dorsal and anal fins pale without dark margins..... SCUTICARIS, 54.
- 7a. Pectoral fins moderately developed, broader than long, nearly as long as snout; head very short; body extremely slender, subterete, its greatest depth little more than two-fifths of head; head short,  $11\frac{1}{2}$  in head and trunk;  $22\frac{1}{2}$  in total length; eye more than half the length of snout, placed over the middle of upper jaw; lower jaw thin, included, not extending to the anterior nostril; snout 7 in head; gill-opening as wide as isthmus; dorsal fin very low, beginning midway between front of eye and gill-openings. Color dark brown, nearly uniform, fins paler.

BASCANIUM, 55.

54. BASCANICHTHYS SCUTICARIS.

*Sphagebranchus scuticaris* Goode & Bean, Proc. U. S. Nat. Mus., 343, 1879 (Cedar Key, Fla.).

*Cacula scuticaris* Jordan & Gilbert, Syn. Fish. N. A., 358, 1883; Jordan, Proc. Acad. Nat. Sci. Phila., 42, 1884 (Egmont Key, Fla.).

*Sphagebranchus teres* Goode & Bean, Proc. U. S. Nat. Mus., 436, 1882 (West Florida).

*Cacula teres* Jordan & Gilbert, Syn. Fish. N. A., 897, 1883 (West Florida).

Habitat: West coast of Florida from Pensacola to Egmont Key.

Etymology: Latin, *scutica*, a whip.

This species is not rare in the Gulf of Mexico; the specimens examined by us are from Egmont Key, Punta Rasa, and Pensacola.

We have no doubt that the two nominal species, *scuticaris* and *teres*, are identical, as our specimens sufficiently agree with both descriptions.

55. BASCANICHTHYS BASCANIUM.

*Cacula bascanium* Jordan, Proc. Acad. Nat. Sci. Phila., 43, 1884 (Egmont Key, Fla.).

*Callechelys bascanium* Jordan, Cat. Fish. N. A., 52, 1885.

Habitat: Gulf of Mexico.

\* Teeth biserial on one side of upper jaw in one specimen.

Etymology: *Bascanion*, the black snake, from *βασκανίος*, malignant.

This species is known only from the original type, taken at Egmont Key. In its short head and developed pectoral it differs sufficiently from *Bascanichthys scuticaris*.

### Genus 13.—CÆCULA.

*Cæcula* Vahl, *Skrivter af Naturhistorisk-Selskabet*, 3d Band, 149, 1794 (*pterygera*).

*Dalophis* Rafinesque, *Caratteri*, 69, 1810 (*serpa*; *bimaculata*).

? *Pterurus* Rafinesque, *Indice*, 59 (*flexuosus*) (name preoccupied).

*Lamnostoma* Kaup, *Apodes* 23, 1856 (*pictus*).

*Anguisurus* Kaup, l. c., 24 (*punctulatus*).

Type: *Cæcula pterygera* Vahl.

Etymology: A diminutive, from *cæcus*, blind.

This genus contains several species all belonging to the Old World. It is allied to *Sphagebranchus*, differing in the possession of more or less developed fins. It is even closer to *Ophichthus*, from which the absence of pectorals separates it, leaving the group called *Quassiremus* intermediate. The name *Cæcula* has clear priority over *Dalophis*.

#### ANALYSIS OF THE EUROPEAN SPECIES OF CÆCULA.

*a* Pectoral minute or wholly wanting: body slender, terete; mouth rather small; jaws weak; eye very small; teeth uniserial in jaws and on vomer; gill-slits vertical, the slit a little longer than the isthmus; dorsal fin inserted about a head's length behind the gill-openings; head 6 in trunk, 7½ in tail; cleft of mouth 4½ in head; eye 3 in snout, the anterior edge over middle of gape; snout 6½ in head, interorbital width equal to isthmus. Color (in spirits) plain pinkish-brown,\* lighter below.....IMBERBIS, 56.

### 56. CÆCULA IMBERBIS.

*Sphagebranchus imberbis* De la Roche, *Ann. Mus.*, XIII, 360, pl. 25, fig. 17, 1809 (*vide* Günther); Kaup, *Apodes*, 25, 1856 (Toulon).

*Ophichthus imberbis* Günther, VIII, 84, 1870 (Sicily; Nice; A'giors).

*Leptocephalus spallanzani* Risso, *Ichth. Nice*, 85, 1810 (Eza).

*Dalophis bimaculata* Rafinesque, *Caratteri*, 69, tab. 7, fig. 2, 1810 (Sicily).

*Dalophis serpa* Rafinesque, *Caratteri*, 69, tab. 7, fig. 3, 1810 (Palermo).

? *Pterurus flexuosus* Rafinesque, *Indice*, 59, 1810 (Palermo).

*Sphagebranchus oculatus* Risso, *Eur. Mer.*, III, 196, 1826 (Mediterranean Sea).

Habitat: Mediterranean Sea.

Etymology: Latin, without barbel.

Of this species we have a single large example, about 16 inches long, obtained at Naples by Prof. William W. Norman.

### Genus 14.—QUASSIREMUS.

*Quassiremus* Jordan & Davis, gen. nov. (*evionthas*).

Type: *Ophichthus evionthas* Jordan & Bollman.

\* According to the Risso, the life color is as follows: "Pink, the back with very small black spots, sides with curved whitish streaks, belly yellowish red."

Etymology: Latin, *quassus*, obliterated; *remus*, oar, from the minute pectorals.

This new generic name is proposed for two species, *nothochir* and *evionthas*, which agree with *Ophichthus* in all respects except that the pectoral fins are rudimentary.

ANALYSIS OF THE SPECIES OF QUASSIREMUS.

- a. [Body marked with rather large yellow spots, each with a black ring, and with black spots and blotches of various sizes; pectorals minute, less than  $\frac{1}{2}$  of eye. Teeth all uniserial; pectorals represented by a small triangular flap, less than  $\frac{1}{2}$  the diameter of eye and  $\frac{1}{4}$  the gill-slit; head  $4\frac{1}{2}$  in trunk; head and trunk longer than tail by a distance equal to the length of the snout; cleft of mouth  $2\frac{1}{2}$  in head; snout 4 in head; eye  $\frac{1}{2}$  of snout, its anterior margin over middle of cleft of mouth; gill-slit vertical, lateral,  $6\frac{1}{2}$  in head. Middle of back with a series of 12 elliptical yellow spots, their length one-half time the diameter of the eye, each spot surrounded by a black ring, coalescent below with a large elliptical black blotch on middle of sides; head closely covered with spots about the size of the eye, around which are reticulations of light yellow.] (*Gilbert*). . . . . *NOTHOCHIR*, 57.
- aa. Body everywhere freckled with small black spots; pectorals very small, about as long as eye; teeth in jaws uniserial, anterior vomerine teeth biserial; head  $4\frac{1}{2}$  in trunk; snout  $4\frac{1}{2}$  in head; eye  $2\frac{1}{2}$  in snout, much nearer angle of mouth than tip of snout; cleft of mouth  $2\frac{1}{2}$  in head. Color light olive, the entire body covered with small numerous round or oval black spots separated at intervals by a yellowish ground color; in about fifteen places these spots are larger and darker and tend to form cross-bands . . . . . *EVIONTHAS*, 58.

57. QUASSIREMUS NOTHOCHIR.

*Ophichthus nothochir* Gilbert, Proc. U. S. Nat. Mus., 58, 1890 (San Josef Island).

Habitat: Gulf of California.

Etymology: *Nothós*, spurious; *χείρ*, hand, from the minute pectorals.

This species is known from three specimens taken by Dr. Gilbert at San Josef Island in the Gulf of California.

58. QUASSIREMUS EVIONTHAS.

*Ophichthus evionthas* Jordan & Bollman, Proc. U. S. Nat. Mus., 154, 1889 (Hood Island, Galapagos).

Habitat: Galapagos Archipelago.

Etymology: *ἔω*, well; *ῥοσθαί*, freckled.

This species is known from a single specimen obtained by the *Albatross* from Hood Island in the Galapagos.

Genus 15.—OPHICHTHUS.

*Ophichthus* Thunberg & Ahl, De Muræna et Ophichtho, 1789 (*ophis*).

*Ophisurus* Lacépède, Hist. Nat. Poiss, 11, 1800 (*ophis*; *serpens*; not of Risso).

*Cogrus* Rafinesque, Caratteri, etc., 62, 1810 (*maculatus*).

*Ophisurus* Swainson, Nat. Hist. Classn. Anim., 334, 1839 (*pictus* = *remicaudus*). (Not of Lacépède.)

*Centrurorhis* Kaup, Apodes, 2, 1856 (*spadicæus*).

*Pœcilocephalus* Kaup, l. c., 5 (*bonapartei*).

*Microdonophis* Kaup, l. c., 6 (*altipinnis*).

*Cœcilophis* Kaup, l. c., 6 (*compar*).

*Herpetoichthys* Kaup, l. c., 7 (*ornatissimus*).

*Elapsopsis* Kaup, l. c., 9 (*versicolor*).

*Muraenopsis*\* ("Le Sueur") Kaup, l. c., 11 (*ocellatus*).

*Scytalophis* Kaup, l. c., 13 (*magniculus*).

*Leptorhinophis* Kaup, l. c., 14 (*gomesi*).

*Cryptopterus* Kaup, Aale Hamburg. Museum, 1859 (*puncticeps*).

*Uranichthys* Poey, Rep. Fis. Nat. Cuba, 11, 256, 1867 (*havannensis*).

*Oxyodontichthys* Poey, Anales Soc. Nat. Hist. Esp., 254, 1830 (*macrurus*).

*Ophichthys* Bleeker, Günther, and of recent authors generally.

Type: *Murana ophis* L.

Etymology:  $\nu\theta\alpha\varsigma$ , snake;  $\iota\chi\theta\acute{o}\varsigma$ , fish; hence more correctly written *Ophichthys*.

We adopt the genus *Ophichthys*, in the same sense as the *Ophichthys* of Bleeker, for those Ophisuroid eels which have sharp teeth, no marked canines, well-developed pectoral fins, and the dorsal inserted behind the head. The species are very numerous in the tropical seas, and many attempts have been made to split the group into smaller genera. Notwithstanding the great differences when extremes are compared, these small genera do not seem well defined. We adopt the original spelling, *Ophichthys*, though *Ophichthys* is the more correct form of the word.

#### ANALYSIS OF AMERICAN AND EUROPEAN SPECIES OF OPHICHTHUS.

a. Teeth of upper jaw uniserial; end of tail more or less sharp (*Cogrus* Rafinesque).

b. Tail very slender, more than twice as long as rest of body. Pectoral fin rather small, contained 3 to 5 times in the length of head; body very long and slender; head small, the gape narrow and the jaws very weak; teeth in jaws uniserial, on vomer biserial, some of the front teeth above very slightly enlarged; gill-openings lateral, vertical, about equal to isthmus; dorsal fin beginning about half the length of the head behind the base of the pectorals; head  $4\frac{1}{2}$  in trunk; head and trunk  $2\frac{1}{2}$  in tail; cleft of mouth 4 in head; eye 2 in snout, anterior edge about over middle of gape; pectoral fin 4 in head. Uniform brown above, lighter below; fins light brown.... HISPANUS, 59.

bb. Tail not twice as long as rest of body.

c. [Pectoral fin short, about one-fourth head; head  $4\frac{1}{2}$  in trunk; gape 3 in head; teeth all uniserial; dorsal beginning at some distance behind pectorals. Color yellowish brown with black dots.] (*Kaup*).... BRASILIENSIS, 60.

cc. [Pectoral fin long, about  $2\frac{1}{2}$  in head; dorsal commencing at a moderate distance from tip of pectoral; head 4 in trunk; tail rather longer than rest of body; dorsal and anal fin with whitish or brownish spots along base; deep scars on the fore part of head. Body above brownish with numerous dark specks, below more dotted with gray; a transverse line of small whitish warts on occiput.] (*Kaup*.)

MACULATUS, 61.

\* There is no genus "*Muraenopsis* Le Sueur." Le Sueur used Lacépède's name, *Muraenophis*, for *Murana*. This name was somewhere misprinted "*Muraenopsis*."

aa. Teeth of upper jaw in two or three series.

d. Mandibular teeth uniserial or nearly so; vomerine teeth in one series or slightly biserial in front.

e. Coloration uniform or nearly so. (*Cryptopterus* Kaup.)

f. [Mandibular teeth all uniserial; end of dorsal and anal hidden in a groove; insertion of dorsal  $4\frac{1}{2}$  times diameter of eye behind base of pectoral; tail  $\frac{2}{3}$  longer than head and trunk; head  $2\frac{1}{2}$  in trunk; snout  $5\frac{1}{2}$  in head; eye rather large, equidistant from tip of snout and angle of mouth; gill-openings close together, the isthmus less broad than one of them. Color slaty-blue.] (*Peters*) . . . . . ATER, 62.

ff. [Mandibular teeth not quite uniserial, some in front forming a second series; dorsal and anal fins disappearing for some distance before their termination near the end of the tail; pectoral fin well developed; dorsal fin commencing at a short distance behind the end of the pectoral; tail  $\frac{2}{3}$  of total length; eye of moderate size; cleft of mouth of moderate width. Coloration uniform.] (*Kaup* per *Günther*.)

PUNCTICEPS, 63.

ee. Coloration not uniform; anterior teeth slightly enlarged; eye rather large, nearly median (*Ophichthus*).

g. Sides of body with one or more series of large, round, black spots; brown; head with numerous small dark spots and longitudinal folds; a series of large, round, dark spots along the side, the interspaces as wide as the spots; another series of alternate smaller spots along the back, and another along the sides of abdomen; fins yellowish, dorsal with a series of brown spots along the edge; eye large, looking upwards,  $1\frac{2}{3}$  in snout; teeth moderate, those in front of upper jaw somewhat canine-like; pectoral fin well developed, its extremity nearly opposite to the origin of the dorsal fin; tail longer than rest of body . . . . . HAVANNENSIS, 64.

gg. [Sides of body with round whitish spots between darker areas; color light olivaceous with about 20 oblong dark blotches along the median line of body and tail, the interspaces between these each a round pale spot about as large as eye. Dorsal inserted  $1\frac{1}{2}$  length of pectorals behind the tips of pectorals; pectorals  $2\frac{1}{2}$  in the distance from the snout to their base; eye  $1\frac{1}{2}$  in snout, equal to interorbital space; cleft of mouth 3 in head; head 9 in length; gill-opening 5 in head; maxillary biserial; mandibular teeth uniserial; vomer with about 15 teeth.] (*Eigenmann*.) . . . . . RETROPINNIS, 65.

dd. Mandibular teeth in two to four series.

h. Vomerine teeth in one row; anterior teeth of jaws or vomer sometimes a little enlarged.

i. Teeth in both jaws biserial; the teeth of the inner series sometimes small and turned inward. (*Muranopsis* Kaup).

j. Sides of body without conspicuous dark spots or blotches; the spots when present mostly whitish.

- k. Dorsal beginning behind the tip of the pectoral, at a distance equal to diameter of eye. Head  $2\frac{3}{8}$  in trunk,  $4\frac{3}{8}$  in tail; pectoral fin shorter than in *ocellatus*,  $3\frac{1}{2}$  in head; eye  $1\frac{1}{2}$  in snout; cleft of mouth  $2\frac{3}{8}$  in head. Color very much as in *ocellatus*, but paler, rather light brown above, pale below, with about 20 round pale spots along the lateral line; lower jaw and throat rather pale, dusted with brown dots; pectoral pale, with a dusky border; a line of small white spots across the occiput, and a shorter but similar row on each side of head... GUTTIFER, 66.
- kk. Dorsal fin beginning over or just before tip of pectoral.
- l. Color rather dark brown above, lighter below, with about 20 round whitish spots along the side, averaging more than half the diameter of the eye; dorsal fin commencing over or a little before the tip of pectoral, light-colored with a narrow dark margin; anal light yellow; a row of small white spots across the top of head, sometimes coalescent into a band, and one or more similar but shorter rows on each side of head; pectoral decidedly dusky; jaws, throat, and chin dusted with brown dots. Vomer with about 15 teeth, the anterior inclined to form a double series; tail  $\frac{1}{2}$  a head's length longer than head and trunk; head  $2\frac{3}{8}$  in trunk; eye  $1\frac{1}{2}$  in snout; snout  $5\frac{1}{2}$  in head; cleft of mouth  $2\frac{1}{2}$  in head; pectoral  $2\frac{3}{4}$  in head... OCELLATUS, 67.
- ll. [Color above dark brown, below paler, the two colors separated by a water line; along the lower border of the dark part a series of small yellowish spots, half an inch apart, invisible posteriorly. Cleft of mouth  $2\frac{1}{2}$  in head, which is half the length of the trunk; eye 2 in snout; pectoral 3 in head; the dorsal inserted just before its tip; terminal inch of dorsal and anal inclosed in a deep groove.] (*Cope.*) ..... UNISERIALIS, 68.
- jj. Sides of body with conspicuous black spots or blotches.
- k. Back and sides with round black spots. Body terete, the tail  $1\frac{1}{2}$  times the length of head and trunk; head flattish; mouth broad, its width as great as distance between the nostrils or as interorbital space; gill-openings vertical, well separated; dorsal fin beginning a little before the tip of the pectoral; head  $2\frac{3}{8}$  in the trunk,  $5\frac{1}{2}$  in the tail; pectoral fin  $2\frac{3}{4}$  to  $3\frac{1}{2}$  in the head, about equal to the lower jaw; cleft of mouth  $2\frac{3}{8}$  in the head; gill-openings less than one-half the pectorals, less than the eye,  $1\frac{1}{2}$  in the isthmus; eye  $1\frac{1}{2}$  in snout,  $2\frac{3}{8}$  in cleft of mouth; teeth rather strong, one or two in front of upper jaw almost canine-like; vomerine teeth small. Color light brown; a row of rather large round black blotches above the lateral line; a series of smaller spots on each side of dorsal, alternating with the large blotches; a row of sub-marginal spots along the dorsal fin, anal fin plain;

top and sides of head with smaller spots; in adults a faint, dusky shade across the pectoral; lower parts pale; longitudinal wrinkles on throat conspicuous..... TRISERIALIS, 69.

kk. [Back with broad blackish cross-bands extending downwards to below lateral line, and alternating with large round dorsal spots; dorsal with a small blackish margin; anal blackish. Teeth all biserial, except on vomer; pectoral more than  $\frac{1}{3}$  length of head; dorsal beginning before middle of pectoral; head  $2\frac{1}{2}$  in trunk; tail longer than rest of body; cleft of mouth more than  $\frac{1}{3}$  of head; eye  $1\frac{1}{2}$  in snout and situated in the anterior part of head.] (Günther.)

GRANDIMACULATUS, 70.

ii. [Teeth in both jaws in bands of 3 to 4 series in the adult. Color brown; a series of very small whitish dots along the anterior part of lateral line; some similar dots on nape; dorsal fin with a black edge; head  $2\frac{1}{2}$  in trunk; cleft of mouth  $2\frac{1}{2}$  in head; eye  $1\frac{1}{2}$  in snout, situated in the anterior third of head; length of pectoral rather more than  $\frac{1}{3}$  of head; dorsal fin low, commencing opposite the extremity of pectoral; tail longer than rest of body.] (Günther)..... PACIFICI, 71.

hh. Vomerine teeth biserial throughout; teeth in both jaws biserial, subequal, no canines; color plain brownish, paler below. (*Scytalophis* Kaup.)

m. Eye large, more than half length of snout.

n. Head rather short,  $2\frac{1}{2}$  to 3 times in the trunk.

o. Pectoral  $2\frac{1}{2}$  to  $2\frac{2}{3}$  in head, about as long as cleft of mouth, which is  $2\frac{2}{3}$  in head. Body terete; the head about  $2\frac{2}{3}$  times ( $2\frac{1}{2}$  to 3) in the trunk; the head and trunk  $1\frac{1}{2}$  ( $1\frac{1}{2}$  "*chrysops*" to  $1\frac{2}{3}$  "*macrurus*") in the tail; snout rather short, pointed; interorbital space broad, equal to eye, which is about  $1\frac{1}{2}$  in snout; nasal tubes short; dorsal inserted behind middle of pectoral; diameter of gill-opening equal to eye,  $1\frac{1}{2}$  in the isthmus, 3 in the pectoral. Olive brown above, the coloration caused by innumerable brown points on a yellowish ground; light yellow below; pectoral dusky, dark along the upper edge; lower jaw with dusky markings; dorsal and anal fin translucent, with dark margins; pores on jaws and head conspicuous..... GOMESI, 72.

oo. Pectoral longer, 2 to  $2\frac{1}{2}$  in head, longer than the cleft of the mouth, which is  $2\frac{1}{2}$  in head. Tail very nearly twice as long as rest of body; snout rather long; interorbital space narrow, less than eye; nasal tubes rather long, flattened, the edge uneven; dorsal commencing over or in front of the middle of pectoral; head  $2\frac{1}{2}$  in the trunk; head and trunk a little more than half the tail; pectoral fin  $2\frac{1}{2}$  in the head; eye  $1\frac{1}{2}$  in the snout,  $\frac{1}{2}$  greater than the interorbital width; gill-opening

- less than eye,  $1\frac{1}{2}$  in isthmus. Color brown above, light yellow below; opercular regions, lower jaw, throat, and pectoral dusky; dorsal and anal edged with black ..... ZOPHOCIR, 73.
- m.* Head rather long,  $1\frac{1}{2}$  to  $2\frac{1}{2}$  in trunk.
- p.* Tail long, about  $2\frac{1}{2}$  times length of rest of body; pectoral  $2\frac{1}{2}$  in head; dorsal inserted over middle of pectoral; gape  $2\frac{2}{5}$  in head; head  $1\frac{1}{2}$  in trunk; eye about  $2\frac{1}{2}$  in snout. Blackish, paler below; dorsal and anal yellowish brown, dotted and bordered with black ..... MAGNIOCCILIS, 74.
- pp.* Tail shortish,  $1\frac{1}{2}$  times rest of body; head  $2\frac{1}{2}$  in trunk; pectoral about 3 in length of head; cleft of mouth about 3 in head; gill-openings very wide, wider than in related species, broader than the isthmus; eye  $1\frac{1}{2}$  in snout; teeth rather small, biserial in both jaws; fins low, the dorsal beginning over the end of the pectoral. Color uniform brown, paler below ..... CALLAENSIS, 75.
- mm.* [Eye small, about  $2\frac{1}{2}$  times in the snout; gill-openings not very wide, approaching nearer together than usual in this genus; anterior nostril with an elongate tapering tube; head 2 in trunk; cleft of mouth  $2\frac{2}{3}$  in head; eye  $2\frac{1}{2}$  in snout; pectoral  $2\frac{1}{2}$  in head; dorsal fin rather low, commencing above posterior third of pectoral; tail twice as long as rest of body; coloration uniform.] (*Günther.*)  
PARILIS, 76.

### 59. OPHICHTHUS HISPANUS.

- ?? *Echelus rufus* Rafinesque, Carratteri, 65, 1810 (Palermo).  
 ?? *Echelus polyrinus* Rafinesque, Indico d'Ittiol. Sicil., 69, 1810 (Palermo), (may be *Ophisoma balearicum*).  
*Ophisurus hispanus* Bolotti, Accad. Fisico-medico Stat. Milano, 1857, (Barcelona) (*sic* Günther).  
*Ophichthys hispanus* Günther, VIII, 72, 1870 (Cannes).

Habitat: Mediterranean Sea.

Etymology: *Hispanus*, Spanish.

This species is known to us from a specimen sent by Professor Doderlein from Palermo. Doderlein has identified this species with the *Echelus polyrinus* of Rafinesque, although the description of the latter writer could not well be worse. The description of *Echelus rufus* fits this species better, but the figure not at all. It is not impossible that both names were intended for young Congers, or perhaps for *Ophisoma*. The basis for the identification of *Echelus polyrinus* is apparently the common name "Gruncu di Rena," given by Rafinesque and still used for this species at Palermo.

### 60. OPHICHTHUS BRASILIENSIS.

- Centrarophis brasiliensis* Kaup, Apodos, 4, 1856 (Rio Janeiro).  
*Ophichthys brasiliensis* Günther, VIII, 73, 1870 (copied).

Habitat: Coast of Brazil.



Etymology: Living in Brazil.

This species is known to us from Kaup's description only. He places it in his genus *Centrurophis*, which is characterized chiefly by the termination of the tail in a translucent thorny tip.

#### 61. OPHICHTHUS MACULATUS.

*Cogrus maculatus* Rafinesque, Caratteri, 62, 1810 (*maculatus*).

*Ophisurus pictus* Swainson, Fish., Rep., and Amph., II, 395, 1839 (Sicily).

*Centrurophis remicaudus* Kaup, Apodes, 3, 1856 (Sicily).

*Ophichthys remicaudus* Günther, VIII, 73, 1870 (copied).

Habitat: Mediterranean Sea.

Etymology: *Maculatus*, spotted.

This rare species is known to us from descriptions only; as it seems to be Rafinesque's *Cogrus maculatus*, we have restored his specific name.

#### 62. OPHICHTHUS ATER.

*Ophichthys (Herpetoichthys) ater* Peters, Monatsber. Akad. Wiss., 525, 1866 (Chile).

*Ophichthys ater* Günther, VIII, 68, 1870 (copied).

Habitat: Coast of Chile.

Etymology: Latin, black.

This species is known to us only from Peters' description.

#### 63. OPHICHTHUS PUNCTICEPS.

*Cryptopterus puncticeps* Kaup, Aale Hamb. Mus., II, tab. 1, fig. 2, 1859 (Puerto Cabello) (*sic* Günther).

*Ophichthys puncticeps* Günther, VIII, 60, 1870 (copied).

Habitat: Caribbean Sea.

Etymology: *Punctus*, speckled; *ceps*, head.

This species is known to us from Kaup's description, as quoted by Günther.

#### 64. OPHICHTHUS HAVANNENSIS.

? *Serpens marinus maculosus* Willughby, Hist. Pisc., tab. G 9, 1686 (no locality).

? *Murana ophis* Linnæus, Syst. Nat., ed. x, 1758 (after Willughby) (and of the copyists); (may be identical with *Ophichthys regius*, a St. Helena species, likewise spotted with black).

? *Ophichthys ophis* Ahl, De Muræna et Ophichtho, 81, 1789 (generic description).

? *Murana ophis* Bloch, Ichthyologia, tab. 154, 1790 (Surinam ?).

? *Ophisurus ophis* Lacépède, Hist. Nat. Poiss., II, 1800 (after Bloch, as is shown by the enumeration of fin rays).

*Innominado* Parra, Dif. Piezas Hist. Nat., pl. 37, fig. 2, 1787 (Havana).

*Murana havannensis* Bloch & Schneider, Syst. Ich., 491, 1801 (after Parra).

*Ophisurus havannensis* Poey, Memorias, II, 320, 1860 (Cuba).

*Uranichthys havannensis* Poey, Repertorio, II, 257, 1866; Poey, Synopsis, 426, 1868; Poey, Enumeratio, 155, 1875 (Cuba).

*Ophichthys havannensis* Günther, VIII, 67, 1870 (Cuba).

? *Ophisurus guttatus* Cuvier, Règne Animal, 1817, 232 (Surinam) (after Bloch, pl. 154).

? *Murana maculosa* Cuvier, l. c. (after *Ophisurus ophis* Lacépède, which is based on Bloch, pl. 154).

*Herpetoichthys sulcatus* Kaup, Apodes, 8, fig. 5 (not 6) (no habitat).

*Uranichthys brachycephalus* Poey, Repertorio, II, 257, 1867 (Cuba); Poey, Synopsis, 426, 1865; Poey, Enumeratio, 155, 1875.

Habitat: West Indian fauna.

Etymology: ὄφις, snake.

This species is known to us from descriptions only. We follow Dr. Günther in placing *sulcatus* and *brachycephalus* in the synonymy of *harannensis*. It may be that the unidentified old name of *ophis* belongs to this species, rather than to *Ophichthys regius* or to *Mystriophis interinctus*, both of which, like *O. harannensis*, have the coloration ascribed to *Murana ophis*. There can be little doubt that the specimen very well figured by Willughby is a species of *Ophichthys*. The figure of Bloch, on which the names *guttatus* and *maculosa* have been founded, seems to have been identical with the figure of Willughby.

#### 65. OPHICHTHUS RETROPINNIS.

*Ophichthys retropinnis* Eigenmann, Proc. U. S. Nat. Mus., 116, 1887 (Pensacola, Fla.).

Habitat: Gulf of Mexico.

Etymology: Latin, *retropinnis*, having backward fins.

This species is based on a single specimen taken from the stomach of some large fish from the Snapper Banks near Pensacola; it seems allied to *Ophichthys ocellatus*, but the dorsal is much farther back than usual, and the teeth are different. These characters have been verified by Dr. Bean, who has kindly reexamined Dr. Eigenmann's type for us.

#### 66. OPHICHTHUS GUTTIFER.

*Ophichthys guttifer* Bean & Dresel, Proc. Biol. Soc. Wash., 100, 1882 (Pensacola); Jordan, Cat. Fish. N. A., 53, 1885.

Habitat: Gulf of Mexico.

Etymology: *Gutta*, spot; *fero*, I bear.

This species is as yet known only from a few specimens obtained from the stomachs of large groupers on the Snapper Banks near Pensacola. The single large example before us was obtained by Mr. Silas Stearns. The species is very close to *O. ocellatus*, from which it differs slightly in form and in the insertion of its dorsal. Possibly a large series would show it to be a variation of *O. ocellatus*.

#### 67. OPHICHTHUS OCELLATUS.

*Murenopsis ocellatus* Le Sueur, Journ. Acad. Nat. Sci. Phila., v, 103, pl. 4, fig. 3, 1825 (South America.) (*vide* Günther).

*Ophisurus ocellatus* Richardson, Voyage Erebus and Terror, Fishes, 104, 1844 (Mexico) (*vide* Günther).

*Muranopsis ocellatus* Kaup, Apodes, 1856.

*Ophichthys ocellatus* Günther, VIII, 63, 1870 (Mexico); Jordan & Gilbert, Syn. Fish. N. A., 359, 1883.

*Herpetoichthys ocellatus* Goode & Bean, Proc. U. S. Nat. Mus., 155, 1879 (Pensacola).

*Ophisurus remiger* Valenciennes, in D'Orbigny Voy. Amér. Mérid., Poiss., pl. 12, fig. 2, 1839 (*vide* Günther).

Habitat: West Indian fauna, north to Florida.

Etymology: Latin, ocellate, from the spots.

Generally common in the West Indies. We have before us several large examples obtained on the Snapper Banks near Pensacola.

#### 68. OPHICHTHUS UNISERIALIS.

*Ophichthys uniserialis* Cope, Proc. Amer. Phil. Soc., 31, 1877 (Bay of Pacasmayo, Peru).

Habitat: Coast of Peru.

Etymology: Latin, one-rowed.

This species is known to us from Cope's description.

#### 69. OPHICHTHUS TRISERIALIS.

*Muranopsis triserialis* Kaup, Apodes, 12, 1856 (Pacific).

*Ophichthys triserialis* Günther, VIII, 58, 1870 (Pacific; Caribbean Sea; Bahia); Streets, Bull. U. S. Nat. Mus., 55, 1877 (Gulf of California); Jordan & Gilbert, Proc. U. S. Nat. Mus., 457, 1880; Jordan & Gilbert, Bull. U. S. Fish Com., 101, 1882 (Mazatlan); Jordan & Gilbert, Proc. U. S. Nat. Mus., 37, 1881; Jordan & Gilbert, Syn. Fish. N. A., 359, 1883; Jordan, Proc. U. S. Nat. Mus., 370, 1885.

*Herpetoichthys callisoma* Abbott, Proc. Acad. Nat. Sci. Phila., 475, 1860 (locality unknown).

*Ophisurus californicus* Garrett, Proc. Acad. Nat. Sci. Cal., 66, 1863 (coast of Lower California).

*Ophichthys rugifer* Jordan & Bollman, Proc. U. S. Nat. Mus., 155, 1880 (Charles Island).

Habitat: Pacific coast of Mexico; Brazil?

Etymology: Latin, three-rowed.

This species is not rare on the Pacific coast of tropical America. It has also been accredited to the Atlantic (Caribbean sea; Bahia) by Dr. Günther. This record needs verification, as perhaps the related species, *O. havannensis*, has been mistaken for it.

There is no doubt of the identity of Garrett's *californicus* with the species commonly called *triserialis*. The original type of Garrett's description in the Museum of the Academy of Natural Sciences at San Francisco has been examined by us. The description of *Herpetoichthys callisoma* applies well to the species in question.

The form called *O. rugifer*, of which two specimens from Chatham Island in the Galapagos, are now before us, seems to differ only in the greater length of the pectoral. This is probably due to their youth, and we have little hesitation in referring *O. rugifer* to the synonymy of *triserialis*.

#### 70. OPHICHTHUS GRANDIMACULATUS.

*Ophichthys grandimaculata* Kner & Steindachner, Sitzgsber. Akad. Wiss. Wien, 389, fig. 13, 1866 (Peru, *sic* Günther); Günther, VIII, 58, 1870 (Peru).

Habitat: Coast of Peru.

Etymology: *Grandis*, large; *maculatus*, spotted.

This species is known to us from descriptions only.

71. *OPHICHTHUS PACIFICI*.

*Ophichthys pacifici* Günther, VIII, 76, 1870 (Valparaiso, Chile; Tambo River, Peru).

Habitat: Coasts of Chile and Peru.

Etymology: From the Pacific Ocean.

This species is known from Günther's description only.

72. *OPHICHTHUS GOMESI*.

(SEA SERPENT.)

*Ophisurus gomesii* Castelnau, Anim. Amor. Sud, 84, pl. 44, fig. 2, 1355 (Rio Janeiro).

*Leptorhinophis gomesii* Kaup, Apodes, 11, 1856 (copied).

*Ophichthys gomesii* Günther, VIII, 60, 1870 (copied).

*Ophisurus chrysops* Poey, Memorias, II, 321, 1867 (Havana).

*Ophichthys chrysops* Poey, Repertorio, II, 255, 1867; Poey, Synopsis, 425, 1868; Poey, Enumeratio, 154, 1875; Jordan & Gilbert, Proc. U. S. Nat. Mus., 261, 1882 (Pensacola); Jordan & Gilbert, ibid, 487 (Charleston).

*Ophichthys chrysops* Jordan & Gilbert, Syn. Fish. N. A., 898, 1883; Jordan, Cat. Fish. N. A., 53, 1885.

*Oxyodontichthys chrysops* Poey, Anal. Soc. Hist. Nat. Esp., 254, 1880 (Cuba).

*Oxyodontichthys macrurus* Poey, Anal. Soc. Hist. Nat. Esp., 254, 1880 (Havana).

*Oxyodontichthys brachyurus* Poey, Synopsis, 426, 1868 (Havana); Poey, Enumeratio, II, 155, 1875.

*Oxyodontichthys limbatus* Poey, Anal. Hist. Nat. Esp., 254, 1880 (based on type of *O. brachyurus*).

Habitat: West Indian fauna, Charleston to Rio Janeiro.

Etymology: Named for Dr. Ildefonso Gomes, who cured the Comte de Castelnau of a dangerous malady in Rio Janeiro.

This species is generally common in the West Indies, ranging as far north as Charleston, Galveston, and Pensacola. The specimens before us are from the Snapper Banks of Pensacola, from St. Augustine, Florida, and from Charleston, South Carolina.

A careful comparison of our specimens with the various published descriptions leads us to regard *chrysops*, *macrurus*, and *brachyurus* as synonyms of *O. gomesi*. In most respects these nominal species fully agree. Our specimens correspond best to the descriptions of *chrysops*, from which *brachyurus* (afterwards called *limbatus*) seems to be inseparable. *Macrurus* is said to have the head and body contained  $1\frac{1}{2}$  times in the tail, while in *chrysops* the number is  $1\frac{1}{2}$ , and in *brachyurus*  $1\frac{1}{4}$ . Our specimens show the ratio of  $1\frac{1}{7}$  to  $1\frac{1}{3}$ . As these numbers are intermediate, and as no other difference appears, we refer all to the same species. *O. gomesi*, poorly described and figured by Castelnau, is probably the same species, rather than *O. parilis*.

The following are the chief characters given in the descriptions of the different nominal species here referred to the synonymy of *Ophichthys gomesi*: In a specimen before us from St. Augustine the head is  $2\frac{2}{3}$  in the trunk, the head and trunk is  $1\frac{2}{3}$  in the tail, cleft of mouth  $2\frac{2}{3}$  in head. In one from Charleston (29970 U. S. Nat. Mus.) the head is  $2\frac{1}{3}$  in trunk, the head and trunk  $1\frac{2}{3}$  in tail, the cleft of the mouth  $2\frac{2}{3}$  in head. In one from Pensacola (43117) these figures are  $2\frac{1}{2}$ ,  $1\frac{1}{2}$ , and  $2\frac{2}{3}$ .

*Leptorhinophis gomesi* Kaup, head 2.83 in trunk; head and trunk 1.74 in tail; cleft  $2\frac{1}{2}$  in head.

*Ophichthys chrysops* Poey, head  $2\frac{1}{2}$  in trunk; head and trunk  $1\frac{1}{2}$  in tail.

*Ophichthys chrysops* Jordan & Gilbert, head and trunk  $1\frac{1}{2}$  in tail; cleft  $2\frac{3}{4}$  in head.

*Ophichthys macrurus* Poey., head  $2\frac{3}{4}$  in trunk; head and trunk  $1\frac{1}{2}$  in tail.

*Ophichthys macrurus* Jordan & Gilbert, head  $2\frac{3}{4}$  in trunk; head and trunk  $1\frac{1}{2}$  and  $1\frac{1}{2}$  in tail; cleft  $2\frac{3}{4}$  in head.

*Ophichthys brachyurus* Poey, head 3 in trunk; head and trunk  $1\frac{1}{2}$  in tail.

Should two species be found in the above synonymy they are probably *gomesi* with head and body  $1\frac{1}{2}$  to  $1\frac{3}{4}$  in tail, and *macrurus* with head and body  $1\frac{1}{2}$  to  $2\frac{1}{4}$  in tail.

### 73. OPHICHTHUS ZOPHOCHIR.

*Ophichthys zophochir* Jordan & Gilbert, Proc. U. S. Nat. Mus., 347, 1881 (Mazatlan); Jordan & Gilbert, Proc. U. S. Nat. Mus., 623, 1882 (Acapulco).

Habitat: Pacific coast from Gulf of California to Acapulco or beyond.

Etymology: *Zóφος*, dusky; *χείρ*, hand (pectoral fin).

This species is rather common on the Pacific coast from the Gulf of California southward. The specimen before us is from Guaymas. The species is very nearly related to *O. gomesi*, which it represents on the Pacific coast, and from which it may prove to be indistinguishable.

### 74. OPHICHTHUS MAGNIOCULIS.

*Scytalophis magniocularis* Kaup, Apodes, 13, fig. 7, 1856 (St. Croix, Brazil).

*Ophichthys magniocularis* Kner, Novara Fische, 376, 1866 (Rio Janeiro).

*Ophichthys magnoculus* Günther, VIII, 59, 1870 (copied).

Habitat: Brazilian fauna.

Etymology: *Magnus*, great; *oculus*, eye.

This species is known to us from a specimen (38522) obtained by the Albatross at Aspinwall. The short trunk and long tail separate it from *O. gomesi*.

### 75. OPHICHTHUS CALLAËNSIS.

*Ophichthys callaënsis* Günther, Journal Museum Godeffroy, IV, 92, 1873 (Callao).

This species is known to us from a specimen (36931, U. S. Nat. Mus.) from Coquimbo, Chile, and from a specimen (1078, M. C. Z.) received by the Indiana University from the Museum at Cambridge. This specimen is from Valparaiso and was sent under the name of *Ophichthys remiger*. As Günther has indicated, *O. callaënsis* is a near relative of *O. magniocularis*, from which it differs in its larger gill-openings and shorter tail.

The following is Dr. Günther's original description, kindly furnished us by Dr. G. A. Boulenger:

#### OPHICHTHYS CALLAËNSIS.

Diese neue Art gehört zu der Abtheilung 1, A, 1, *b*  $\beta$ , meiner Synopsis (Fish, VIII, p. 55). Die Kiemensöffnungen sind weit, weiter als der Zwischenraum, durch den sie an der Bauchseite von einander getrennt sind. Die Länge des Kopfes ist mehr

als die Hälfte der Entfernung der Kiemenspalte vom After. Die Schnautze springt über den Unterkiefer vor. Länge der Maulspalte  $\frac{1}{2}$  der Kopflänge. Auge ziemlich gross, mehr als halb so lang als die Schnautze. Zähne ziemlich gleichmässig klein, in doppelten Reihen in beiden Kiefern. Die Länge der Brustflosse ist  $\frac{2}{3}$  der Kopflänge. Rücken und Afterflosse sehr niedrig, die erstere fängt über dem Endtheile der Brustflosse an. Die Körperlänge verhält sich zur Schwanzlänge = 2:3. Einfärbig braun, heller am Bauche. Ein Exemplar, 10 Zoll lang, von Callao (No. 21). Es scheint diese Art dem *Ophichthys magniocularis* verwandt zu sein, unterscheidet sich aber durch seine Körperverhältnisse. (Zweiter ichtyologischer Beitrag nach Exemplaren aus dem Museum Godeffroy, von Dr. Albert Günther, Journal des Museum Godeffroy, Heft. IV, p. 91, 1873).

Our specimens have the head a little less than half the length of the trunk, and the pectoral fin about 3 times in head.

*Ophichthys dicellurus* (Richardson), a Chinese species, has also been recorded from Coquimbo, Chile, by Dr. Günther, Proc. Zoöl. Soc. London, 1881, 22, without description. Perhaps *O. callaënsis* was intended.

#### 76. OPHICHTHUS PARILIS.

*Ophisurus parilis* Richardson, Voyage Erebus and Terror, 105, 1844 (West Indies); Kaup, Apodes, 14, fig. 8, 1856 (Brazil; Surinam; West Indies).

*Ophichthys parilis* Günther, VIII, 59, 1870 (Cuba; Bahia).

*Ophichthys pauciporus* Poey, Repertorio, II, 255, lam. 3, fig. 5, 1868; Günther, VIII, 60, 1870; Poey, Enumeratio, 154, 1875.

Habitat: West Indies to Brazil.

Etymology: *Parilis*, like.

This species is known to us only from descriptions. It appears to differ from *O. gomesi* in the longer nasal tubes, and especially in the smaller eye.

We refer *O. pauciporus* Poey to the synonymy of *O. parilis* with some doubt. Poey's figure shows the small eye of *O. parilis*, and rather large nasal tubes. The tail in *pauciporus* is said to be twice as long as the rest of body, as in *parilis*. In *pauciporus* the insertion of the dorsal is said to be behind (*mas atras*) the end of the pectoral. It is before the tip in *parilis*, but this is likely either an error or an individual variation. No other difference appears in the descriptions.

#### Genus 16.—MYSTRIOPHIS.

**Mystriophis** Kaup, Apodes, 10, 1856 (*rostellatus*).

**Echiopsis** Kaup, Abhandl. Naturh. Verein., I. c., 13 (*intertinctus*).

**Crotalopsis** Kaup, Abhandl. Naturwiss. Verein. Hamburg, IV, 12, 1860 (*punctifer*).

**Macrodonophis** Poey, Repertorio Fis. Nat. Cuba, II, 251, 1867 (*wordax*).

**Scytalichthys** Jordan & Davis, subgen. nov. (*miurus*).

Type: *Ophisurus rostellatus* Richardson.

Etymology: *Μυστήριον*, a spoon, from the form of the snout of the typical species; *ὄφις*, snake.

This genus as understood by us contains about four species distinguished from *Ophichthus* by the canine teeth and large mouth. The species have not much in common, and should perhaps be ranged in three different genera, unless all are replaced in *Ophichthus*.

ANALYSIS OF SPECIES OF MYSTRIOPHIS.

- a. Jaws narrowed and not expanded at tip.
- b. Vomerine teeth small, biserial or triserial, fixed; tail moderate. (*Echiopsis* Kaup.)
- c. Teeth in jaws biserial; long canines in front of jaws; outer teeth of upper jaw unequal, some of them canine; vomerine teeth in two series, these sometimes partly coalescing (sometimes, var. *punctifer*, partly divided into three); lower jaw scarcely included; pectoral fin about 5 in the head; tail a little longer than rest of body; dorsal commencing behind tip of the pectoral, a distance equal to about the length of same; isthmus equal to  $\frac{2}{3}$  the gill-openings, which are large, close together, and subinferior, anterior in position; head  $2\frac{1}{2}$  to  $2\frac{5}{8}$  in the trunk; eye small,  $1\frac{1}{2}$  to 2 in the snout; gape  $2\frac{1}{2}$  in head; snout 3 in cleft of mouth, 7 in head. Dark brown above, paler below, side with two rows of large round or ovate black spots, the upper row close to the dorsal fin, the lower row below the lateral line; besides these some smaller spots, also black; head a little darker than the body, the spots smaller and numerous, some larger ones below eye; dorsal and anal with dark borders formed by spots; pectoral black at tip, the remainder more or less dusky ..... INTERTINCTUS, 77.
- bb. Vomerine teeth in one series of about 4 slender depressible canines; tail very short, much shorter than rest of body. (*Scytalichthys* Jordan & Davis.)
- dd. Dorsal fin inserted well behind tip of pectorals; gill-opening midway between eye and beginning of dorsal fin; pectoral fin very short, as long as snout, 10 in head; snout short, 4 in cleft of mouth; head depressed and pointed, the mouth large; teeth long, those on vomer and side of lower jaw canine-like; teeth of upper jaw biserial, rather small; lower teeth uniserial; vomerine teeth uniserial; eye small, placed well forward; gill-openings small, transverse, inferior, as in *Cacula imberbis*, the slit as long as snout and wider than isthmus; head  $4\frac{3}{4}$  in the very long trunk; tail 14 in rest of body; cleft of mouth  $2\frac{1}{2}$  in head. Coloration light yellowish, a series of roundish dark-brown blotches on each side of body, the two series alternating; two alternating series of small half blotches on the back, these coalescing into one on median line before dorsal; head with small dark spots; sides of lower jaw spotted; fins pale .. ..... MIURUS, 78.

77. MYSTRIOPHIS INTERTINCTUS.

*Ophisurus intertinctus* Richardson, Voy. Erebus and Terror, Fishes, 102, 1844 (West Indies).

*Echiopsis intertinctus* Kaup, Apodes, 13, 1856 (Martinique).

*Ophichthys intertinctus* Günther, VIII, 57, 1870; Jordan, Proc. Acad. Nat. Sci. Phila., 43, 1884 (Egmont Key, Fla.); Jordan, Cat. Fish. N. A., 53, 1885.

? *Ophisurus sugillatus* Richardson, Voyage Erebus and Terror, 1844, 103 (habitat uncertain; supposed to be West Indies).

*Crotalopsis punctifer* Kaup, Abhandl. Wiss. Verein. Hamb., IV, 2, 12, taf. 1, fig. 3, 1860 (1859) (Puerto Cabello) (fide Günther).

*Ophichthys punctifer* Günther, 56, 1870 (copied).

*Conger mordax* Poey, Memorias, II, 319, 1860 (Cuba).

*Macrondonophis mordax* Poey, Repertorio, II, 252, 1868; Poey, Synopsis, 425, 1868.

*Crotalopsis mordax* Poey, Enumeratio, 153, 1875; Goode & Bean, Proc. U. S. Nat. Mus., 344, 1879 (Clear Water Harbor, Fla.).

*Ophichthys schneideri* Steindachner, Ich. Beitr., VIII, 66, 1879 (Brazil); Jordan & Gilbert, Proc. U. S. Nat. Mus., 143, 1883 (Pensacola); Jordan, Cat. Fish. N. A., 53, 1885.

Habitat: West Indian fauna, north to western Florida.

Etymology: Latin, colored between or within.

This species is not rare in the West Indies, and has been occasionally taken on the west coast of Florida. The four examples before us are from Lemon Bay, Egmont Key, St. Thomas, and Pensacola. A careful comparison of the descriptions of different writers with our specimens leads us to the conclusion that the forms called *intertinctus*, *punctifer*, *schneideri*, and *mordax* belong to one species. *O. schneideri* is said to have the vomerine teeth biserial, while in *punctifer* (= *mordax*) they are triserial. Our specimens have the teeth biserial or somewhat triserial in front. In the forms called *intertinctus* the teeth are biserial in front and uniserial behind. In the type of *O. sugillatus* the vomerine teeth are said to be uniserial. This species is said to have the pectorals longer than in *intertinctus*, as long as eye and snout. Probably all these characters represent variation of individuals.

78. MYSTRIOPHIS MIURUS.

*Ophichthys miurus* Jordan & Gilbert, Proc. U. S. Nat. Mus., 387, 1882 (Cape San Lucas).

Habitat: Pacific coast of Mexico.

Etymology: *Μεωροπυγ*, curtailed, from the short tail.

This species is known only from two specimens, both taken at Cape San Lucas by Mr. John Xantus. One of these, 43104, has been only lately found in the Museum collections.

This species has little relation to any other found in America, although in coloration it is much like *intertinctus*, *ophis*, and *triserialis*.

Genus 17.—BRACHYSOMOPHIS.

*Brachysomophis* Kaup, Apodes, 9, 1856 (*horridus*).

? *Achirophichthys* Bleeker, Poissons Inéd. Murènes, Ned. Tijdschr. Dierk., II, 42; *typus* = young.

Type: *Brachysomophis horridus* Kaup.

Etymology: *Βραχύς*, short; *σῶμα*, body; *ὄφις*, snake.

This East Indian genus is once recorded in our fauna.

ANALYSIS OF THE SPECIES OF BRACHYSOMOPHIS.

- a. [Teeth unequal in size; maxillary teeth in a double row, those of the inner row stronger and less numerous than the outer; vomerine and mandibular teeth uniserial; large canine teeth; head 3 in trunk; snout extremely short and rather flattened, scarcely twice as long as the eye, which is small and situated in the anterior ninth of the length of the head; vertical fins moderately well developed; distance between the origin of the dorsal fin and gill-opening 2½ in head; pectoral small; body longer than tail. Upper parts brownish, minutely dotted with darker; a series of black pores along the lateral line, sometimes a whitish line across the occiput.] (*Günther*.) ..... CROCODILINUS, 79.

79. BRACHYSOMOPHIS CROCODILINUS.

*Ophisaurus crocodilinus* Bennett, Proc. Com. Zool. Soc., 32, 1831 (*vide* *Günther*).

*Ophichthys crocodilinus* *Günther*, VIII, 64, 1870 (Galapagos Islands).

*Brachysomophis horridus* Kaup, Apodes, 9, fig. 6, 1856 (Otaheite); Bleeker, "Versl. Medel. Akad. Wet. Amsterd., II, 303, 1868" (*vide* *Günther*).

? *Achirophichthys typus*, Bleeker, Ned. Tijdschr. Dierk., 42 (Celebes).



Habitat: East Indies; once found at the Galapagos Islands.

Etymology: Latin, like a crocodile.

This species, said to have been once taken at the Galapagos, is known to us only through descriptions.

Genus 18.—OPHISURUS.

*Ophisurus* Lacépède, Hist. Nat. Poiss., II, 1800 (*ophis*; *serpens*).

*Oxystomus* Rafinesque, Caratteri, 62, 1810 (*hyalinus* = *serpens*, young).

*Ophisurus* Risso, Europe Méridionale, III, 206, 1826 (restricted to *serpens*).

*Leptognathus* Swainson, Natur. Hist. Class'n. Fish., II, 234, 1839 (*oxyrhynchus* = *serpens*).

*Leptorhynchus* Smith, Illustr. Fishes S. Afr., 1840 (*capensis*) (the name six times preoccupied).

*Ophisurus* Kaup, Apodes 7, 1856 (*serpens*, not of Lacépède as restricted by Swainson and Bleeker).

Type: *Muraena serpens* L.

Etymology: ὄφις, snake; ὄψις, tail.

This genus is based on a single species found in the seas of Europe. In form of snout it differs materially from the other Ophisurid eels, approaching in some degree to the beloniform jaws of *Nemichthys*. We adopt the name *Ophisurus* instead of *Oxystomus* or *Leptognathus*. The earliest restriction of Lacépède's genus, that of Risso, made *serpens*, the type of *Ophisurus*. The association of the name *Ophisurus* with the blunt-toothed species here called *Myrichthys* rests wholly on errors.

ANALYSIS OF THE SPECIES OF OPHISURUS.

- a. Body slender, subterete; head  $3\frac{1}{4}$  in trunk; head and trunk  $2\frac{1}{4}$  in total length; cleft of mouth half as long as head; snout  $3\frac{1}{2}$  in head; eye large, 3 in snout, nearer angle of mouth than tip of snout; dorsal beginning behind base of pectorals at a distance equal to twice the length of pectorals; pectorals  $1\frac{1}{2}$  in snout. Color olivaceous, silvery below; covered with many small brown specks, more numerous on back.

80. OPHISURUS SERPENS.

*Muraena exacte teres cauda acuta apterygia* Artedi, Genera Piscium, 24, 1733 (Rome).

*Muraena serpens* Linnaeus, Syst. Nat., ed. X, 244, 1758, (after Artedi) (and of copyists).

*Ophisurus serpens* Lacépède, Hist. Nat. Poiss., II, 193, 1801 (*vide* Günther).

*Ophichthys serpens* Günther, VIII, 65, 1870 (Bay of Naples; Atlantic; Damara Land; Japan; Australia).

*Echelus oxyrinchus* Rafinesque, Caratteri, 64, 1810 (Sicily).

*Leptognathus oxyrhynchus*, Swainson, Fish. Rep. and Amph., II, 396, 1839 (Sicily).

*Echelus microphthalmus* Rafinesque, Caratteri, 64, 1810 (Palermo).

*Oxystomus hyalinus* Rafinesque, Indicoe, 62, 1810 (Palermo; larva).

*Leptorhynchus capensis* Smith, Ill. Zoöl. S. Afr., Pisc., pl. 6, 1838 (*vide* Günther).

*Muraena acutirostris* Gronow (ed. Gray), Cat. Fishes, 19, 1854 ("America").

? *Ophisurus macrorhynchus* Bleeker, Verh. Bat. Gen., XXV, Muraena, 28, 1865 (Japan) (*vide* Günther).

Habitat: Southern Europe and southward, said to extend its range to Cape of Good Hope and Japan.

Etymology: *Serpens*, serpent.

Of this species we have one large specimen taken by Professor Doderlein at Palermo. Whether the Japanese and African representatives of this type are specifically identical with *Ophisurus serpens* we do not know. They are so considered by Dr. Günther.

*Oxystomus hyalinus* is a name applied to a young eel with translucent body and long and slender jaws, the lower the longer, taken by Rafinesque at Palermo. It is evidently the young of *O. serpens*.

### Family III.—ECHELIDÆ.

(THE WORM EELS.)

We recognize provisionally as a distinct family the *Myrophince*, or *Myrine* of authors, small eels intermediate in character between the *Ophisuridæ* and the *Murænesocidæ*. The osteology has not yet been carefully studied, but they will probably be found to be most nearly related to the latter family, if indeed the two should not be, as in Bleeker's arrangement, reunited with the *Congridæ*.

The *Echelidæ* have the end of the tail surrounded by the confluent vertical fins; the posterior nostril is in or very near the upper lip, and the tongue is more or less fully adnate to the floor of the mouth.

The species are usually of small size and plain colors, more or less worm-like in form, and inhabit sandy coasts in tropical seas. Few of the genera are rich in species.

#### ANALYSIS OF AMERICAN AND EUROPEAN GENERA OF ECHELIDÆ.

- a. Body short, much compressed; pectorals almost invisible; mouth narrow; vomerine teeth none; snout obtuse, depressed; vertical fins well developed, the dorsal beginning behind the gill-opening.....CHILORHINUS, 19.
- aa. Body elongate, subterete; pectorals present, sometimes minute; anterior nostril tubular; dorsal fin beginning behind head; teeth small.
  - b. Dorsal fin beginning behind vent; no teeth on vomer; teeth mostly uniserial; body slender, terete .....AHLIA, 20.
  - bb. Dorsal fin beginning before the vent; vomer with teeth.
    - c. Dorsal fin beginning at a point about midway between gill-opening and vent; pectorals very small; teeth subequal; body slender, terete; the tail much longer than rest of body .....MYROPHIS, 21.
    - cc. Dorsal fin beginning close behind base of pectoral; tail longer than rest of body; pectoral well developed.
      - d. Teeth in jaws mostly biserial.....PARAMYRUS, 22.
      - dd. Teeth in jaws in cardiform bands.....ECHELUS, 23.

#### Genus 19.—CHILORHINUS.

*Chilorhinus* Lütken, Vidensk. Meddel. Naturh. Foren. Kjöbenhavn, 1, 1851 (*suensonii*).

Type: *Chilorhinus suensonii* Lütken.

Etymology: *Χεῖλος*, lip; *ῥιν*, nostril.

This genus is known from a single West Indian species.

ANALYSIS OF THE SPECIES OF CHILORHINUS.

- a. [Head and trunk forming  $\frac{2}{3}$  of the total length; dorsal fin commencing at a point half way between vent and snout; depth 9 times in the total length; eye  $2\frac{1}{2}$  in interorbital width, latter equaling the muzzle; teeth on palatines biserial; ten teeth in two transverse rows on the nasals; teeth on lower jaw triserial. Color uniform dark brown; throat paler; fins darker-margined] (Cope). SUENSONII, 81.

81. CHILORHINUS SUENSONII.

*Chilorhinus suensonii* Lütken, Vid. Med. Naturh. Foren., 1, 1851 (St. Croix); Lütken, Wiegmann's Archiv, 272, 1852; Günther, VIII, 52, 1870 (copied); Cope, Trans. Amer. Phil. Soc., 482, 1870 (St. Croix).

Habitat: West Indian fauna.

Etymology: A personal name.

This species is known to us only from the descriptions of Lütken and Cope. The known specimens are from St. Croix.

Genus 20.—AHLIA.

*Ahlia* Jordan & Davis, gen. nov. (*egmontis*).

Type: *Myrophis egmontis* Jordan.

Etymology: Named for Jonas Nicolas Ahl, of Upsala, whose thesis "De Muræna et Ophichtho" "modestly offered for the consideration of the president of the medical faculty" in the University of Upsala ("Carolus Vet. Thunberg") in 1789, furnishes the beginning of our systematic arrangement of the eels.

A single species of this genus is known.

ANALYSIS OF THE SPECIES OF AHLIA.

- a. Dorsal beginning behind vent, at a distance about equal to length of gape; anterior nostril in a short tube; posterior, large, labial, directly behind it; cleft of mouth short, extending beyond the rather large eye,  $3\frac{1}{2}$  in head; eye 2 in snout; teeth on both jaws uniserial; four small canines in front of upper jaw; no teeth on vomer; lower jaw considerably shorter than the upper; top of head with large pores; head  $4\frac{1}{2}$  in trunk; head and trunk a little shorter than tail; pectorals short and broad, slightly longer than snout; gill-opening short, oblique, extending downward and backward from near middle of base of pectoral. Dark brown, nearly uniform, somewhat paler below .....EGMONTIS, 82.

82. AHLIA EGMONTIS.

*Myrophis egmontis* Jordan, Proc. Acad. Nat. Sci. Phila., 44, 1889 (Egmont Key, Florida); Jordan, Cat. F. N. A., 54, 1885.

Habitat: Coast of Florida.

Etymology: From Egmont Key.

This species is known from the single example taken at Egmont Key, Florida.

Genus 21.—MYROPHIS.

*Myrophis* Lütken, Vidensk. Meddel. Nat. Foren. Kjöbenhavn, 1, 1851 (*punctatus*).

Type: *Myrophis punctatus* Lütken.

Etymology: *Μύπος*, *Myrus*; *ὄφις*, snake.

This genus contains three species of small eels, resembling earth-worms, found on the sandy shores of tropical America.

ANALYSIS OF THE SPECIES OF MYROPHIS.

- a. Pectoral fin very small, no larger than the pupil of the eye. Body cylindrical, vermiform, the head small and jaws rather weak; gill-openings very small,  $1\frac{1}{2}$  the diameter of the eye, 3 to 4 in the isthmus, which is about as wide as the length of the lower jaw; teeth uniserial in all the bones of the mouth; dorsal fin commencing at a distance about twice the length of head behind the gill-openings; head  $4\frac{1}{2}$  in the trunk; head and trunk  $1\frac{1}{2}$  in tail; eye  $2\frac{1}{2}$  in the snout, situated just back of the middle of gape, which is  $3\frac{1}{2}$  in head; depth of body at vent containing the snout twice and contained in the head  $2\frac{1}{4}$  times. General color light brown, the dorsal region appearing darker because of the multitude of minute dark-brown specks; a light streak running from beginning of dorsal forward to the nape; nape and back of head a little darker in color. FRIO, 83.
- aa. Pectoral fin larger,  $1\frac{1}{4}$  to 2 times the diameter of the eye.
- b. Base of pectoral fin half the width of the gill-opening; snout very narrow; jaws weak; width of snout between the anterior nostrils less than diameter of eye; width of interorbital space equal to eye; greatest width of head less than that of body behind the gill-openings; teeth uniserial on vomer and mandible, biserial on maxillary; head 3 times in the trunk, 7 times in the tail; depth of body at gill-openings  $2\frac{1}{4}$  in the head; eye 2 in snout, which is 6 in the head; gape  $3\frac{1}{2}$  in head; upper jaw projecting. General color light brown, the sides and back punctate with dark-brown dots; belly and throat plain, except a little patch of dusky points below the gill-openings.....PUNCTATUS, 84.
- bb. Base of pectoral fin as wide as the gill-opening; snout almost as broad as long; width at the nostrils greater than the interorbital width; dorsal commencing nearer the vent than the gill-openings; teeth uniserial on vomer and mandible, biserial on maxillary; head a little less than three in the trunk,  $5\frac{1}{2}$  in the tail; depth of body at the gill-openings  $3\frac{1}{2}$  to 4 in the head; upper jaw projecting. Color light brown; sides and back with minute brown specks, smaller than in *punctatus*; belly and throat plain.....VAFER, 85.

83. MYROPHIS FRIO.

*Myrophis frio* Jordan & Davis, sp. nov. (Cape Frio).

Habitat: Coast of Brazil.

Etymology: From the original locality, Cape Frio.

This species is known from a single example,  $12\frac{1}{2}$  inches long, collected by the *Albatross* at Station 2762, off Cape Frio, near Rio Janeiro.

The species is well separated from the others by the minute pectoral, which is almost invisible. This species is intermediate between *Myrophis* and the East Indian genus *Muraenichthys*, which differs only in the total absence of pectorals.

84. MYROPHIS PUNCTATUS.

*Myrophis punctatus* Lütken, Vid. Mod. Naturh. Foren. Kjöben., 1, 1851 (West Indies); Jordan, Proc. Acad. Nat. Sci. Phila., 282, 1883 (description of Lütken's type); Jordan, Proc. U. S. Nat. Mus., 33, 1884 (Pensacola); Jordan, Cat. Fish. N. A., 54, 1885; Jordan & Evermann, Proc. U. S. Nat. Mus., 474, 1886 (Pensacola); Jordan, *ibid*, 567.

*Myrophis longicollis* Kaup, Apodes, 30, 1856 (Surinam) (not *Muraena longicollis* Cuvier); Peters, Monatsber. Akad. Wiss. Ber. 397, 1864.

*Myrophis microstigmus* Poey, Repertorio, II, 250, 1867 (Cuba); Poey, Synopsis, 425, 1868; Poey, Enumeratio, 153, 1875; Jordan & Gilbert, Syn. Fish. N. A., 900, 1883.

*Myrophis lumbricus* Jordan & Gilbert, Syn. Fish. N. A., 899, 1883 (Galveston, Tex.).

Habitat: West Indian fauna, from Texas to Surinam.

Etymology: Latin, speckled.

This species is common in the West Indies and along the Gulf coast of the United States. The specimens before us are from the Snapper Banks near Pensacola. We reject the name *longicollis* for this species because the figure of Lacépède ("La Murene Myre"), on which *Muraena longicollis* was founded, by no means represents a *Myrophis*, and was more likely intended for *Echelus myrus*. We are also convinced that the forms called *microstigmus* and *lumbricus* are but individual variations of *Myrophis punctatus*.

### 85. MYROPHIS VAFER.

*Myrophis vafēr* Jordan & Gilbert, Proc. U. S. Nat. Mus., 645, 1882 (Panama); Jordan, Proc. U. S. Nat. Mus., 370, 1885 (Panama; Guaymas).

Habitat: Pacific coast of tropical America.

Etymology: Latin, *vafēr*, subtle or sly.

This species is close to *M. punctatus*, which it represents on the Pacific coast. The larger pectoral, however, at once distinguishes *vafēr* from *punctatus*. The specimens before us are from the Gulf of California, collected by Dr. Gilbert.

### Genus 22.—PARAMYRUS.

*Paramyrus* Günther, Cat. Fish. Brit. Mus., VIII, 51, 1870 (*cylindroideus*).

Type: *Conger cylindroideus* Ranzani.

Etymology: *ἡπά*, near; *Myrus* = *Echelus*.

This genus, a near relative of *Echelus*, contains one American and one Asiatic species.

#### ANALYSIS OF THE AMERICAN SPECIES OF PARAMYRUS.

a. [Dorsal fin commencing nearly above the middle of pectorals; tail twice as long as head and trunk; vertical fins with a narrow black edge.] (*Ranzani*)

CYLINDROIDEUS, 86.

### 86. PARAMYRUS CYLINDROIDEUS.

*Conger cylindroideus* Ranzani, Nov. Spec. Pisc. Diss. Prima, 80, pl. 13, fig. 2, 1838 (Brazil).

*Paramyrus cylindroideus* Günther, VIII, 51, 1870 (copied).

Habitat: Coast of Brazil.

Etymology: *Κύλινδρος*, cylinder; *εἶδος*, like.

This species is known only from Ranzani's description and figure.

## Genus 23.—ECHELUS.

*Echelus* Rafinesque, Caratteri di Alcuni Generi., 64, 1810 (in part, includes species of *Conger*, *Ophisoma*, etc.).

*Myrus* Kaup, Apodes 31, 1856, (*vulgaris*=*myrus*).

*Echelus* Bleeker, Atlas Ichth. Murènes, 30, 1864 (*myrus*).

Type: *Echelus punctatus* Rafinesque=*Muraena myrus* L. (as restricted by Bleeker).

Etymology: \**Ἐχχελος*, eel, properly spelled *Enchelys*.

This genus contains two species, both of the eastern Atlantic, eels of larger size than the others of the family.

We follow Bleeker in using the name *Echelus* instead of *Myrus*. The genus *Echelus* as originally proposed included species of *Leptocephalus*, *Ophisoma*, *Ophisurus*, and *Myrus*. It has priority over *Ophisoma* and *Myrus*, of which *Myrus* is the more recent.

## ANALYSIS OF THE SPECIES OF ECHELUS.

a. [Pectoral long,  $2\frac{3}{4}$  in head; dorsal fin commencing behind tip of pectoral; body elongate; tail  $\frac{2}{3}$  of total length; head  $4\frac{1}{2}$  in the trunk; eye 2 in the snout, which is 3 in the head; cleft of mouth extending behind hinder margin of eye; dorsal inserted as much behind gill-openings as gill-openings are behind the eye; lateral line distinct. Color gray; fins paler; gill-openings black.] (*Vaillant*).

PACHYRHYNCHUS, 87.

aa. Pectoral moderate,  $3\frac{1}{2}$  in the head; dorsal commencing a little in front of the top of the pectoral; head  $2\frac{3}{4}$  in the trunk, 5 in the tail; eye  $1\frac{1}{2}$  in the snout, which is a little more than 4 in the head; gape of mouth 3 in the head, extending almost to the hinder margin of the eye; gill-openings 2 in the isthmus. Uniform brown, darker on the opercular regions; two rows of small light-colored spots extend from the front of the dorsal fin forwards; a light band across the head, in front of which are several other shorter bands, running both longitudinally and transversely; snout with several small, irregular, whitish blotches; vertical fins posteriorly, with the edge darkest; gill-openings light-colored...MYRUS, 88.

## 87. ECHELUS PACHYRHYNCHUS.

*Myrus pachyrhynchus* Vaillant, Exp. Travailleur et Talisman, 81, pl. v, fig. 1, 1a, 1b, 1888 (Morocco; Cape Verde Islands).

Habitat: Deep waters of the Mediterranean and adjacent seas.

Etymology: *Παχύς*, thick; \**ρογχος*, snout.

This species is known from the account given by Vaillant.

## 88. ECHELUS MYRUS.

*Serpens marinus alter* Willughby, 108, 1686 (Mediterranean Sea).

*Muraena rostro acuto* Artedi, Genera, 1738 (based on Willughby).

*Muraena myrus* Linnaeus, Syst. Nat., ed. x, 225 (based on Artedi and of the copyists).

*La muraena myre* Lacépède, Hist. Nat. Poiss., II, pl. 3, fig. 3, 1798.

*Echelus punctatus* Rafinesque, Caratteri, 63, 1810 (Sicily).

*Muraena longicollis* Cuvier, Règne Animal, 313, 1828 (no description; based on Lacépède).

*Myrus vulgaris* Kaup, Apodes, 31, fig. 14, 1856; Günther, VIII, 50, 1870, and of European writers generally.

Habitat: Mediterranean Sea.

Etymology: *Μύρος*, *Myrus*, the ancient name of the species.

This species is not rare in the Mediterranean; we have a single specimen from Palermo. It reaches a larger size than the other members of the family.

### Family IV.—MURÆNESOCIDÆ.

This family as here understood comprises those scaleless Anguilloid eels which have the posterior nostril not labial, the tongue largely adnate, the jaws not excessively elongate, the end of the tail surrounded by the caudal fin, and the pectoral fins well developed. None of these characters appear to have in themselves great importance, but according to Dr. Gill, in the genus *Murænesox*, the only genus in which the osteology is well known, the characters are such as fully to justify family distinction. Dr. Gill gives the following:

#### DIAGNOSIS OF MURÆNESOCIDÆ.

Enchelycephalous apodals with the tongue not free, the branchiostegal membrane connecting the opposite sides below, the epipharyngeals reduced to one pair, and the hypopharyngeals linguiform and encroaching on the fourth branchial arch.

To this should be added: Gill-openings rather wide; pectoral fins well developed; jaws of moderate length; vomer well armed.

Whether all these characters are found in the other genera commonly associated with *Murænesox* is not yet known. The family seems divisible into two well-marked groups, which are perhaps as distinct from each other as from the *Echelidæ* or the *Congridæ*. The *Nettastomina*, usually associated with *Murænesox*, we have removed to form a distinct group near the *Nemichthyidæ*.

The species of this family are not very numerous, and a large proportion are American. In general appearance and habits they approach the Congers. All are plainly colored and some descend to rather deep water.

#### ANALYSIS OF AMERICAN GENERA OF MURÆNESOCIDÆ.

- a. Dorsal and anal fins low anteriorly, developed chiefly on the tail. (STILBISCINÆ.)
  - b. Tail short, little more than half as long as rest of body; teeth all uniserial, unequal, some of them canine-like; body very slender, whip-shaped.
    - c. Dorsal fin beginning close behind the nape..... GORDICHTHYS, 24.
    - cc. Dorsal fin beginning behind the vent.....STILBISCUS, 25.
  - bb. Tail about as long as rest of body; teeth moderate; dorsal beginning before the vent.
    - d. Body whip-shaped, the diameter less than one-fiftieth the length; dorsal beginning not far behind pectoral.....LEPTOCONGER, 26.
    - dd. Body moderately elongate, the diameter more than one-thirtieth the length; dorsal beginning just before vent.....NEOCONGER, 27.
- aa. Dorsal and anal fins well developed throughout, the dorsal beginning nearly above gill-opening; snout moderately produced; vomerine teeth very strong. (MURÆNESOCINÆ.)

e. Teeth in jaws biserial, small; vomer with a series of long, pointed canines; tail about 4 times as long as rest of body; gill-openings narrow.

Hoplunnis, 28.

ee. Teeth in jaws in several series; gill-openings wide.

f. Teeth in jaws in several series, those of one series enlarged and compressed, long canines in front; vomer with several long series of teeth, the middle one of conical canines ..... Murænesox, 29.

ff. Teeth all conical, slender, and sharp, those of jaws in wide bands; maxillary with deep groove, running the entire length of the bone and dividing the band of teeth into two portions; shaft of vomer with a medial series of conical teeth ..... Xenomyx, 30.

Genus 24.—GORDIICHTHYS.

*Gordiichthys* Jordan & Davis, gen. nov. (*irretitus*).

Type: *Gordiichthys irretitus* Jordan & Davis.

Etymology: *Gordius*, a horse-hair worm, from *Γόρδιος*, the king whose complicated knot was cut by Alexander; *ιχθύς*, fish.

This genus is based on a single species, distinguished from *Stilbiscus* by the position of its dorsal.

ANALYSIS OF SPECIES OF GORDIICHTHYS.

a. Dorsal fin beginning before the gill-opening, not far behind the nape; trunk very long; tail  $1\frac{1}{2}$  in rest of body; head about 16 in trunk (15 to 18, the type being so injured that the gill-openings can not be made out); greatest depth of body 40 to 50 times in length of body; upper jaw much the longer, arched, the eye behind its middle; eye moderate,  $2\frac{1}{2}$  in snout,  $4\frac{1}{2}$  in gape; lower jaw with one row of about 10 stoutish recurved teeth on each side, those in front enlarged and canine-like; upper jaw with a series of similar teeth on each side and another down middle of vomer, these three series converging forward and meeting at a point opposite middle of lower jaw; in front of this on premaxillary and nasal bones about 4 large, stout, hooked canines, the largest teeth of all; 123 vertebrae in trunk (probably about 100 in tail); (pectoral, gill-opening, and skin wholly digested in the type; coloration probably similar to *Stilbiscus edwardsi*).

IRRETITUS, 89.

89. GORDIICHTHYS IRRETITUS.

*Gordiichthys irretitus* Jordan & Davis, sp. nov. (Snapper Banks at Pensacola).

Habitat: Gulf of Mexico.

Etymology: *Irretitus*, entangled.

This species is known from a single partly digested example, 31 inches long, from the spewings of snappers (*Lutjanus aya*) on the Snapper Banks at Pensacola.

Genus 25.—STILBISCUS.

*Stilbiscus* Jordan & Bollman, Proc. U. S. Nat. Mus., 549, 1888 (*edwardsi*).

Type: *Stilbiscus edwardsi* Jordan & Bollman.

Etymology: *Σταλβω*, to shine.

This genus contains a single species, a very slender eel, distinguished from *Leptoconger* by its short tail.



ANALYSIS OF SPECIES OF STILBISCUS.

- a. Head  $7\frac{1}{2}$  in trunk,  $4\frac{1}{2}$  in tail; snout 7 in head, its length somewhat greater than distance between gill-openings; eye  $1\frac{1}{2}$  in snout,  $1\frac{1}{2}$  in interorbital space; cleft of mouth reaching to posterior margin of eye; upper jaw 5 in head; height of gill-opening  $1\frac{1}{2}$  in snout; teeth all uniserial, some of the anterior enlarged, canine-like; dorsal beginning  $1\frac{1}{2}$  length of head behind vent; length of first part about equal to head and pectoral; developed part of dorsal at tail contained  $1\frac{1}{2}$  times in the head; pectoral 6 in head. Upper part of head and body above lateral line brown; lower parts bright metallic-bluish silvery; dorsal and anal pale, the latter with a dusky stripe on each side of its base; pectorals dusky; caudal black.....EDWARDSI, 90.

90. STILBISCUS EDWARDSI.

*Stilbiscus edwardsi* Jordan & Bollman, Proc. U. S. Nat. Mus., 549, 1888 (Green Turtle Cay, Bahama Islands).

Habitat: West Indian fauna.

Etymology: Named for Charles Lincoln Edwards.

This species is known from a single specimen taken by Dr. C. L. Edwards at Green Turtle Cay, one of the Bahama Islands.

Genus 26.—LEPTOCONGER.

*Leptoconger* Poey, Anales Hist. Nat. Esp., 250, 1880 (*perlongus*).

Type: *Neoconger perlongus* Poey.

Etymology: *λεπτός*, slender; *Conger*.

This genus is based on a single species, a little-known eel of the West Indian fauna. It is very close to *Neoconger*, from which it differs mainly in the very slender body.

ANALYSIS OF SPECIES OF LEPTOCONGER.

- a. [Head 4 in trunk; tail about a third longer than rest of body; gape 4 in head; eye large,  $1\frac{1}{2}$  in snout; snout pointed; teeth hooked, short and robust, subequal and uniserial, a few in front enlarged; lower jaw much shorter than upper; dorsal beginning just behind tip of pectoral. Violet brown, pale below; dark points over the entire surface.] (*Poey* .....PERLONGUS, 91.

91. LEPTOCONGER PERLONGUS.

*Neoconger perlongus* Poey, Ann. Lyc. Nat. Hist. N. Y., 67, tab. 9, fig. 3-4, 1874 (Matanzas).

*Leptoconger perlongus* Poey, Ann. Hist. Nat. Esp., 250, 1880 (Matanzas).

Habitat: West Indian fauna.

Etymology: Latin, *perlongus*, very long.

This species is known only from Poey's description.

Genus 27.—NEOCONGER.

*Neoconger* Girard, U. S. Mex. Bound. Surv., Ichth., 77, 1859 (*Mucronatus*).

Type: *Neoconger mucronatus* Girard.

Etymology: *νέος*, new; *Conger*.

This genus, like the two preceding, is composed of small eels inhabiting considerable depths of water. Two species are known.

## ANALYSIS OF THE SPECIES OF NEOCONGER.

- a. [Pectoral small. Dark reddish brown above, paler below; head small, slender, pointed; upper jaw the longer; dorsal fin beginning just in front of the vent, forming a membranous ridge until near the tail, where it expands and becomes fin-like.] (*Girard*) ..... MUCRONATUS, 92.
- aa. Pectoral well developed,  $3\frac{1}{2}$  to 4 in head. Snout anteriorly short, slightly projecting beyond mouth; mouth small, reaching slightly behind eye; teeth small, conical, uniserial in jaws, biserial anteriorly on the vomer, uniserial posteriorly; gill-slits vertical, longer than eye, a little longer than isthmus; dorsal beginning half the length of the head in advance of the vent; body not very slender, its depth  $2\frac{1}{2}$  in head; head  $3\frac{1}{2}$  in trunk; cleft of mouth  $3\frac{1}{2}$  in head; tail usually a little longer than the rest of body; tip of tongue slightly free. Color uniform, yellowish-olive on body and fins, finely dotted with black .... VERMIFORMIS, 93.

## 92. NEOCONGER MUCRONATUS.

*Neoconger mucronatus* Girard, U. S. Mex. Bound. Surv., 77, 1859 (St. Joseph Isl., Texas); Günther, VIII, 49, 1870 (copied); Goode & Bean, Proc. U. S. Nat. Mus., 155, 1879; Jordan & Gilbert, Syn. Fish. N. A., 360, 1883 (copied).

Habitat: Gulf of Mexico.

Etymology: Latin, *mucronatus*.

This species is known only from the indifferent description given by Dr. Girard. A second specimen from West Florida is said to be in the National Museum, but we have not seen it, and no description has been published. The descriptions are not sufficient to distinguish the species from *Neoconger vermiformis*.

## 93. NEOCONGER VERMIFORMIS.

*Neoconger vermiformis* Gilbert, Proc. U. S. Nat. Mus., 57, 1890 (station 3035, Lower California).

Habitat: Pacific coast of Mexico.

Etymology: Latin, *vermis*, worm; *forma*, shape.

This species is known from several specimens, the largest 6 inches long, taken by Dr. Gilbert at station 3035, off the coast of Lower California, at a depth of 30 fathoms. An additional specimen, from station 2799 off Panama, has been since received; this is considerably larger than the types and has the pectorals shorter (somewhat worn at the end), scarcely  $\frac{1}{2}$  length of head. The specimen agrees in other respects with *N. vermiformis*, and is probably of the same species.

## Genus 28.—HOPLUNNIS.

*Hoplunnis* Kaup, Aale Hamburg. Museum, 19, 1859, (*schmidtii*.)

Type: *Hoplunnis schmidtii*, Kaup.

Etymology: ὄπλον, armature; ὕνις, vomer; correctly written *Hoplunnis*.

This genus contains a single species.

ANALYSIS OF THE SPECIES OF HOPLUNNIS.

- a. [Tail about four times as long as rest of body; eye 3 in snout; posterior portion of vertical fins black.] (*Kaup per Günther*) ..... SCHMIDTII, 94.

94. HOPLUNNIS SCHMIDTII.

*Hoplunnis schmidtii* Kaup, Aale Hamb. Mus., 19, taf. 2, fig. 4, 1859 (Puerto Cabello) (*vide* Günther); Günther, VIII, 49, 1870.

Habitat: Atlantic coast of Central America.

Etymology: A personal name.

This species is known to us only from Kaup's account as quoted by Dr. Günther

Genus 29.—MURÆNESOX.

*Murænesox* McClelland, Calcutta Journ. Nat. Hist., IV, 405, 1843 (*cinereus*).

*Cynoponticus* Costa, Fauna Napoli Pesci., 1850, tav. 28 (*ferox* = *savanna*).

*Brachyconger* Bleeker, Nederl. Tijdschr. Dierkunde, 11, 231, 1865 (*savanna*).

*Congresox* Gill, Proc. U. S. Nat. Mus., 234, 1890 (*talabon*).


Type: *Muræna cinerea* Forskål.


Etymology: *Muræna*; *esox*, pike.

This genus contains numerous species, large, conger-like eels, some of which are found in all warm seas. They are remarkable for the strong armature of the vomer.

There seems to be no doubt that the group called *Cynoponticus* and *Brachyconger* is generically identical with the type of *Murænesox*, but the group called *Congresox*, from the East Indies, having the vomerine teeth acutely conic, is somewhat different, and should perhaps be recognized as a distinct genus.

ANALYSIS OF THE AMERICAN SPECIES OF MURÆNESOX.

- a. Median teeth on vomer enlarged, compressed, cultrate; median teeth on side of lower jaw also enlarged and compressed or bluntish. (MURÆNESOX.)
- b. Middle series of teeth on vomer not distinctly tricuspidate; pectoral rather more than half head; vomer with a median row of about 15 very large, strong teeth, which are much compressed, the tip angular and directed backwards, and with a nick on the posterior edge, thus ; one or two of the anterior teeth only slightly tricuspidate; on each side of the median row on vomer some very small, blunt teeth, disappearing anteriorly, arranged in one or two rows very close to the median row; jaws with one or two outer rows of small, blunt teeth, next a row of rather large, wedge-shaped teeth, and then an inner band of small, conical, blunt teeth in two, three, or four series; front of both jaws with groups of canines, which are shorter than the pupil of the eye; in old examples the teeth, especially those on the vomer, are often so worn that their original form is not at all evident; head 2 in trunk, 3½ in tail; pectoral fin twice in the distance between the tip of snout and the base of the fin; eye 2½ in the snout, 1½ in interorbital width, 3½ in cleft of mouth, situated a little behind middle of gape; cleft of mouth 2½ in the head; gill-opening large, containing the isthmus twice; dorsal beginning over the gill-openings. Olive brown above, dull whitish below; dorsal and anal light brown with a dark margin; caudal and pectoral fins black .. CONICEPS, 95.

bb. Median series of teeth on vomer distinctly tricuspidate in the young, becoming entire with age, with nearly even surface, thus, ; pectoral as long as maxillary,  $2\frac{2}{3}$  in head; eye 2 in snout, which is  $4\frac{1}{2}$  in head; dorsal inserted over the gill-opening. Brown above, silvery below; dorsal and anal edged with black.

SAVANNA, 96.

#### 95. MURÆNESOX CONICEPS.

*Murænesox coniceps* Jordan & Gilbert, Proc. U. S. Nat. Mus., 348, 1881 (Mazatlan); Jordan, Cat. Fish. N. A., 55, 1885.

Habitat: Pacific coast of tropical America, Mazatlan to Panama.

Etymology: Latin, *conus*, cone; *ceps*, headed.

This species is generally common on the Pacific coast of tropical America, where it reaches a length of 2 or 3 feet. Our specimens are from Mazatlan, Panama, and off the coast of Colombia.

The species is very close to the next, and the difference in dentition, well marked in young examples, seems to be wholly lost in the adult.

#### 96. MURÆNESOX SAVANNA.

*Murænesox savanna* Cuvier, Règne Animal, 1828 (name only) ("La Savanne de Martinique").

*Conger savanna* Bennett, Proc. Comm. Zool. Soc., 135, 1831 (*vide* Günther).

*Murænesox savanna* Kaup, Apodes, 117, fig. 74, 1856 (South America); Günther, VIII, 47, 1870.

*Brachyconger savanna* Bleeker, Atlas des Murènes Indes Orient., IV, 20, 1864 (generic diagnosis).

*Conger brasiliensis* Ranzani, Nov. Spec. Pisc. Diss. Prima., IV, 17, tab. 13, fig. 1, 1838 (Brazil).

*Cynoponticus ferox* Costa, Fauna Napoli Pesc., tab. 28, 1850 (Naples) (*vide* Günther).

*Congrus curvidens* Richardson, Voy. Erebus and Terror, III, 1845 (no habitat); Kaup, Apodes, 117, 1856.

*Conger limbatus* Castelnau, Anim. Amer. Sud, 83, pl. 43, fig. 3, 1855 (Rio Janeiro).

Habitat: West Indian fauna from Cuba to Rio Janeiro; also occasional in the Mediterranean Sea.

Etymology: From the local name "Savanne," at Martinique.

We follow Günther in referring all the nominal species of *Murænesox* found in the Atlantic to the synonymy of *Murænesox savanna*. The specimen examined by us is from Bahia. The variations due to age in the form of large teeth on the vomer are very considerable.

#### Genus 30.—XENOMYSTAX.

*Xenomystax* Gilbert, MSS. (*atrarius*).

Type: *Xenomystax atrarius* Gilbert.

Etymology: *Ξένος*, strange; *μύσταξ*, maxilla.

This genus, which is allied to *Murænesox*, is thus described by Dr. Gilbert:

Scaleless; pectorals well developed; vertical fins large, continuous around the tail, the rays evident; dorsal beginning before base of pectorals. Gill-slits vertical and rather wide, the gill membrane continuous below the throat. Branchiostegals

apparently 11 or 12 in number, long and much curved, continuing around the posterior and upper edges of the opercles; mouth with wide lateral cleft, not extending far beyond eye; maxillaries very wide, not extending far forwards, the clasping processes applied to shaft of vomer well behind its head. Teeth all conical, slender, and sharp, mostly depressible, those in jaws in wide bands; maxillary with a deep lengthwise groove, running the entire length of the bone and dividing the band of teeth into two portions; lower jaw much shorter than upper. Posterior nostril a linear slit, midway between eye and tip of snout; the anterior is a short tube just behind the head of vomer; tongue small, with the tip free; lips undeveloped; the lateral line conspicuous.

ANALYSIS OF THE SPECIES OF XENOMYSTAX.

a. [Snout very long and slender; end of maxillary equidistant from tip of mandible and gill-opening; front of orbit over the beginning of last third of gape; long slit-like pores on margin of upper jaw, a conspicuous series on mandible and preopercle; teeth in jaws in wide bands, mostly depressible; maxillary teeth divided by a deep groove running entire length of jaw, those on inner side of groove long, close-set, rigid, in single series; mandible with much narrower and shallower groove, on the inner edge of which is a single series of very small conical teeth, directed inwards; tip of mandible enlarged to form a knob which fits into a toothless depression just behind head of vomer, the vomer extending well beyond the tip of lower jaw; teeth on head of vomer and knob of mandible similar, slightly larger than those of side of jaw; anterior part of shaft of vomer with median series of strong conical teeth, accompanied by smaller lateral series and followed by a narrower band of very small conical teeth. Head equal to trunk and  $\frac{1}{3}$  of tail; gill-openings broadly lunate, vertical length of slit  $\frac{1}{4}$  of snout, interspace  $\frac{1}{2}$  length of slit; pectorals narrow,  $\frac{1}{2}$  snout. Color very dark brown; fins black; pores of lateral line white.] (*Gilbert*) . . . . . *ATRARIUS*, 97.

97. XENOMYSTAX ATRARIUS.

*Xenomystax atrarius* Gilbert, mss. (off coast of Ecuador).

Habitat: Deep waters of the eastern Pacific.

Etymology: *Atrarius*, blackish.

A single specimen, 18 $\frac{3}{4}$  inches long, was taken by the *Albatross* off the west coast of Ecuador at about lat. 1° S., long. 81° W., 401 fathoms.

Family V.—NETTASTOMIDÆ.

This family, as understood by us, contains a few species of deep-sea eels closely allied to the *Murænesocidæ* in technical characters, but more resembling the *Nemichthyidæ* in appearance, form of the head, and in dentition. The family, which is a provisional one, may be thus defined:

Enchelycephalous eels without pectoral fins, with the tongue not free, the posterior nostrils remote from the lip, the gill-openings small, separate, and subinferior, the vent remote from the head, the tail ending in a slender tip or filament, the dorsal and anal fins moderately developed, and the jaws produced, slender, and straight, the upper the longer, and both, as also the vomer, armed with bands of sharp, close-set, recurved, subequal teeth.

Three genera are known, deep-sea fishes with fragile bodies and the thin skin charged with black pigment.

ANALYSIS OF GENERA OF NETTASTOMIDÆ.

- a. Dorsal fin low, beginning nearly above gill-opening.
- b. Nostrils lateral, the posterior slit-like and placed just in front of eye; snout without fleshy tip..... CHLOPSIS, 31.
- bb. Nostrils nearly superior, the posterior above and in front of eye, the anterior at tip of bony portion of snout; head with numerous mucous pores.
- c. Snout without a fleshy proboscis, the anterior nostrils near its tip.  
NETTASTOMA, 32.
- cc. Snout with a long, slender, fleshy tip or proboscis, at the base of which are the anterior nostrils..... VENEFICA, 33.

Genus 31.—CHLOPSIS.

*Chlopsis* Rafinesque, Indice Ittiol. Sicil., 58, 1810 (*bicolor*).

*Saurenehelys* Peters, Berliner Monatsberichte, 397, 1864 (*caucrivora*).

Type: *Chlopsis bicolor* Rafinesque.

Etymology: *χλόη*, a green twig; *ᾠψις*, appearance.

This genus is based on a single little-known species from the Mediterranean to which another has been recently added. It is not very different from *Nettastomc*, apparently differing in the position of the nostrils.

ANALYSIS OF THE SPECIES OF CHLOPSIS.

- a. (Head  $2\frac{1}{2}$  in head and trunk; eye  $\frac{1}{2}$  length of snout; upper jaw the longer; vertical fins with a black margin posteriorly; peritoneum silvery.) (*Peters, per Günther*)..... BICOLOR, 98.
- aa. [Head  $2\frac{3}{4}$  in head and trunk; eye  $3\frac{1}{2}$  in snout; body extremely slender, tapering posteriorly to a very narrow tail, which is, however, not filamentous; head long and slender, lower jaw shorter than the upper; eye nearly over angle of mouth; posterior nostril a long horizontal slit immediately in front of lower margin of eye; series of slit-like mucous pores along upper jaw; series of round pores along lower jaw; transverse series on occiput; both jaws and vomer with wide bands of short, sharp conical teeth, inner series on jaws slightly longer than the other; bands on shaft of vomer reaching back to front of posterior nostril; gill-openings with their margins much curved, forming  $\frac{1}{2}$  of a circle, their vertical diameter nearly equal to that of eye, and more than twice the length of the interspace; gape  $2\frac{3}{4}$  in head; head  $2\frac{3}{4}$  in head and trunk; body  $3\frac{1}{2}$  in tail; eye  $3\frac{1}{2}$  in snout; dorsal beginning  $1\frac{1}{2}$  length of head behind the same. Color dusky-olive, dotted with coarse brown specks everywhere except on under side of head and fins: blackish streak on median line of belly; fins translucent.] (*Gilbert*)  
EQUATORIALIS, 99.

98. CHLOPSIS BICOLOR.

*Chlopsis bicolor* Rafinesque, Indice Ittiol. Sicil., 59, 1810 (Palermo).

*Saurenehelys caucrivora* Peters, Monatsber. Akad. Wiss. Berl., 397, 1864 (Mediterranean) (*vide* Günther); Günther, VIII, 48, 1860 (copied).

Habitat: Mediterranean Sea.

Etymology: Latin, two-colored.

This species is known to us only from the scanty description of Peters. The equally scanty description and poor figure given by Rafinesque of his *Chlopsis bicolor* seems to belong to the same species, and we have therefore substituted Rafinesque's name for the preferable name given by Peters.

99. *CHLOPSIS EQUATORIALIS*.

*Chlopsis equatorialis* Gilbert, mss.

Habitat: Deep waters of eastern Pacific.

Etymology: From the equator.

[This species has not the appearance of a deep-sea eel, though the intestine protruded through the anus in the type specimen, as the result of the release of pressure. It is described from a single specimen, 14½ inches long, taken by the *Albatross* off the coast of Ecuador at about lat. 1° S., long. 81° W., in 401 fathoms.] (Gilbert.)

## Genus 32.—NETTASTOMA.

*Nettastoma* Rafinesque, Caratteri, etc., 66, 1810 (*melanurum*).

*Hyoprorus* Kölliker, Verh. Phys. Med. Ges. Würzb., IV, 101, 1854 (*messinensis* = larva of *melanurum*).

Type: *Nettastoma melanurum* Rafinesque.

Etymology: *Νῆττα*, duck; *στόμα*, mouth.

This genus contains two or three species from the deeper parts of both oceans.

## ANALYSIS OF EUROPEAN SPECIES OF NETTASTOMA.

- a. (Cleft of the mouth extending to below the hind margin of eye; dorsal fin commencing immediately behind the gill-openings; tail long, nearly twice as long as body; fins with a black margin posteriorly; peritoneum black.) (Günther.)  
MELANURUM, 100.

## 100. NETTASTOMA MELANURUM.

(SORCIÈRE.)

*Nettastoma melanurum* Rafinesque, Caratteri, 66, 1810 (Sicily); Günther, VIII, 48, 1870 (Nice); Doderlein, Atti. Acc. Soc. 58, 1877 (Palermo); Giglioli, Cat. Anf. e Pesci Ital., 47, 1880 (Nice, Palermo); Vinciguerra, Ann. Mus. Civ. St. Nat. Genova, 585, 1883; Günther, Voy. Challenger, XXII, 253, 1887, and of European writers generally.

*Muranophis saga* Risso, Ichth. Nice, 370, pl. 10, fig. 39, 1810 (Nice).

*Hyoprorus messinensis* Kölliker, Verh. Phys. Med. Gesellschafts. Würzburg, IV, 101, 1854 (Messina; larval form); Vaillant, Expéd. Travailleur et Talisman, 95 (Morocco).

? *Nettastoma brevirostre* Facciolá, "Nat. Sicil., VI, 166, pl. III, f. 3, Sicily," 1887 (*fidæ* Zoölogical Record).

Habitat: Mediterranean Sea.

Etymology: *Μελάζ*, black; *οὐρά*, tail.

This species is not rare in the deeper parts of the Mediterranean. According to Risso, its flesh has a disagreeable odor. Another species, *Nettastoma brevirostre* Facciolá, has been described from the Mediterranean, but we have not seen the description.

## Genus 33.—VENEFICA.

*Venefica* Jordan & Davis, gen. nov. (*procerum*).

Type: *Nettastoma procerum* Goode & Bean.

Etymology: *Venefica*, sorceress, from the name *Sorcière* used at Nice for *Nettastoma melanurum*.

This genus contains two known species, from the depths of the Atlantic and Pacific Oceans. They differ from *Nettastoma* only in the presence of a fleshy tip to the snout.

## ANALYSIS OF SPECIES OF VENEFICA.

- a. [Tail twice as long as head and trunk; body very elongate, compressed, especially so posteriorly; head slender, conical; upper jaw projecting an eye's diameter beyond the chin; beyond this a slender, fleshy, proboscis-like tip, whose length is twice that of the eye; snout a little more than 2 in the head: anal fin beginning at a distance from the snout, equal to  $2\frac{3}{4}$  times the length of the head; tail twice as long as rest of body, the head included. Color, dark brownish; peritoneum black.] (*Goode & Bean.*).....PROCERA, 101.
- aa. (Tail a little longer than head and trunk; nasal proboscis a flat, triangular projection half the length of snout, resembling the snout of the snake "Porte-épée," *Langaha ensifera*; teeth fine, in cardiform bands on jaws and palate; gill-openings near together; dorsal inserted nearly over the gill-openings; tail a little more than one-half the total length; head 10 in total length. Color, brown or almost black.] (*Vaillant.*).....PROBOSCIDEA, 102.

## 101. VENEFICA PROCERA.

*Nettastoma procerum* Goode & Bean, Bull. Mus. Comp. Zool., x, 5, 224, 1883 (Atlantic Ocean, lat. 33° 35' to 40° N., long. 76° W.; depth, 178 to 647 fathoms).  
Günther, Voy. Challenger, xxii, 253, 1887 (copied).

Habitat: Depths of the Atlantic.

Etymology: *Procerus*, elongate.

This species is known from three specimens obtained by the *Albatross* in the Gulf Stream off the coast of North Carolina.

## 102. VENEFICA PROBOSCIDEA.

*Nettastoma proboscideum* Vaillant, Expéd. Travailleur et Talisman, 84, 1888 (Morocco).

Habitat: Deep waters of the Mediterranean.

Etymology: Latin, having a proboscis.

The type of this species is from near Morocco.

## Family VI.—NEMICHTHYIDÆ.

(THE THREAD EELS.)

This family includes eels with the body attenuate and the jaws very slender, needle-like, and more or less recurved at tips. There are no scales; the gill-openings are separate or partly confluent; the pectoral fins are well developed (in our species, wanting in the East Indian genus *Gavialiceps*), as well as the dorsal and anal, and the nostrils are near together, in front of eye, without tube or flap.

These eels inhabit the deep seas; the species are little known and the anatomy has never been studied. Judging from external characters, their nearest relations are with the *Nettastomida*, and possibly through them with the *Muranesocida*, but the connection of *Nettastoma* with *Muranesox* is very questionable.



ANALYSIS OF GENERA OF NEMICHTHYIDÆ.

- a. Gill-openings partly confluent, rather large; vomerine teeth conspicuously enlarged.
- b. Vomerine teeth lancet-shaped, very close set; jaws moderate, the snout not longer than rest of head; vent at a distance behind head about equal to postorbital part of head; eye above angle of mouth .... SERRIVOMER, 34.
- bb. Vomerine teeth conical; jaws very long, attenuate; color silvery.  
SPINIVOMER, 35.
- aa. Gill-openings distinctly separate; vomerine teeth moderate; jaws excessively attenuate, the upper longer and recurved; tail probably always normally with a filiform tip; (truncate in injured specimens; short and band-like in translucent larvæ).
- c. Vent remote from the head, at a distance behind pectoral more than 3 times length of that fin; color black.
- d. Gill-slits very small, inferior, well separated; dorsal commencing above vent; (tail truncate); jaws moderate..... CYEMA, 36.
- dd. Gill-slits lateral, vertical, well separated; dorsal commencing above pectorals; tail filamentous; jaws long and slender; a single series of pores along lateral line ..... AVOCETTINA, 37.
- cc. Vent at the throat, at a distance behind the head less than length of pectoral; anal fin beginning below middle of pectorals; body very long and slender, most of the dorsal rays very slender, nearly free, appearing like slender spines; jaws very slender, not expanded at tip.
- e. (Tail truncate, the result of mutilation?); a single row of pores along lateral line; color black ..... LABICHTHYS, 38.
- cc. Tail always ending in a long filament; two or three rows of pores along lateral line; color dusky silvery, darker below ..... NEMICHTHYS, 39.

Genus 34.—SERRIVOMER.

*Serrivomer* Gill & Ryder, Proc. U. S. Nat. Mus., 260, 1883 (*beani*).

Type: *Serrivomer beani* Gill & Ryder.

Etymology: Latin, *serra*, saw; *vomer*.

This genus contains a single species, from the deep waters of the Atlantic.

ANALYSIS OF THE SPECIES OF SERRIVOMER.

- a. [Stoutest of the family, with much shorter jaws than any other, and with a very formidable vomerine armature; depth of head at vertical from mandibular articulation contained 37 times in the total length; greatest height 29½ in total length.] (*Gill & Ryder*) ..... BEANI, 103.

103. SERRIVOMER BEANI.

*Serrivomer beani* Gill & Ryder, Proc. U. S. Nat. Mus., 261, 1883 (Atlantic).

Habitat: Atlantic Ocean (lat. 41° 40' 30'', long. 65° 28' 30'').

Etymology: Named for Tarleton H. Bean.

This species is known from the brief description given by Dr. Gill.

Genus 35.—SPINIVOMER.

*Spinivomer* Gill & Ryder, Proc. U. S. Nat. Mus., 261, 1883 (*goodei*).

Type: *Spinivomer goodei* Gill & Ryder.

Etymology: Latin, *spinus*, spine; *vomer*.

This genus contains, so far as known, a single species from the deep sea.

ANALYSIS OF THE SPECIES OF SPINIVOMER.

- a. [Silvery; recognizable also from its smaller eye and deeper mandibles, greatest height of body at the branchial regions contained 52 times in total length; rays ensheathed in a tough membrane.] (*Gill & Ryder*)..... GOODEI, 104.

104. SPINIVOMER GOODEI

*Spinivomer goodei* Gill & Ryder, Proc. U. S. Nat. Mus., 261, 1883 (Atlantic).

Habitat: Atlantic Ocean (lat. 38° 19' 26", long. 68° 20' 20").

Etymology: Named for George Brown Goode.

This species was taken by the *Albatross* in the Atlantic.

Genus 36.—CYEMA.

*Cyema* Günther, Ann. & Mag. Nat. Hist. II, 251, 1878 (*atrum*).

Type: *Cyema atrum* Günther.

Etymology: *Κορυμα*.

The name *Cyema* is based on a single species apparently allied to *Nemichthys* and still more closely to *Avocettina*, from which it differs in the more posterior position of the vent, in the form of the tail, which is not surrounded by a fin, and especially in the very small, inferior gill-slits. The peculiar soft band-like form of the body in *Cyema atrum* is probably not characteristic of the species when adult, the type being probably in a larval or leptocephalous stage.

ANALYSIS OF THE SPECIES OF CYEMA.

- a. [Dorsal fin commencing nearly opposite the vent; body compressed, soft, and short; the depth contained 12 times in the body, the head not included; eye minute; upper jaw tapering into a very long, slender beak; teeth on jaws in broad bands; gill-openings very small, close together at the lower surface of the body, immediately in front of base of pectorals, at some distance from angle of lower jaw; vent midway between angle of mouth and end of tail; dorsal commencing nearly over vent; pectoral fin well developed, its distance from eye  $\frac{2}{3}$  of that from vent. Coloration uniform black.] (*Günther*)..... ATRUM, 105.

105. CYEMA ATRUM.

*Cyema atrum* Günther, Ann. & Mag. Nat. Hist., II, 251, 1887; Günther, Voy. Challenger, XXII, 265, pl. LIV, fig. D (South Pacific, 1500 fathoms; Antarctic Ocean, 1800 fathoms); Vaillant, Expéd. Travailleur et Talisman, 91, pl. 8, fig. 4, 1888 (coast of Morocco).

Habitat: Atlantic and Pacific in deep water.

Etymology: Latin, *ater*, black.

This singular fish is known only from the accounts given by Günther and Vaillant. It seems probable that its peculiar form is due to its imperfect development, and that it is a larval *Nemichthyid*.

## Genus 37.—AVOCETTINA.

*Avocettina* Jordan & Davis, gen. nov. (*infans*).

Type: *Nemichthys infans* Günther.

Etymology: From *Avocetta*, the avocet or *Recurvirostra*.

This genus is based on a species allied to *Nemichthys*, but differing notably in the position of the vent. A second species, imperfectly known, is doubtfully assigned to the same group.

## ANALYSIS OF THE SPECIES OF AVOCETTINA.

- a. Eye rather large, contained 2 to 3 times in the distance between eye and pectoral; jaws long and filamentous, upper jaw 4 times the length of rest of head; both jaws covered with very fine recurved teeth; pectoral fin about as long as the head is high; gill-openings a little less than eye; postorbital part of head contained about 4 times in trunk; dorsal beginning over pectorals, consisting of very delicate rays; trunk contained at least 13 times in tail; greatest depth of body about equal to head without snout. Color uniform black, jaws lighter.
- INFANS, 106.
- aa. [Eye minute; upper jaws short, scarcely as long as rest of head; trunk longer than head; tail with trunk  $\frac{1}{5}$  of whole length.] (*Vaillant*) ..... RICHARDI, 107.

## 106. AVOCETTINA INFANS.

*Nemichthys infans* Günther, Ann. and Mag. Nat. Hist., 24, 1878 (mid-Atlantic 2,500 fathoms); Günther, Voyage Challenger, XXII, 264, 1884 (mid-Atlantic 2,500 fathoms; off Pernambuco 500 fathoms; Mona Channel, West Indies, 814 fathoms).

*Labichthys gilli* Bean, Proc. U. S. Nat. Mus., 45, 1890 (east of Prince of Wales Island, 56° 20' N, 136° 20' W, depth 1,569 fathoms).

Habitat: Deep waters of Atlantic and Pacific.

Etymology: Latin, *infans*; immature.

Our description is taken from a specimen collected by Dr. Gilbert on the west coast of Alaska. In Dr. Gilbert's opinion, the species called *gilli* is identical with *infans*.

## 107. AVOCETTINA RICHARDI.

*Nemichthys infans* Vaillant, Expéd. Trav. et Talis., 95, pl. VII, fig. 1, 1a, 1888 (Azores).  
*Nemichthys richardi* Vaillant, op. cit., Appendix, 93, 1888.

Habitat: Deep water off the Azores.

Etymology: Named for M. Richard.

This species is known from the account given by Vaillant, based on an imperfect specimen.

## Genus 38.—LABICHTHYS.

*Labichthys* Gill & Ryder, Proc. U. S. Nat. Mus., 261, 1883 (*carinatus*).

Type: *Labichthys carinatus* Gill & Ryder.

Etymology:  $\lambda\alpha\beta\gamma$ , grip or hold, correlated with  $\lambda\alpha\beta\epsilon\varsigma$ , forceps;  $\iota\chi\theta\acute{\upsilon}\varsigma$ , fish.

This genus is based on two species from deep waters of the Atlantic. The scanty description does not show any important difference from *Nemichthys*, if we suppose, as is probable, that the truncate tail is the result of mutilation.

## ANALYSIS OF THE SPECIES OF LABICHTHYS.

- a. [The ridges that bound the median rostral groove converging and forming a carina along the median line in vertical from the anterior border of the orbit; greatest height  $34\frac{1}{2}$  in total length. Color black.] (*Gill & Ryder.*) [Dorsal beginning over base of pectoral; vent close behind the pectorals]. (*Bean.*)....CARINATUS, 108.
- aa. [The ridges that bound the rostral groove not confluent backwards in a carina-form extension, but ending in a vertical from the orbit; greatest height of body 36 in a total length. Color black.] (*Gill & Ryder.*) .....ELONGATUS, 109.

## 108. LABICHTHYS CARINATUS.

*Labichthys carinatus* Gill & Ryder, Proc. U. S. Nat. Mus., 253, 255, 261, 1883 (Atlantic).

Habitat: Atlantic Ocean, lat.  $41^{\circ} 13'$ , long.  $65^{\circ} 33' 30''$ .

Etymology: Latin, *carinatus*, keeled.

This species is known only from the scanty description of Gill & Ryder. According to Bean it agrees with *Nemichthys* in the position of its vent.

## 109. LABICHTHYS ELONGATUS.

*Labichthys elongatus* Gill & Ryder, Proc. U. S. Nat. Mus., 262, 1883 (Atlantic).

Habitat: Atlantic Ocean, lat.  $39^{\circ} 22'$ , long.  $68^{\circ} 34' 30''$ .

Etymology: Latin, *elongatus*, elongate.

This species is known only from the original diagnosis. The position of the vent is not stated.

## Genus 39.—NEMICHTHYS.

*Nemichthys* Richardson, Voyage Samarang, 16, 1848 (*scolopaceus*).

*Leptorhynchus* Lowe, Ann. Mag. Nat. Hist., x, 54, 1852 (*leuchtenbergi*) (preoccupied).

*Belonopsis* Brandt, Mém. Ac. St. Petersb., Savans Étrangers, 174, 1854 (*leuchtenbergi*).

Type: *Nemichthys scolopaceus* Richardson.

Etymology: *Νίμα*, thread; *ἰχθῆς*, fish.

This genus contains one or two species of long and very slender eels living in deep water, though perhaps nearer the surface than the members of related genera.

## ANALYSIS OF THE AMERICAN SPECIES OF NEMICHTHYS.

- a. (Head comparatively stout, its depth one-seventh its greatest length; eye moderate, less than one-third the length of head without snout; length of pectoral slightly less than height of anal. Pale above, belly and anal fin blackish, the color not abruptly changing; back somewhat speckled.).....SCOLOPACEUS, 110.

- aa. Head slenderer, its depth one-ninth its greatest length; eye large, one-third the head without snout; length of pectoral scarcely greater than height of anal, head 12, depth 58, in total length. Translucent; belly with close-set dark spots; its lower edge and anal fin black, the back abruptly white and unspotted.

AVOCETTA, 111.

110. NEMICHTHYS SCOLOPACEUS.

*Nemichthys scolopacca* Richardson, Voy. Samarang, 25, 1848 (South Atlantic) (*vide* Günther); Günther, VIII, 21, 1870 (Madeira); Peters, Monatsber. Akad. Wiss., 849, 1876 (New Guinea); Goode & Bean, Bull. Essex Inst., 26, 1879 (George's Bank); Goode, Proc. U. S. Nat. Mus., 485, 1880 (south of coast of New England); Goode & Bean, Bull. Mus. Comp. Zool., 225, 1883; Jordan & Gilbert, Syn. Fish. N. A., 366, 1883; Günther, Voy. Challenger, XXII, 263, 1887 (Madeira).

*Leptorhynchus leuchtenbergii* Lowe, Mém. Soc. Savans Étrangers, Petersburg, 171, 1854 (Madeira).

*Belonopsis leuchtenbergii* Brandt, Mém. Soc. Sav. Étr., Petersb., 174, 1854 (with good plate) (Madeira).

Habitat: Deep waters of Atlantic.

Etymology: Latin, *scolopax*, snipe.

This species is not rare in the North Atlantic, large numbers having been taken with the trawl off the coast of New England.

111. NEMICHTHYS AVOCETTA.

*Nemichthys avocetta* Jordan & Gilbert, Proc. U. S. Nat. Mus., 409, 1880 (Puget Sound); Jordan & Gilbert, Proc. U. S. Nat. Mus., 37, 1881; Bean, *ibid.*, 266 (Puget Sound); Jordan & Gilbert, Syn. Fish. N. A., 367, 1883; Günther, Voy. Challenger, XXII, 263, 1887 (copied).

Habitat: Pacific coast of United States.

Etymology: From the Avocet (*Recurvirostra*).

Of this species a single specimen, 22 inches long, is known. It was taken near Seattle on Puget Sound, swimming near the surface. Its movements in life were very active. It is not unlikely that this species will prove identical with *Nemichthys scolopaceus*, which it greatly resembles.

Family VII.—HETEROCONGRIDÆ.

This group consists of the single genus, *Heteroconger*. It appears to form a family distinct from the *Congridæ*, if the naked *Enchelycephalous* eels are not all to be referred to one family.

The genus is thus defined by Dr. Günther:

ANALYSIS OF GENERA OF HETEROCONGRIDÆ.

- a. Body and especially tail exceedingly elongate, subcylindrical, scaleless; tail compressed; snout obtuse, very short, with the cleft of mouth obliquely ascending upwards, the lower jaw projecting beyond the upper; mouth small, extending to below front margin of the eye; teeth small, acicular, in narrow bands on the jaws and on the vomer; nostrils very small, in front of the eye; gill-openings lateral, narrow slits; pectoral none, vertical fins rather low; dorsal commencing at a short distance behind gill-opening.....HETEROCONGER, 36.

## Genus 40.—HETEROCONGER.

*Heteroconger* Bleeker, Versl. Med. Ak. Wet., Amsterdam, 331, 1868 (*polyzona*).

Type: *Heteroconger polyzona* Bleeker.

Etymology: "Ἐτερος, different; Conger.

This singular genus contains two species, one from the East Indies, the other from the eastern Atlantic.

## ANALYSIS OF THE SPECIES OF HETEROCONGER.

a. [Coloration uniform; head 5 in trunk; tail more than twice as long as head and trunk; eye small; vertical fins rather indistinct and low.] (*Günther*.)

LONGISSIMUS, 112.

## 112. HETEROCONGER LONGISSIMUS.

*Heteroconger longissimus* Günther, VIII, 45, 1870 (Lanzarote, Canary Islands).

Habitat: Canary Islands.

Etymology: Latin, excessively long.

This species is known to us only from Günther's description.

## Family VIII.—CONGRIDÆ.

(THE CONGER EELS.)

This family includes those eels which are scaleless, and have the tongue largely free in front, the body moderately elongate, the end of the tail surrounded by a fin, the posterior nostril remote from the upper lip and near front of eye, and the pectoral fins well developed. All the species are plainly colored, grayish or dusky above, silvery below, and the dorsal edged with black.

The three recognized genera are all represented within the limits of this paper. As, however, the osteology of most of the species is unknown, we can not say whether the *Muranesocidæ* and *Echelidæ* should really be separated from this group, or whether possibly *Heteroconger* should be included in it. Bleeker places all these genera with *Nettastoma* and *Nemichthys*, also in his family of *Congroidei*. Günther approximates *Conger* to *Anguilla*, while recognizing the allies of *Muranesox*, *Echelus*, *Heteroconger*, and *Nemichthys* as distinct subfamilies. *Nettastoma* he places with *Neoconger* and *Muranesox*.

## ANALYSIS OF GENERA OF CONGRIDÆ.

a. Vomerine teeth uniserial, some of them canine-like; maxillary teeth biserial; dorsal beginning above root of pectoral; cleft of mouth extending beyond middle of eye; tail very long and slender, about half longer than rest of body.

UROCONGER, 41.

aa. Vomerine teeth in bands, none of them canine-like; lips thick.

b. Dorsal fin beginning over the gill-opening; bones of front of head with large muciferous cavities; mouth rather small; jaws with bands of small teeth, the outer not forming a cutting edge; tail from half to two-thirds of total length.

OPHISOMA, 42.

- bb. Dorsal fin inserted at a point behind base of pectoral, but nearer pectoral than vent; head with inconspicuous mucous cavities; jaws with an outer series of close-set teeth forming a cutting edge; tail about half longer than rest of body. LEPTOCEPHALUS, 43.

Genus 41.—UROCONGER.

*Uroconger* Kaup, Apodes, 110, 1856 (*lepturus*).

Type: *Conger lepturus* Richardson.

Etymology: *ὄψα*, tail; *Conger*.

This genus contains no American species.

ANALYSIS OF EUROPEAN SPECIES OF UROCONGER.

- a. [Vomerine teeth large; two strong canines in front of vomer; lateral line distinct, with white points; cleft of mouth reaching the center of the eye; tail one-half longer than rest of body; pectoral fin  $2\frac{1}{2}$  in head; dorsal commencing over the tip of pectoral fin; body stouter than in *Uroconger lepturus*. Uniform brown.] (Vaillant.) ..... VICINUS, 113.

113. UROCONGER VICINUS.

*Uroconger vicinus* Vaillant, Expéd. Travailleur et Talisman, 86, pl. vi, 1880-83 (Coast of Soudan, Arguin, Cape Verde Islands).

Habitat: Deep waters of the eastern Atlantic.

Etymology: Latin, *vicinus*, near (to *Uroconger lepturus*).

This species is known only from Vaillant's description and figure.

Genus 42.—OPHISOMA.

† *Ariosoama* Swainson, Nat. Hist. Classn. Fishes, II, 196, 1839 (no type mentioned).

*Ophisoma* Swainson, Nat. Hist. Classn. Fishes, II, 334, 1839 (*acuta*) not *Ophisomus* Swainson, l. c., p. 277 = *Muraenoides* Lacépède.

*Conger-murana* Kaup, Apodes, 108, 1856 (*balearica*).

*Gnathophis* Kaup, Aale Hamb. Mus., 1859 (*heterognathus*).

*Congromurana* Günther, VIII, 40, 1870 (*balearica*).

*Ophisoma* Bleeker, Poey, etc.

Type: *Ophisoma acuta* Swainson = *Murana balearica* De la Roche.

Etymology: *ὄφεις*, snake; *σώμα*, body.

This genus contains numerous species of small Congers, distinguished by the more anterior insertion of the dorsal and by the greater development of the muciferous cavities in the head. The species are very closely related and are therefore not well known.

The name *Ophisoma* was given by Swainson to two eels, *O. obtusa* and *O. acuta*, which are apparently identical with *Conger* and *Ophisoma balearicum*. The name was retained by Bleeker to the present group on the supposition that these eels belonged to the group called *Conger-murana* by Kaup. It is therefore questionable whether *Congermurana* should not be used, and *Ophisoma* be made a synonym of *Conger*. As, however, one of the typical species of *Ophisoma* is a member of this genus, and as the name has been restricted to this genus by Bleeker, it seems best to use the older name.

*Ariosoma*, which is still older, we do not adopt because no species is mentioned in connection with it, and the definition is wholly inadequate for determination. Swainson distinguishes it from *Anguilla* as follows: "Spiracle before the base of the pectoral; nostrils simple." We can infer its identity with *Ophisoma* only from the fact that the latter takes the place in the systematic synopsis in the latter part of the work which *Ariosoma* has in the analytical keys. In other words, the genus which at first Swainson proposed to call *Ariosoma* he afterwards described as *Ophisoma*.

The species of this genus are very closely related. *Conger punctus* Jenyns doubtfully referred to this genus by Günther, is, as elsewhere stated, not an eel at all, but a Lycodid (*Maynea puncta*). We are indebted to Dr. Gilbert for a revision of our account of this genus.

## ANALYSIS OF EUROPEAN AND AMERICAN SPECIES OF OPHISOMA.

- a. Vent submedian; the body and tail about equal in length; upper jaw but little projecting; lips thin; head about 6 in total length; the tail a little longer than the head and trunk; eye about equal to snout, 5 in head. Color brownish or yellowish; silvery on sides and below; vertical fins with a narrow black edge. .... BALEARICUM, 114.
- aa. Vent anterior in position, the tail much longer than the body.
- b. [Snout comparatively short and heavy, blunt, and broadly rounded, projecting but little beyond tip of mandible; tail twice length of body; lips full; teeth in mandible in a broad band, those of outer series the largest; maxillary and vomerine teeth also in broad bands; vomerine patch divided by a groove into which fits the tip of the mandible; no teeth on shaft of vomer; posterior nostril an elliptical slit, on level of upper margin of pupil; anterior nostril a round pore near tip of snout; five large mucous pores on each side of jaws; gape extending slightly beyond pupil,  $2\frac{1}{2}$  in head; eye moderate,  $\frac{2}{3}$  in snout, 6 in head; head  $1\frac{1}{2}$  in trunk, 4 in tail; pectorals  $\frac{1}{2}$  length of head; origin of dorsal slightly behind base of pectorals. Color dusky above; under side of head and abdomen light, the two areas separated by a well-defined line; fins dusky, becoming black towards tip of tail, with whitish border; inside of mouth, gill cavity, and peritoneum silvery.] (*Gilbert*).....MACRURUM, 115.
- bb. Snout long and acute, projecting well beyond tip of mandible.
- c. Tail less than twice length of body.
- \*d. Eye large, equaling snout, 5 in head. [Upper lip much swollen and thickened; upper jaw pointed, much projecting beyond lower; tail considerably longer than the body; dorsal beginning immediately behind the gill-opening. Coloration uniform.] (*Günther*).....MYSTAX, 116.
- dd. [Eye small, 2 in snout,  $8\frac{1}{2}$  in head, slightly less than length of gill-slit; snout long and sharp, the acute tip projecting beyond mandible for  $\frac{1}{2}$  length of orbit; teeth villiform, in broad bands, none of them enlarged, a transverse groove behind head of vomer to receive tip of mandible; posterior nostril slit-like, the anterior with distinct membranous tube; mandibles very broad and strong; gape reaching to vertical from posterior margin of pupil,  $\frac{1}{2}$  of head; conspicuous pore just behind angle of mouth; head

\* Taken from Steindachner's description, which reads: "The point of the upper jaw projects considerably beyond the lower jaw; the angle of the mouth lies in a vertical direction from the middle of the eye; the eyes of unusual size, their diameter equaling the snout or contained 5 times in the head," etc.



equal to trunk, 3 in tail without fin; depth 13 in total length; pectoral  $3\frac{1}{2}$  in head; dorsal beginning in advance of gill-opening, its distance from tip of snout slightly less than half the distance from snout to anal. Uniform light brown; fins dusky, black near tip of tail, and there with narrow bright white margin; mouth, gill-cavity and peritoneum black.] (Gilbert)

PRORIGERUM, 117..

- cc. Tail much more than twice length of body; body slender; tail compressed; lower jaw considerably shorter than the upper; dorsal beginning slightly in advance of the root of the pectoral. Head  $1\frac{1}{2}$  in trunk,  $5\frac{1}{2}$  in tail; tail  $2\frac{2}{3}$  times as long as head and trunk; snout  $4\frac{1}{2}$  in head, very soft; eye very large, 7 in head,  $1\frac{1}{2}$  in snout; interorbital area 2 in eye; cleft of mouth  $3\frac{1}{2}$  in head, extending slightly behind middle of eye; pectoral long and narrow,  $2\frac{1}{2}$  in head,  $1\frac{1}{2}$  times as long as gill-slit. Color olivaceous, upper parts of head and body with numerous fine black dots; a silvery shade across opercles and below lateral line; peritoneum bright silvery, giving belly a pale color; dorsal and anal with a narrow black margin, below which are a few small spots; pectoral pale .....NITENS, 118.

114. OPHISOMA BALEARICUM.

*Murana balearica* De La Roche, Ann. Mus., 327, fig. 3, 1809 (*vide* Günther).  
*Conger balearicus* Costa, Faun. Nap. Pesc., tab. 29, 1845 (*vide* Günther).  
*Conger-Murana balearica* Kaup, Apodes, 110, 1856.  
*Congromurana balearica* Günther, VIII, 41, 1870 (Malta; Algiers).  
*Ophisoma balearicum* Gilbert, Proc. U. S. Nat. Mus., 1891 (Galapagos Islands).  
*Echelus ciuciara* Rafinesque, Caratteri, 65, 1810 (Sicily).  
*Murana cassini* Risso, Ich. Nice, 91, 1810 (Nice).  
*Ophisoma acuta* Swainson, Fish. Rept. Amph., II, 396, 1839 (Sicily).  
*Conaer opisthophthalmus* Ranzani, De Nov. Spec. Pisc. Dissert., Prima 16, tab. v, fig. 1, 1838 (Bahia).  
*Conger microstomus* Castelnau, Anim. Nouv. Rares, Amérique du Sud, 83, pl. 42, fig. 4, 1855 (Rio Janeiro).  
*Conger analis* Poey, Memorias, II, 318, 1860 (Havana).  
*Ophisoma analis* Poey, Repertorio, II, 248, tab. 3, fig. 3, 1866 (Havana).  
*Congromurana analis* Poey, Enumeratio, 152, 1875 (Havana).  
*Conger impressus* Poey, Mem. Cub., II, 318, 1860 (Cuba).  
*Ophisoma impressus* Poey, Repertorio, II, 248, 1866.  
*Congromurana impressa* Poey, Enumeratio, 152, 1875.  
*Congromurana mellissii* Günther, VIII, 42, 1870 (St. Helena).  
*Leptocephalus conger* Jordan & Gilbert, Proc. U. S. Nat. Mus., 378, 1883 (Cape St. Lucas).

Habitat: Mediterranean Sea and both Atlantic and Pacific shores of tropical America.

Etymology: From the Balearic Islands.

This species is not rare in the Mediterranean Sea, and apparently extends to both the Atlantic and Pacific shores of tropical America. As it now stands the range of the species is wide, and there may prove, upon comparison of specimens from different parts of the range, to be specific differences; as yet no such comparison has been made. The specimens before us are from Palermo, and from the Bonaparte collection without locality. We have compared these with Poey's account of the Cuban species called *impressus*, and can find no difference. *Conger analis* Poey, also from Cuba, seems to differ only in the slightly larger

mouth and stronger teeth, and is probably identical with *impressus*. *Congromurana mellissii* Günther seems to belong here rather than under the synonymy of *mystax*, where it is placed by Dr. Steindachner. *Conger opisthophthalmus* and *Conger microstomus* seem to be the same, and specimens recently obtained by Dr. Gilbert from the Galapagos Islands seem referable to this species. Should the American species prove different, it will stand as *Ophisoma opisthophthalmus*.

#### 115. OPHISOMA MACRURUM.

*Ophisoma macrurum* Gilbert, mss. (Gulf of California).

Habitat: Gulf of California.

Etymology: *Μακρός*, long; *ὄψα*, tail.

One specimen, 9½ inches long, was obtained by Dr. Gilbert in the Gulf of California.

#### 116. OPHISOMA MYSTAX.

*Murana mystax* De La Roche, Ann. Mus., 328, fig. 10, 1809 (Barcelona) (*vide* Günther).

*Conger mystax* Risso, Eur. MÉR., III, 203, 1826.

*Congermurana mystax* Kaup, Apodes. 110, 1856 (copied).

*Congromurana mystax* Günther, VIII, 43, 1870; Steindachner, Ich. Beiträge, XII, 2, 1872 (Spalato).

*Echelus nebulosus* Rafinesque, Caratteri, 64, 1810 (Sicily).

Habitat: Mediterranean Sea and eastern Atlantic.

Etymology: *Μβάραξ*, upper lip; the original type having a thick and swollen upper lip.

This species is known to us only from descriptions. According to Steindachner, *Congromurana mellissii* is identical with *Conger mystax* of De La Roche. The differences between *mystax* and *balearicum*, however, seem to lie in the swollen lips, the greatly projecting upper jaw, and the longer tail of the former, and in these respects *mellissii* wholly agrees with *balearicum*.

#### 117. OPHISOMA PRORIGERUM.

*Ophisoma prorigerum* Gilbert, mss. (Panama; Ecuador). [Two specimens: one 10½ inches long from off the coast of Ecuador; the other from the Bay of Panama.] (Gilbert.)

Habitat: Pacific coast of tropical America.

Etymology: *Prora*, prow; *gero*, I bear.

#### 118. OPHISOMA NITENS.

*Ophisoma nitens* Jordan & Bollman, Proc. U. S. Nat. Mus., 153, 1890 (off Bay of Panama, 8° 47' N., 79° 29' 30" W., in 14 fathoms).

Habitat: Pacific coast of tropical America.

Etymology: Latin, *nitens*, shining.

This species is known from one specimen dredged by the *Albatross* at station 2801, off Panama.

## Genus 43.—LEPTOCEPHALUS.

## (a) ADULT FORMS.

- Echelus** Rafinesque, *Caratteri*, etc., 63, 1810 (includes species of *Conger*, *Ophisoma*, and *Myrus*; restricted by Bleeker to *Myrus*).
- Echelus** Jordan, *Manual Vert.*, ed. v, 90, 1888 (*conger*) (not *Echelus* Rafinesque as restricted by Bleeker).
- Conger** Cuvier, *Règne Animal*, ed. II, 1827 (*conger*).
- Congrus** Richardson, *Voyage Erebus and Terror*, 1844, 107 (*conger*).
- Conger** Bleeker, Günther, etc. (*conger*).

## (b) LARVAL FORMS.

- Leptocephalus** Gmelin, *Syst. Nat.*, 1150, 1788 (*Morrissi*: a larval form, probably of *Conger conger*); Risso, *Europe Méridionale*, 201, 1826.
- Oxyurus** Rafinesque, *Caratteri*, 19, 1810 (*vermiformis*, a larva).
- Helmictis** Rafinesque, *Indico d'Ittiologia Siciliana*, 62, 1810 (*punctatus*) a larva.
- Helmichthys** Costa, *Fanna Napoli, Pesci (diaphanus)*.
- ?? **Leptocephalichthys** Bleeker, *Act. Soc. Sci. Ind. Veerl.*, 1, Manado., 69 (*hypselsoma*).
- ?? **Diaphanichthys** Peters, *Monatsber. Ak. Wiss. Berl.*, 399, 1864 (*brevicaudus*).

Type: *Muræna conger* L.

Etymology: λεπτός, slender; κεφαλή, head.

This genus contains the well known and widely distributed *Conger* eel and three or four closely related species. The earliest generic name used for members of the group is that of *Leptocephalus*, based on a curious, elongate, transparent, band-like creature with minute head and very small mouth, found in the waters of Europe, and known as *Leptocephalus morrissi*. This has been shown by Gill and Günther to be the young and larval form of *Conger conger*. A number of genera and species of the supposed family of *Leptocephalidae* have been described, but there is no doubt that all of them are larvæ, some of eels as *Conger* and *Nettastoma*, others of Isospondylous fishes, as *Albula*, *Elops*, *Alepocephalus*, *Stomias*, *Fierasfer*. Whether these forms are normal young or individuals abnormally arrested in development is not certain. Dr. Günther inclines to the latter opinion, but the observations of Dr. Gilbert on the leptocephalous forms of *Albula*, *Elops*, and *Conger* seem to point to the former conclusion. For a full discussion of these larval forms see Günther, VIII, 136.

Although as the name *Leptocephalus* has been associated for more than a century with these larval forms it is a decided inconvenience to accord to it precedence as a generic name over *Conger*. The strict law of priority, however, demands its retention, and the tendency among systematic zoölogists is to recognize as few exceptions as may be to this rule.

The fish described by Jenyns from Tierra del Fuego under the name of *Conger punctus* (*Voyage of the Beagle, Fishes*, 143, 1842), and doubtfully referred by Günther to *Congromuræna (Ophisoma)* is not an eel at all, but belongs to the *Lycodidae* and is apparently identical with *Maynea patagonica* (Cunningham). It may stand as *Maynea puncta*.

## ANALYSIS OF THE AMERICAN SPECIES OF LEPTOCEPHALUS.

- a. [Dorsal beginning the length of pectoral behind the extremity of that fin. Uniform brown; vertical fins with black edge.] (*Günther*).....MULTIDENS, 119.
- aa. Dorsal beginning opposite to or just behind the tip of the pectoral; eye  $1\frac{1}{2}$  in snout, 5 to 6 in head; snout  $3\frac{1}{2}$  to 4 in head; gape extending nearly or quite to posterior margin of eye; head  $1\frac{1}{2}$  to  $1\frac{1}{4}$  in trunk; tail longer than rest of body; pectorals  $3\frac{1}{2}$  in head; upper lip full, with conspicuous pores. Ashy gray or blackish; vertical fins with a black margin; body sometimes (var. *niger*) entirely black.....CONGER, 120.
- aaa. Dorsal fin beginning above the middle of pectorals; eye as long as snout,  $4\frac{1}{2}$  in head; gape extending to beyond the middle of the eye; head  $1\frac{1}{2}$  to  $1\frac{1}{4}$  in trunk; tail longer than rest of body; pectorals 3 to  $3\frac{1}{2}$  in head. Brown, vertical fins with a broad black margin, which is again edged with white; the dorsal black anteriorly for  $\frac{2}{3}$  its depth.....CAUDILIMBATUS, 121.

## 119. LEPTOCEPHALUS MULTIDENS.

- Conger multidens* Castelnau, Anim. Amor. Sud, 84, pl. 44, fig. 1, 1855 (Rio Janeiro); Kaup, Apodes, 114, 1856 (copied); *Günther*, VIII, 40, 1870 (copied).
- Conger brasiliensis* Kaup, Apodes, 115, 1856 (Brazil) (not of Ranzani).

Habitat: Coast of Brazil.

Etymology: Latin, *multus*, many; *dens*, tooth.

This species is known to us only through descriptions.

## 120. LEPTOCEPHALUS CONGER.

(THE COMMON CONGER; CONGER EEL.)

(a) ADULT FORMS.

- Murana supremo margine pinnae dorsalis nigro* Artedi, Synon., 40, 2, 1738 (Mediterranean).
- Murana conger* Linnæus, Syst. Nat., ed. X., 245 (based on Artedi, and of the early copyists).
- Conger conger* Jordan, Proc. U. S. Nat. Mus., 370, 1865 (Havana).
- Murana nigra* Risso, Ich. Nice, 93, 1810, (Nice).
- Conger niger* Risso, Eur. MÉR., 201, 1826 (black variety) (Nice).
- Conger vulgaris* Cuvier, Règne Animal, ed. II, 1827; *Günther*, VIII, 38, 1870, and of European writers generally.
- Anguilla oceanica* Mitchell, Jour. Acad. Nat. Sci. Phila., 407, 1818.
- Conger verus* Risso, Eur. MÉR., III, 201, 1826 (Nice).
- Ophisoma obtusa* Swainson, Fish., Rep., and Amph., II, 395, 1839 (Sicily).
- Conger orbignyanus* Valenciennes, D'Orbigny, Voy. Am. MÉRID., Poiss., pl. 12, 1 (South America); Kaup, Apodes, 115, 1856 (copied).
- Conger rubeccens* Ranzani, De Novis Spec. Pisc. Diss. Prima, 1838, 19, tab. v, fig. 5 (Mediterranean Sea).
- Conger occidentalis* DeKay, Fishes, N. Y., 314, pl. 53, fig. 172, 1842 (New York).
- Congrus leucophaeus* Richardson, Voy. Ereb. and Terror, Fish., 108, 1844 (*vide* *Günther*.)
- Conger verreauxi* Kaup, Apodes, 115, 1856 (no habitat).
- Conger oceanicus* Gill, Cat. Fishes E. C. N. A., 1871, and of several American authors.
- Conger esculentus* Poy, Memorias, II, 346, 1860 (Cuba).

(b) LARVAL FORMS (*Leptocephalus*).

The following list includes most of the larval Congers and other eels described under the name of *Leptocephalus*. Probably none are valid species, but only a few have been positively identified:

- Leptocephalus morrissi* Gmelin, Syst. Nat., 1150, 1788 (Holyhead, England); *Günther*, VIII, 139, 1870 (a true Conger).
- Ophidium pellucidum* Couch, Loud. Mag. Nat. Hist., v, 313, 742 (England) (Conger).

- Lepidopus pellucidus* Risso, Ichthy. Nice, 152, pl. 5, fig. 19, 1810 (Nice).  
*Leptocephalus spallanzani* Risso, Eur. Mérid., III, 205, 1826 (Mediterranean).  
*Leptocephalus gussoni* Cocco, Isis., 1340, 1831 (Mediterranean).  
*Leptocephalus candidissimus* Costa, Faun. Nap. Pesci, C. tab. (Naples).  
*Leptocephalus bibronii* Kaup, Apodes, 149, fig. 12, 1856.  
*Leptocephalus gegenbauri* Kaup, Apodes, 149, fig. 11, 1856 (Messina).  
*Leptocephalus köllikeri* Kaup, Apodes, 148, fig. 10, 1856 (Messina).  
*Leptocephalus longirostris* Kaup, Apodes, 150, fig. 14, 1856 (Messina).  
*Leptocephalus punctatus* Kaup, Apodes, 148, fig. 8, 1856 (Nice).  
*Leptocephalus brevirostris* Kaup, Apodes, 150, fig. 15, 1856 (Messina).  
*Helmichthys diaphanus* Costa, Faun. Napol. Pesc., tab. 31 (Naples).  
*Leptocephalus gracilis* Storer, Mem. Am. Ac., II, 524 (Massachusetts).  
*Leptocephalus diaphanus* Kaup, Apodes, 148, fig. 9, 1856 (Messina).  
*Leptocephalus yarrelli* Kaup, Apodes, 149, fig. 13, 1856 (Messina).  
*Leptocephalus hackeli* Kaup, "Ann. and Mag. Nat. Hist., VI, 270, pl. 3, fig. B, 1860"  
(Messina).  
*Leptocephalus multimaculatus* Steindachner, Ich. Notiz, IX, 27, 1869 (Peru).  
*Leptocephalus peruanus* Steindachner, l. c., 28 (Peru).  
*Leptocephalus affinis* Facciola, Atti. Soc. Tosc., 4, fig. 1, 1884 (Straits of Messina).  
*Leptocephalus inornatus*, l. c., p. 5, fig. 2.  
*Leptocephalus sicanus*, l. c., p. 5, fig. 3.  
*Leptocephalus borelli*, l. c., p. 6, fig. 4.  
*Leptocephalus inæqualis*, l. c., p. 7, fig. 5.  
*Leptocephalus maurolici*, l. c., p. 7, fig. 6.  
*Leptocephalus gutturosus*, l. c., p. 8, fig. 7.  
*Leptocephalus peloritianus*, l. c., p. 9, fig. 8.  
*Leptocephalus zancleus*, l. c., p. 9, fig. 9.  
*Leptocephalus tenuirostris*, l. c., p. 10, fig. 10.  
*Leptocephalus prestandrewi*, l. c., p. 10, fig. 11.  
*Leptocephalus esopus*, l. c., p. 11, fig. 12.  
*Leptocephalus oxyrhynchus* Bellotti, Atti. Soc. Ital., XXVI, 177, 1884 (Messina).  
*Leptocephalus polleni* Facciola, Atti. Soc. Mod. Mem., I, 119, fig. 1, 1889 (Sea of Messina).  
*Leptocephalus lalandii*, l. c., 120, fig. 2.

**Habitat:** Atlantic Ocean on both coasts from Cape Cod to Brazil, also in the Western Pacific, but not found on the Pacific coast of North or South America.

**Etymology:** Latin, *Conger*, the ancient name.

The Conger eel is generally common in the warmer parts of the Atlantic and its islands. Our specimens are from Naples, Palermo, Paris, Havana, and Charleston. The young example in the National Museum from Cape San Lucas, assigned to this species by Jordan and Gilbert (Proc. U. S. Nat. Mus., 378, 1882), belongs to *Ophisoma balearicum*. Of the forms called *Leptocephalus* only three (*L. gracilis* Storer, from Massachusetts, and *L. multimaculatus* and *L. peruanus* Steindachner, from Peru) have been described from American waters.

*Leptocephalus gracilis* is doubtless (like *L. morrissi*) a young Conger. *L. multimaculatus* from Peru, a slender form with a sharp nose, we are unable to recognize from the description, as also the deep-bodied and band-shaped *Leptocephalus peruanus*. We refer to these species for the

sake of completeness, but as larval forms of unknown species they should have no place in systematic lists.

A number of specimens before us, from Palermo, labeled by Dr. Doderlein *Leptocephalus j nctatus*, seem to be the young of the Conger.

#### 121. LEPTOCEPHALUS CAUDILIMBATUS.

*Echelus caudilimbatus* Poey, Repertorio, II, 249, 1867 (Cuba). Poey, Ann. N. Y. Acad. Nat. Hist., 322, 1870.

*Ophisoma caudilimbatus* Poey, Synopsis, 424, 1867 (Cuba).

*Conger caudilimbatus* Poey, Enumeratio, 152, 1875 (Cuba).

*Conger macrops* Günther, 40, 1870 (Madeira; Bahama Islands).

*Conger caudicula* Bean, Proc. U. S. Nat. Mus., 435, 1882 (Pensacola); Jordan & Gilbert, *ibid*, 262 (Pensacola); Jordan & Gilbert, Syn. Fish. N. A., 900, 1883.

Habitat: Tropical Atlantic, Pensacola to Madeira.

Etymology: Latin, *cauda*, tail; *limbatus*, margined.

Of this species we have examined several examples, identical with the type of *C. caudicula*, from the Snapper Banks of Pensacola. We do not see that these differ in any important respect from the descriptions of *macrops* and *caudilimbatus* and refer all to one species.

### Family IX.—ANGUILLIDÆ.

(THE TRUE EELS.)

The true eels or *Anguillidæ* are characterized by their scaly skin in connection with a conical head and a general resemblance to the *Congridæ*. The group is thus diagnosed by Dr. Gill:

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

The *Anguillidæ* approach more nearly than most of the other eels to the type of the true fishes. In one respect, that of the minute ova and concealed generation, however, they differ widely from these. The single genus of living *Anguillidæ* is widely diffused in temperate and tropical waters. Unlike the other eels the *Anguillidæ* freely ascend the rivers, descending to the sea for purposes of reproduction.

#### ANALYSIS OF GENERA OF ANGUILLIDÆ.

- a. Dorsal fin inserted well behind base of pectorals; shoulder girdle well developed; lower jaw projecting.....ANGUILLA, 44.

#### Genus 44.—ANGUILLA.

*Anguilla* "Thunberg, Nouv. Mem., Stockholm, about 1795" (reference unverified).

*Anguilla* Shaw, General Zoölogy, IV, 15, 1804 (*Anguilla*).

*Terpolepis* "McClelland," (*vide* Day).

*Muraena* Bleeker, Poey, etc. (taking as type *Muraena anguilla*, the first species mentioned by Artedi under *Muraena*).

*Anguilla* Kaup, Günther, Gill, and of authors generally.

Type: *Muraena anguilla* L.

Etymology: *Anguilla* (ἄγγελος), the original name of the eel.

This genus is widely distributed through the waters of the North Temperate and Torrid Zone, being only absent in the Eastern Pacific. Unlike the other eels, its species freely enter fresh waters, and they are subject to great variations in form, size, and color, which have given rise to a host of nominal species.

ANALYSIS OF AMERICAN AND EUROPEAN SPECIES OF ANGUILLA.

- a. Distance between origin of dorsal and vent  $\frac{5}{8}$  to  $1\frac{1}{4}$  in head; pectoral 3 to  $3\frac{3}{8}$  in head; head  $2\frac{1}{2}$  to  $2\frac{1}{2}$  in trunk; upper jaw  $3\frac{1}{2}$  to  $4\frac{1}{2}$  in head. Yellow, brown, or black, underparts paler..... ANGUILLA, 122.
- aa. Distance between origin of dorsal and vent  $1\frac{1}{8}$  to 2 in head; pectoral  $2\frac{5}{8}$  to  $3\frac{3}{8}$  in head; head 2 to  $2\frac{1}{2}$  in trunk; body more robust and trunk slightly shorter than in *anguilla*, otherwise similar..... CHRYSYPA, 123.

122. ANGUILLA ANGUILLA.

(THE COMMON EEL.)

- Muraena unicolor maxilla inferiore longiore* Artedi, Genera Pisc., 24, 1738.
- Muraena anguilla* Linnaeus, Syst. Nat., ed. x, 245, 1758 (after Artedi).
- Anguilla vulgaris* Shaw, Gen. Zoöl., IV, 15, pl. 1, 1804 (after Linnaeus).
- Anguilla vulgaris marina* Rafinesque, Indice, 38, 1810 (Sicily).
- Anguilla vulgaris fluviatilis* Rafinesque, l. c. (Sicily).
- Anguilla fluviatilis* Heckel & Kuer, Süßwasserfische. 319, 1858 (Dalmatia) (*vide* Günther).
- Anguilla acutirostris* Risso, Eur. MÉR., III, 198, 1826 (Nice).
- Anguilla vulgaris acutirostris* Doderlein, Atti. Acc. Soc., 58, 1879.
- Anguilla mediorostris* Risso, Eur. MÉR., III, 198, 1826.
- Anguilla vulgaris mediorostris* Reguis, Bull. Soc. d'Études, 126, 1881 (Provence).
- Murana eurhina* Ekström, Fisch. Mörkö, 142, 1835 (*vide* Günther).
- Murana platyrhina* Ekström, Fisch. Mörkö, 142, 1835 (*vide* Günther).
- Anguilla canariensis* Valenciennes, in Webb & Berthelot, Îles Canar., Poiss., 88, pl. 20, fig. 1, 1838.
- Anguilla platyrhynchus* Costa, Fauna Napoli, Pesc., tab. 58 and 60, fig. 3, 1840 (*vide* Günther).
- Anguilla septembrina* Bonaparte, Cat. Pesc. Eur., 38, 1846 (Central Italy).
- Anguilla cloacina* Bonaparte, l. c. (southern Europe).
- Anguilla callensis* Guichenot, Explor. Alger., Poiss., III, pl. 7, fig. 1. 1850 (Calle, Algiers.)
- Anguilla migratoria* Kröyer, Danmark's Fiske, III, 616, 1853 (*vide* Günther).
- Anguilla kieneri* Kaup, Apodes, 32, fig. 15, 1856.
- Anguilla vulgaris kieneri* Reguis, Bull. Soc. d'Études, 126, 1881 (Provence).
- Anguilla euvieri* Kaup, Apodes, 33, 1856.
- Anguilla bibroni* Kaup, Apodes, 33, fig. 16, 1856 (Sicily).
- Anguilla savignyi* Kaup, Apodes, 34, 1856 (Naples).
- Anguilla capitone* Kaup, Apodes, 34, fig. 17, 1856 (Naples).
- Anguilla vulgaris capitone* Doderlein, Att. Acc. Soc., 58.
- Anguilla marina* Kaup, Apodes, 35, fig. 18, 1856 (Naples).
- Anguilla melanocheir* Kaup, Apodes, 35, fig. 19, 1856 (Tiber).

- Anguilla marginata* Kaup, Apodes, 36, fig. 20, 1856 (Valentia).  
*Anguilla microptera* Kaup, Apodes, 36, fig. 21, 1856 (Bay of Algesirus).  
*Anguilla ancidda* Kaup, Apodes, 37, fig. 22, 1856 (Sicily).  
*Anguilla altirostris* Kaup, Apodes, 37, fig. 24, 1856 (Seine).  
*Anguilla platycephala* Kaup, Apodes, 38, fig. 25, 1856 (Baillon).  
*Anguilla latirostris* Kaup, Apodes, 38, fig. 26, 1856 (L'Orient).  
*Anguilla vulgaris latirostris* Reguis, Bull. Soc. d'Études, 126, 1881 (Provence).  
*Anguilla nilotica* Kaup, Apodes, 40, fig. 28, 1856 (Nile River).  
*Anguilla aegyptica* Kaup, Apodes, 40, 1856 (Nile).  
*Anguilla eurystoma* Heckel & Kner, Süßwasserfische, 325, 1858 (Dalmatica) (*vide* Günther).  
*Anguilla hibernica* Couch, Brit. Fish., iv, 328, pl. 235, 1865 (*vide* Günther).  
*Anguilla vulgaris platirostris* Doderlein, Att. Acc. Soc., 58, 1879.  
*Anguilla vulgaris oblongirostris* Reguis, Bull. Soc. d'Études, 126, 1881 (Provence).

Habitat : Coast of Europe and Northern Africa (not found north of lat. 64° 30', nor in the Danube River, Black and Caspian Seas), Azores, Canary, and Cape Verde Islands. Perhaps also in the East Indies.

Etymology : *Anguilla*, eel.

We have regarded all the nominal species of *Anguilla* from Europe as identical, as no reliable specific differences have yet been indicated among them. We exclude Asiatic references, as we have had no satisfactory material for comparison, and other forms may exist. The eel is excessively common in southern Europe. We have specimens from Athens, Venice, Palermo, and Paris.

### 123. ANGUILLA CHRYSYPA.

(THE AMERICAN EEL.)

- Murana anguilla* Schöpf, Beobacht. Naturforscher, VII, 138, 1788 (New York) (*vide* Günther) (not of L.).  
*Anguilla vulgaris* Mitchell, Trans. Lit. & Phil. Soc., 360, 1814 (not of Shaw).  
*Anguilla chryssypa* Rafinesque, Amer. Mont. Mag. & Crit. Rev., 120, 1817 (Lake George ; Hudson River ; Lake Champlain).  
*Anguilla blephura* Rafinesque, l. c., 120, 1817 (Long Island).  
*Anguilla laticauda* Rafinesque, Amer. Monthly Mag. & Crit. Rev., 445 (Ohio River).  
*Anguilla aterrima* Rafinesque, Ichthyologia Ohiensis, 78, 1820 (Ohio River).  
*Anguilla ranthomelas* Rafinesque, Ich. Ohiensis, 78, 1820 (Ohio River).  
*Anguilla lutca* Rafinesque, Ich. Ohiensis, 78, 1820 (Ohio River).  
*Murana rostrata* Le Sueur, Journ. Acad. Nat. Sci. Phil., 1821, 81 (Cayuga Lake).  
*Anguilla rostrata* DeKay, Fish. N. Y., 312, 1842 (Cayuga and Seneca Lakes).  
*Anguilla anguilla rostrata* Meek, Bull. U. S. Fish. Com., 430, 1883.  
*Murana bostoniensis* Le Sueur, Journ. Acad. Nat. Sci. Phil., 1821, 81.  
*Anguilla bostoniensis* DeKay, Fishes N. Y., 313, 1842 (northern coast).  
*Murana serpentina* Le Sueur, Journ. Acad. Nat. Sci. Phil., 82, 1821 (Newport, R. I.).  
*Anguilla serpentina* Storer, Syn. Fish. N. A., 486, 1845.  
*Murana macrocephala* Le Sueur, Journ. Acad. Nat. Sci. Phil., 82, 1821 (Saratoga, N. Y.).  
*Anguilla macrocephala* DeKay, Fishes N. Y., 313, 1842.  
*Anguilla tenuirostris* DeKay, Fishes N. Y., 310, 1842.  
*Murana argentea* Le Sueur, Journ. Acad. Nat. Sci. Phil., 82, 1821 (Boston Bay).  
*Anguilla argentea* DeKay, Fishes N. Y., 313, 1842 (northern coast).  
*Anguilla novaeorleanensis* Kaup, Apodes, 43, fig. 33, 1856 (New Orleans, La.)  
*Anguilla punctatissima* Kaup, Apodes, 44, 1856 (Niagara).



*Anguilla cubana* Kaup, Apodes, 44, 1856 (Cuba).

*Murana cubana* Poey, Syn., 421, 1868 (Havana).

*Anguilla novaterre* Kaup, Apodes, 45, fig. 35, 1856 (Newfoundland).

*Anguilla texana* Kaup, Apodes, 45, fig. 36, 1856 (Texas).

*Anguilla wabashensis* Kaup, Apodes, 46, 1856 (Wabash River).

*Anguilla tyrannus* Girard, U. S. and Mex. Bound. Surv., 75, 1859 (Rio Grande).

**Habitat:** Atlantic coast from Maine to Mexico, and throughout the West Indies; also, ascending all rivers east of the Rocky Mountains and South of Canada.

**Etymology:** χρῶσός, gold; ὄψο, below.

Among the multitudes of American eels examined by us we have been unable to detect specific differences. As all these specimens differ in a slight degree from any we have seen from Europe, we may provisionally recognize the American form under its oldest name, *Anguilla chrysypa*, as a distinct species. As these differences are slight, it is not unlikely that intermediate forms may occur, in which case the American form may stand as var. *chrysypa*. Dr. Bean records in the "Nineteenth Report of the Commission of Fisheries of New York, page 280," five individuals from Great South Bay, Long Island, which he thinks may represent *Anguilla argentea* Le Sueur. These specimens are described as having "large eyes, short snout, and long pectoral fins as compared with the common form, silvery gray above with a clear satiny white abdomen separated from the color above by the lateral line." These specimens are very interesting because they were found "to be males with the generative glands so well developed as to leave no doubt concerning the sex."

## Family X.—SIMENCHELYIDÆ.

This family contains a single species, a deep-sea parasitic eel, having the general characters of *Anguilla*, but with the form of the head strikingly different. The following diagnosis is given by Dr. Gill:

Apodal fishes with a blunt snout, transverse, anterior mouth, massive jaws with an acrodont dentition, and inferior longitudinal branchial slits moderately far apart from each other.

The skin has the peculiar rudimentary scales of *Anguilla*; the teeth are blunt, uniserial, on the edge of the jaws only, and there are no lips.

### Genus 45.—SIMENCHELYS.

*Simenchelys* Gill in Goode & Bean, Bull. Essex Inst., 27, 1879 (*parasiticus*).

*Conchognathus* Collett, Bull. Soc. Zool. France, 122, 1889 (*grimaldii*).

Type: *Simenchelys parasiticus* Gill.

Etymology: Σιμός, snub-nosed; ἔγγελος, eel.

This genus contains a single species from the Atlantic.

## ANALYSIS OF SPECIES OF SIMENCHELYS.

- a. Anterior profile of head bluntly rounded; angle of mouth at a point half-way between the tip of snout and anterior edge of eye; body stout, the depth at vent about equal to length of head; dorsal beginning about a head's length behind gill-openings; eye  $1\frac{1}{2}$  to 2 in snout; pectoral  $2\frac{1}{2}$  in head; head  $4\frac{1}{2}$  to  $4\frac{3}{4}$  in trunk; tail a head's length longer than head and trunk; color brown, nearly plain.

PARASITICUS, 124.

## 124. SIMENCHELYS PARASITICUS.

*Simenchelys parasiticus* Gill (mss.) in Goode & Bean, Bull. Essex Inst., 27, 1879 (Newfoundland Banks); Bean, Proc. U. S. Nat. Mus., 113, 1880 (a list of localities); Goode, *ibid*, 485; Jordan & Gilbert, Syn. Fish N. A., 363, 1883; Günther, Voy. Challenger, xxii, 252, 1887.

*Conchognathus grimaldii* Collett, Bull. Soc. Zool. France, 122, 1889 (Azores Islands).

Habitat: Deep waters of the Atlantic.

Etymology: Latin, parasitic.

This singular eel is occasionally taken in the North Atlantic, where it burrows into the flesh of the halibut (*Hippoglossus hippoglossus*). Our specimen is from the Grand Banks of Newfoundland.

## Family XI.—ILYOPHIDIDÆ.

This family contains a single species with characters intermediate between the *Simenchelyidæ* and the *Synaphobranchidæ*, combining the general physiognomy of *Synaphobranchus* with the separate gill-slits and long-bowed branchiostegal rays of *Simenchelyidæ* (Gilbert).

## Genus 46.—ILYOPHIS,

*Ilyophis* Gilbert, mss.

This genus is thus described by Dr. Gilbert:

Body scaly; pectorals well developed; lateral line prominent; gill-slits horizontal, inferior, well separated; nostrils lateral, the posterior immediately in front of the eye, the anterior with a short tube, near tip of snout. Maxillaries as in *Synaphobranchus*; the clamping processes closely appressed to the side of the vomer behind its head; lower jaw strong, apparently with the coronoid process well developed; series of teeth on head and shaft of vomer continuous; no lips; tongue little developed, with narrow free margin; branchiostegal rays 15 in number (as determined without dissection), not shortened, some of them curved around and above the opercle. Dorsal, anal, and caudal confluent, rather high, the rays clearly visible through the skin; dorsal beginning well forward, its origin immediately behind the base of pectorals; origin of anal near end of anterior third of body.

Type: *Ilyophis brunneus* Gilbert.

Etymology: ἰλός, ooze; ὄφις, snake.

ANALYSIS OF THE SPECIES OF ILYOPHIS.

- a. [Body narrow, compressed throughout; snout and jaws slender; gape one-half length of head, extending beyond the eye for a distance less than the diameter of the latter; maxillary teeth small, bluntly conic, in narrow band; teeth on vomer large, conic, those on shaft of vomer in single row; teeth in mandible in narrow band, those on the inner series enlarged and retrorse though less than half the size of the vomerine teeth; front of pupil over end of second third of length of jaw; gill-slits narrow, inferior, horizontal, crescent-shaped, about equaling horizontal diameter of eye, their lower (anterior) ends separated by a distance equal to their own length, their upper (posterior) ends by  $1\frac{1}{2}$  times that distance; head 2 in trunk; head and trunk  $3\frac{1}{2}$  in total length; pectorals small, 6 in head, rays evident; scales very fine, arranged in groups at right angles to one another; lateral line running high anteriorly, its pores white and conspicuous. Color brown, the fins, lower side of head, and branchial regions darker.] (*Gilbert.*)

BRUNNEUS, 125.

125. ILYOPHIS BRUNNEUS.

*Ilyophis brunneus* Gilbert, mss. (Chatham Island).

Habitat: Galapagos Islands.

Etymology: *Brunneus*, brown.

A single specimen 15 inches long was collected by the *Albatross* near Chatham Island, Galapagos, 634 fathoms.

Family XII.—SYNAPHOBRANCHIDÆ.

This group consists of deep-sea eels, differing from the *Anguillidæ* in having the gill-openings externally confluent into a single slit. The following diagnosis is given by Dr. Gill:

Echelycephalous Apodals with conic, pointed head, moderate opercular apparatus, lateral maxillines, cardiform teeth, distinct tongue, inferior branchial apertures discharging by a common aperture, continuous vertical fins, pectorals well developed, scaly skin, and nearly perfect branchial skeleton.

The form of the branchiostegals is characteristic. They are in moderate number (about 15), attached to the sides of the compressed ceratohyal and ephiyal, slender, abbreviated, and moderately bowed, not being curved up above the operculum. Two genera are known, very similar to each other.

ANALYSIS OF GENERA OF SYNAPHOBRANCHIDÆ.

- a. Dorsal fin low, beginning behind vent; vomerine teeth in a single patch; pectorals long, longer than the rather slender snout..... SYNAPHOBRANCHUS, 47.  
 aa. Dorsal fin beginning close behind base of pectorals; vomerine teeth in two patches, one behind the other; pectorals short, not longer than the short snout.

HISTIOBRANCHUS, 48.

Genus 47.—SYNAPHOBRANCHUS.

*Synaphobranchus* Johnson, Proc. Zool. Soc. London, 169, 1862 (*kaupi*).

Type: *Synaphobranchus kaupi* Johnson = *Muraena pinnata* Gronow.

Etymology: *Συναψής*, united; *βράχια*, gills.

This genus contains two or three species of deep-sea fishes from the Atlantic and Pacific.

## ANALYSIS OF THE SPECIES OF SYNAPHOBANCHUS.

- a. Dorsal fin beginning  $\frac{1}{2}$  to  $\frac{1}{4}$  head's length behind vent; maxillary reaching a point almost opposite gill-opening; head 3 to  $3\frac{1}{2}$  in distance from tip of snout to dorsal,  $\frac{1}{4}$  to  $\frac{1}{2}$  in trunk; snout  $3\frac{1}{2}$  in head; eye 2 to  $2\frac{1}{2}$  in snout; cleft of mouth  $1\frac{1}{2}$  to  $1\frac{1}{4}$  in head; pectorals 3 in head, their insertion about equidistant from snout and anus. Uniform brown, vertical fins darker behind, light-edged anteriorly; inside of mouth blue-black; gill-openings dark.....PINNATUS, 126.

## 126. SYNAPHOBANCHUS PINNATUS.

*Murana pinnata* Gronow, Cat. Fish. Brit. Mus., 1<sup>o</sup>, 1854 (habitat unknown).

*Synaphobranchus pinnatus* Günther, VIII, 23, 1870 (Madeira); Goode and Bean, Bull. Essex Inst., 26, 1879 (Offshore Banks, 200 to 300 fathoms); Bean, Proc. U. S. Nat. Mus., 113, 1870 (list of localities); Goode, *ibid.*, 485; Goode & Bean, Bull. Mus. Comp. Zool., 222, 1883; Jordan and Gilbert, Syn. Fish. N. A., 364, 1883; Günther, Voy. Challenger, XXII, 253, 1887 (Maderia; Brazil; Japan; Phillipine Islands, etc.); Vaillant, Expéd. Travailleur and Talisman, 89, 1888 (Morocco; Canaries; Soudan; Cape Verde Islands; Azores; Arguina).

*Synaphobranchus kaupii* Johnson, Proc. Zool. Soc. Lond., 169, 1862 (Madeira) (*vide* Günther).

*Synaphobranchus affinis* Günther, Ann. and Mag. Nat. Hist., 445, 1877 (Inosima, Japan).

Habitat: Deep waters of the north Atlantic and Pacific.

Etymology: Latin, pinnate.

The species is not rare in the deep waters of the north Atlantic, especially off the Newfoundland Banks. The form found in the north Pacific, *Synaphobranchus affinis*, is now regarded by Dr. Günther as identical with the Atlantic species.

Our specimens of *Synaphobranchus pinnatus* are from the Grand Banks of Newfoundland.

## Genus 48.—HISTIOPRANCHUS.

*Histiobranchus* Gill, Proc. U. S. Nat. Mus., 255, 1883 (*infernalis*).

Type: *Histiobranchus infernalis* Gill.

Etymology: ἵστιον, sail, *i. e.*, dorsal fin; βράγχια, gills, from the insertion of the dorsal.

This genus is close to the preceding, from which it is distinguished by the insertion of its dorsal. Two species have been described, perhaps identical with each other.

## ANALYSIS OF THE SPECIES OF HISTIOBRANCHUS.

- a. [Pectoral fin longer than snout; eye  $\frac{1}{4}$  or  $\frac{1}{3}$  of the length of snout; head and trunk  $1\frac{1}{2}$  in tail; dorsal commencing above or immediately behind the pectoral, which is only  $\frac{1}{2}$  the length of head; scales quite rudimentary, lanceolate, imbedded in the skin; cheeks naked; dorsal and anal fins low, especially the former; uniformly black.] (*Günther*).....BATYBIUS, 127.
- aa. [Pectorals considerably shorter than snout; dorsal commencing a little behind root of pectoral,  $1\frac{1}{10}$  of length, while the anal arises not much nearer the snout than the end of tail; color black.] (*Gill*).....INFERNALIS, 128.

127. HISTIOBRANCHUS BATHYBIUS.

*Synaphobranchus bathybius* Günther, Ann. and Mag. Nat. Hist., xx, 445, 1877; *ibid*, Voy. Challenger, 254, pl. LXII, fig. b, 1887 (middle of North Pacific, South of Yedo; midway between Cape of Good Hope and Kerguelen Island).

Etymology: *Bathús*, deep; *βίος*, life.

A specimen of this species was obtained by the *Albatross* in the depths of Bering Straits.

128. HISTIOBRANCHUS INFERNALIS.

? *Synaphobranchus bathybius* Günther, Ann. Mag. Nat. Hist., 1877, 445; Günther, Challenger, xxii, 254, pl. 62 (off Yedo; North Pacific; between Cape of Good Hope and Kerguelen Land).

*Histiobranchus infernalis* Gill, Proc. U. S. Nat. Mus., 255, 1883.

Habitat: Atlantic Ocean, latitude 38° 30' 30", longitude 69° 08' 25".

Etymology: Latin, infernal, from its color.

This species from the Atlantic agrees, so far as the scanty description goes, with *Synaphobranchus bathybius* Günther (Ann. Mag. Nat. Hist., 1877, 445), a species now known from various localities in the North Pacific and from the Antarctic Ocean south of the Cape of Good Hope. The only apparent difference is that the Atlantic form (*infernalis*) has the pectoral fins shorter than the other, perhaps an individual variation.

RECAPITULATION OF GENERA AND SPECIES OF EELS INCLUDED IN THIS PAPER.

The general distribution of each species is indicated by the following letters:

- |  |   |
|--|---|
| A, Alaskan fauna.  | P, Panama fauna.                        |
| B, Californian fauna.                                      | R, Brazilian fauna.                     |
| E, European fauna (north of Spain).                        | S, South Atlantic and Gulf Coast fauna. |
| I, Islands of East Atlantic (Madeira, Cape Verde).         | T, Patagonian fauna (Terra del Fuego).  |
| M, Mediterranean Sea.                                      | V, Chilian fauna (Valparaiso).          |
| N, East coast of United States; Cape Cod to Cape Hatteras. | W, West Indian fauna.                   |

The species not studied by us are indicated by a star (\*).

Order APODES.

Suborder COLOCEPHALI.

Family I. MURÆNIDÆ.

Genus 1. *Uropterygius* Rippoll.

1. *Uropterygius necturus* (Jordan & Gilbert). P.

Genus 2. *Channomuræna* Richardson.

2. *Channomuræna vittata* Richardson. W.

Genus 3. *Enchelycore* Kaup (perhaps to be called *Enchelynassa*).

3. *Enchelycore nigricans* (Bonnaterro). W.

Genus 4. *Pythonichthys* Poey.

4. *Pythonichthys sanguineus*\* (Poey). W.

## Order APODES—Continued.

## Suborder COLOCEPHALI—Continued.

## Family I. MURÆNIDÆ—Continued.

Genus 5. *Gymnothorax* Bloch.§. *Rabula* Jordan & Davis.

5. *Gymnothorax aqua-dulcis* (Cope). P.
6. *Gymnothorax marmoratus*\* (Kaup) (doubtful species). I.
7. *Gymnothorax panamensis* (Steindachner). P.
8. *Gymnothorax longicauda* (Peters). W.
9. *Gymnothorax porphyreus*\* (Guichenot). V.

§. *Gymnothorax*.

10. *Gymnothorax unicolor* (De la Roche). M, I.
11. *Gymnothorax verrilli* (Jordan & Gilbert). P.
12. *Gymnothorax vicinus* (Castelnau). W.
13. *Gymnothorax virescens*\* (Poey). W.
14. *Gymnothorax polygonus* (Poey). W.
15. *Gymnothorax moringa* (Cuvier). W, E.
16. *Gymnothorax wieneri*\* (Sauvage) (doubtful species). V.
17. *Gymnothorax anatinus*\* (Lowe). I.
18. *Gymnothorax sancta-helenæ*\* (Günther). I.
19. *Gymnothorax mordax* (Ayes). C.
20. *Gymnothorax funebris* (Ranzani). W, E, P.
21. *Gymnothorax chilensis*\* (Günther.) V.
22. *Gymnothorax dovii* (Günther). P.
23. *Gymnothorax conspersus*\* (Poey). W.
24. *Gymnothorax miliaris*\* (Kaup). I.
25. *Gymnothorax staropictus*\* (Kaup). W.
26. *Gymnothorax elaboratus* (Poey). W.
27. *Gymnothorax obscuratus*\* (Poey). W.
28. *Gymnothorax irregularis*\* (Kaup). I.
29. *Gymnothorax chlevasces* (Jordan & Gilbert). P.
30. *Gymnothorax modestus*\* (Kaup). V.

§. *Priodonopsis* Kaup.

31. *Gymnothorax madeirensis*\* (Johnson). I.
32. *Gymnothorax ocellatus* (Agassiz). W.

Genus 6. *Muræna* (Artedi) Linnaeus.

33. *Muræna helena* L. L, M, I.
34. *Muræna insularum* (Jordan & Davis). P.
35. *Muræna argus*\* (Steindachner). P.
36. *Muræna retifera* Goode & Bean. W, E.
37. *Muræna lentiginosa* (Jenyns). P.
38. *Muræna melanotis* (Kaup). W.
39. *Muræna angusti*\* (Günther). I.

Genus 7. *Echidna* Forster.

40. *Echidna nocturna* (Cope). P.
41. *Echidna catenata* (Bloch). W.

## Suborder ENCHELYCEPHALI.

## Family II. OPHISURIDÆ.

Genus 8. *Sphagebranchus* Bloch.

42. *Sphagebranchus cæcus*\* (De la Roche). M.
43. *Sphagebranchus anguiformis*\* (Peters) (doubtful species). W.
44. *Sphagebranchus sclachops* (Jordan & Gilbert). P.
45. *Sphagebranchus acutirostris*\* (Barneville) (doubtful species). W.
46. *Sphagebranchus rostratus*\* (Bloch). W.
47. *Sphagebranchus kendalli* (Gilbert). W.

## Order APODES—Continued.

## Suborder ENCHELYCEPHALI—Continued.

## Family II. OPHISURIDÆ—Continued.

Genus 9. *Letharchus* Goode & Bean.48. *Letharchus volifer* Goode & Bean. W, F.Genus 10. *Myrichthys* Girard.49. *Myrichthys pardalis*\* (Valenciennes). W, T.50. *Myrichthys tigrinus* Girard. P.51. *Myrichthys oculatus* (Kaup). W.52. *Myrichthys acuminatus* (Gronow). W, F.Genus 11. *Callechelys* Kaup.53. *Callechelys murana* Jordan & Evermann. W, F.Genus 12. *Bascanichthys* Jordan & Davis.54. *Bascanichthys scuticaris* (Goode & Bean). W, F.55. *Bascanichthys bascanium* (Jordan). W, F.Genus 13. *Cæcula* Vahl.56. *Cæcula imberbis* (De la Roche). M.Genus 14. *Quassiremus* Jordan & Davis.57. *Quassiremus nothochir* (Gilbert). P.58. *Quassiremus evionthas* (Jordan & Bollman). P.Genus 15. *Ophichthus* Abl.§ *Cogrus* Rafinesque.59. *Ophichthus hispanus* Belotti (perhaps to receive some older name). M.60. *Ophichthus brasiliensis*\* Kaup. W.61. *Ophichthus maculatus*\* (Rafinesque). M.§ *Cryptopterus* Kaup.62. *Ophichthus ater*\* (Peters). V.63. *Ophichthus puncticeps*\* Kaup. W.§ *Ophichthus*.64. *Ophichthus havannensis* (Bloch). W.65. *Ophichthus retropinnis* Eigenmann. W, F.§ *Muranopsis* Kaup.66. *Ophichthus guttifer* Bean & Dresel. W, F.67. *Ophichthus ocellatus* (Le Suour). W, F.68. *Ophichthus uniserialis*\* (Cope). V.69. *Ophichthus triserialis* (Kaup). P.70. *Ophichthus grandimaculatus*\* Kner & Steindachner. V.71. *Ophichthus pacifici*\* Günther. V.§ *Scytalophis* Kaup.72. *Ophichthus gomesi* (Castelman) (perhaps includes two species, *gomesi* and *macrurus*). W, F.73. *Ophichthus zophochir* Jordan & Gilbert. P.74. *Ophichthus magniocularis* (Kaup). W.75. *Ophichthus callaënsis* Günther. V.76. *Ophichthus parilis*\* (Richardson) (perhaps includes two species, *parilis* and *pauciporus*). W, B.Genus 16. *Mystriophis* Kaup.§ *Crotalopsis* Kaup.77. *Mystriophis intertinclus* (Richardson) (perhaps includes two or three species, *intertinctus*, *punctifer*, *schneideri*). W, F.§ *Scytalichthys* Jordan & Davis.78. *Mystriophis mirus* (Jordan & Gilbert). P.Genus 17. *Brachysomophis* Kaup.79. *Brachysomophis crocodilinus*\* (Bennett). P.

## Order APODES—Continued.

## Suborder ENCHELYCEPHALI—Continued.

## Family II. OPHISURIDÆ—Continued.

Genus 18. *Ophisurus* (Lacépède) Risso.80. *Ophisurus serpens* (L.). M, I.

## Family III. ECHELIDÆ.

Genus 19. *Chilorhinus* Lütken.81. *Chilorhinus suensoni*\* Lütken. W.Genus 20. *Ahlia* Jordan & Davis.82. *Ahlia egmontis* (Jordan). W, F.Genus 21. *Myrophis* Lütken.83. *Myrophis frio* Jordan & Davis. B.84. *Myrophis punctatus* Lütken. W, F.85. *Myrophis raser* Jordan & Gilbert. P.Genus 22. *Paramyrus* Günther.86. *Paramyrus cylindroideus*\* (Ranzani). B.Genus 23. *Echelus* Rafinesque.87. *Echelus pachyrhynchus*\* (Vaillant). M, I.88. *Echelus myrus* (L.). M.

## Family IV. MURÆNESOCIDÆ.

Genus 24. *Gordiiichthys* Jordan & Davis.89. *Gordiiichthys irretitus* Jordan & Davis. S.Genus 25. *Stilbiscus* Jordan & Bollman.90. *Stilbiscus edwardsi* Jordan & Bollman. W.Genus 26. *Leptoconger* Poey.91. *Leptoconger perlongus*\* Poey. W.Genus 27. *Neoconger* Girard.92. *Neoconger mucronatus*\* Girard. W, F.93. *Neoconger vermiformis* Gilbert. P.Genus 28. *Hoplunnis* Kaup.94. *Hoplunnis schmidti*\* Kaup. W.Genus 29. *Murænesox* McClelland.§ *Murænesox*.95. *Murænesox coniceps* Jordan & Gilbert. P.96. *Murænesox savanna* Cuvier. W, B.Genus 30. *Xenomystax* Gilbert.97. *Xenomystax atrarius* Gilbert. P.

## Family V. NETTASTOMIDÆ.

Genus 31. *Chlopsis* Rafinesque.98. *Chlopsis bicolor*\* Rafinesque.99. *Chlopsis equatorialis* Gilbert. P.Genus 32. *Nettastoma* Rafinesque.100. *Nettastoma melanurum* Rafinesque. M, A.Genus 33. *Venefica* Jordan & Davis.101. *Venefica procerca* (Goode & Bean). A.102. *Venefica proboscidea*\* Vaillant. A.

## Family VI. NEMICHTHYIDÆ.

Genus 34. *Serrivomer* Gill & Ryder.103. *Serrivomer beani* Gill & Ryder. A.Genus 35. *Spinivomer* Gill & Ryder.104. *Spinivomer goodii*\* Gill & Ryder. A.Genus 36. *Cyema* Günther.105. *Cyema atrum* Günther. A.Genus 37. *Avocettina* Jordan & Davis.106. *Avocettina infans* Günther. A, P.107. *Avocettina richardii*\* Vaillant. A.



Order APODES—Continued.

Suborder ENCHELYCEPHALI—Continued.

Family VI. NEMICHTHYIDÆ—Continued.

Genus 38. *Labichthys* Gill & Ryder.

108. *Labichthys carinatus*\* Gill & Ryder. A.

109. *Labichthys elongatus*\* Gill & Ryder. A.

Genus 39. *Nemichthys* Richardson.

110. *Nemichthys scolopaceus* Richardson. A.

111. *Nemichthys avocetta* Jordan & Gilbert (perhaps identical with *N. scolopaceus*). P.

Family VII. HETEROCONGRIDÆ.

Genus 40. *Heteroconger* Bleeker.

112. *Heteroconger longissimus*\* Günther. A.

Family VIII. CONGRIDÆ.

Genus 41. *Uroconger* Kaup.

113. *Uroconger vicinus*\* Vaillant. A.

Genus 42. *Ophisoma* Swainson.

114. *Ophisoma balearicum* De la Roche. M, W, B.

115. *Ophisoma macrurum* Gilbert. P.

116. *Ophisoma mystax*\* De la Roche. M.

117. *Ophisoma prorigerum* Gilbert. W, B.

118. *Ophisoma nitens* Jordan & Bollman. P.

Genus 43. *Leptocephalus* Gmelin (perhaps to be called *Conger*).

119. *Leptocephalus multidentis*\* Castelnan. B.

120. *Leptocephalus conger* (L.). E, M, N, S, F, W, B, P.

121. *Leptocephalus caudilimbatus* Poey. W, F.

Family IX. ANGUILLIDÆ.

Genus 44. *Anguilla* Shaw.

122. *Anguilla anguilla* (L.), Europe, etc.

123. *Anguilla chrysypa* Rafinesque, Eastern America (probably a variety of the preceding).

Family X. SIMENCHELYIDÆ.

Genus 45. *Simenchelys* Gill.

124. *Simenchelys parasiticus* Gill. A.

Family XI. ILYOPHIDIDÆ Gilbert.

Genus 46. *Ilyophis* Gilbert.

125. *Ilyophis brunneus* Gilbert. P.

Family XII. SYNAPHOBRANCHIDÆ.

Genus 47. *Synaphobranchus* Johnson.

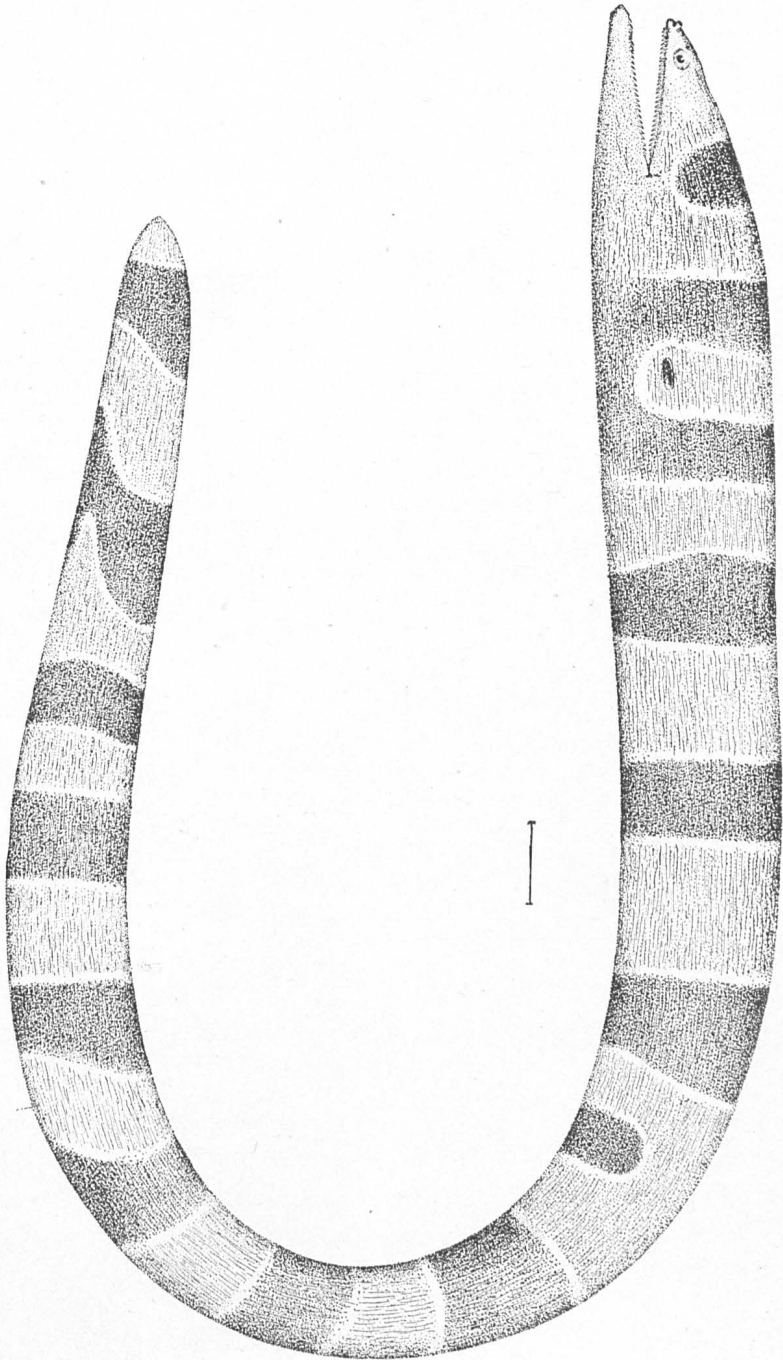
126. *Synaphobranchus pinnatus* Gronow. A, P.

Genus 48. *Histiobranchus* Gill.

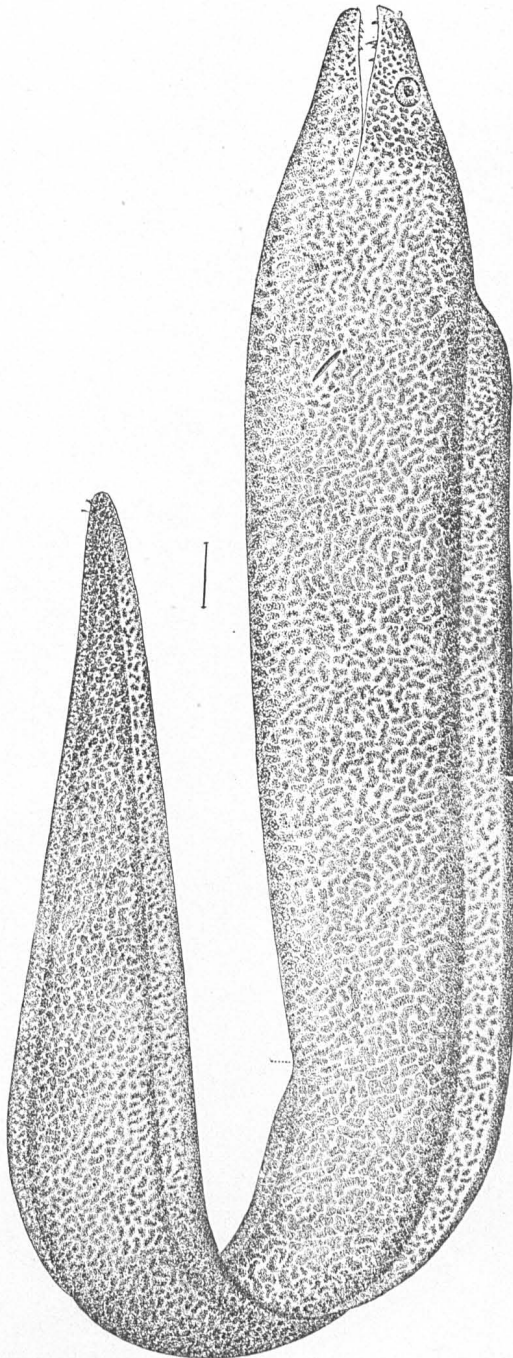
127. *Histiobranchus bathybius* Günther. P.

128. *Histiobranchus infernalis*\* Gill (probably identical with *H. bathybius* Günther). A.

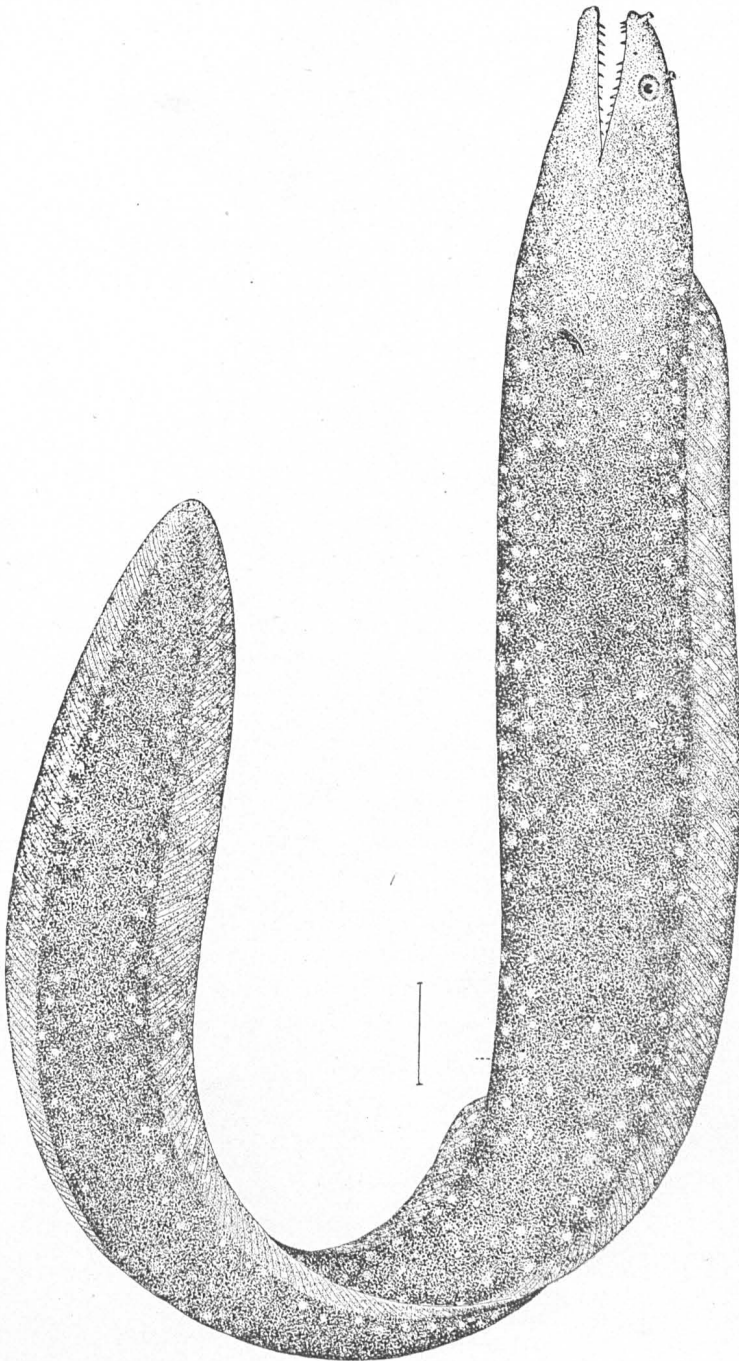
CHANNOMURÆNA VITTATA.



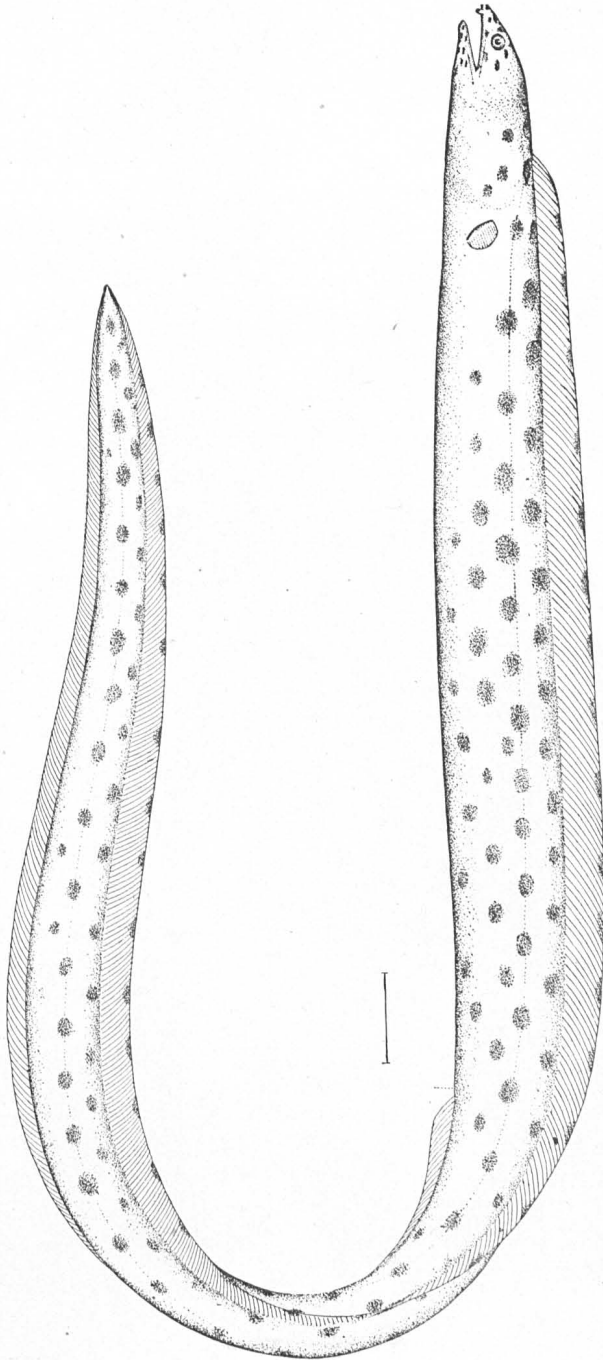
GYMNOTHORAX MORINGA. Common Moring; Hamlet.



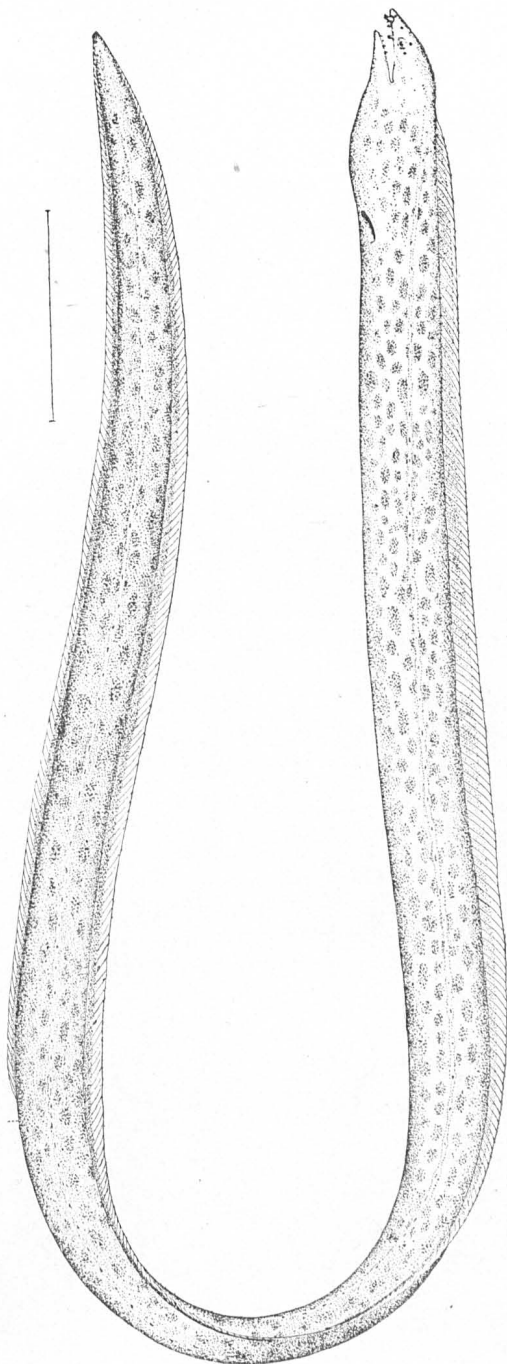
MURÆNA INSULARUM.



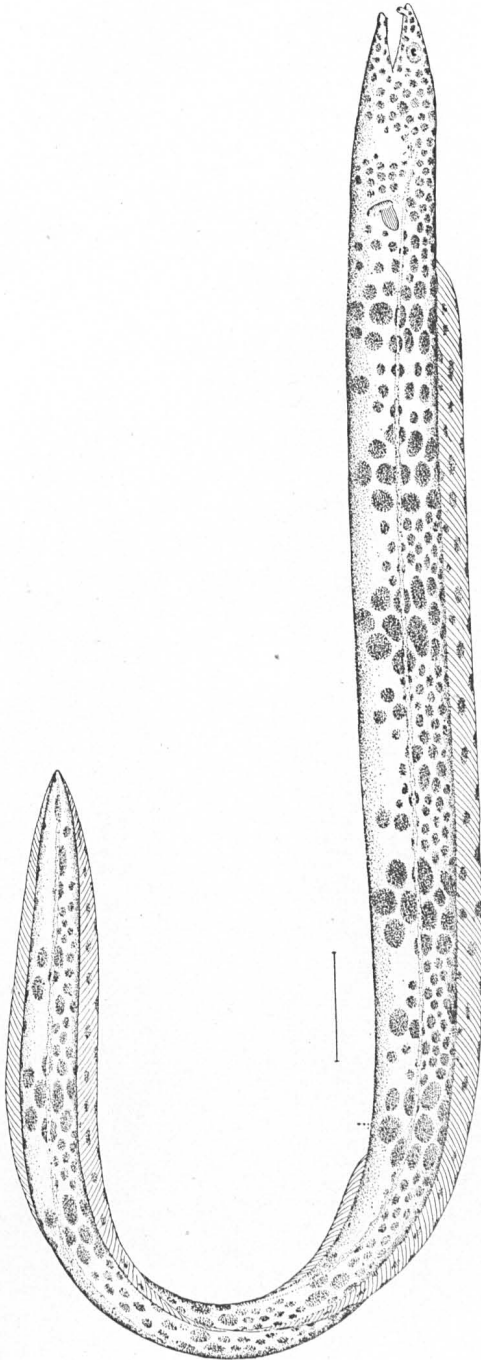
MYRICHTHYS TIGRINUS.

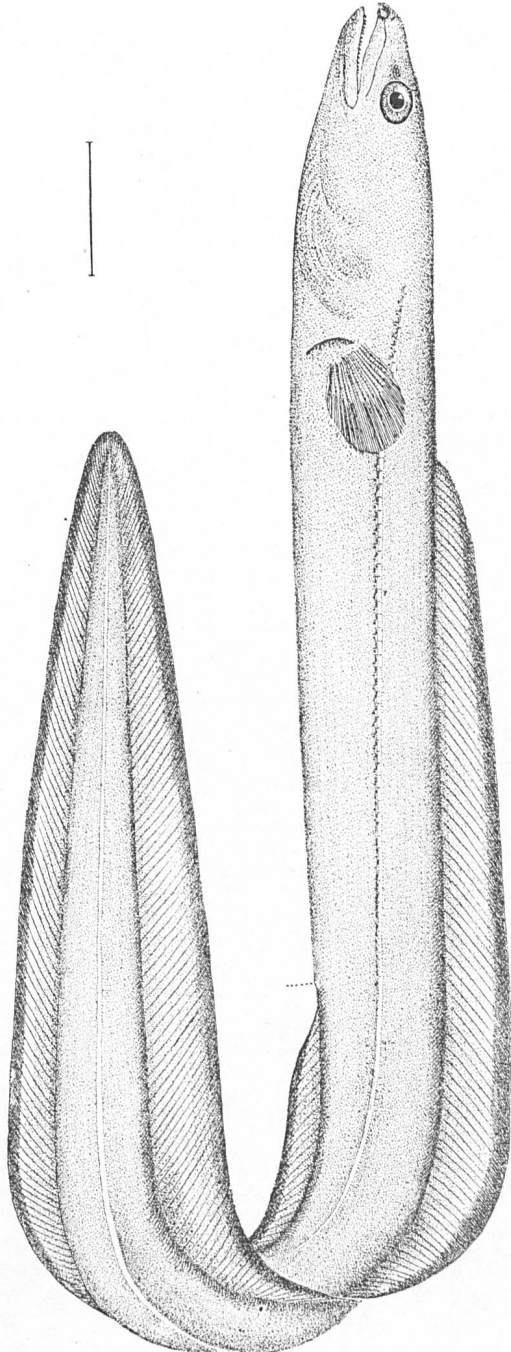


CALLECHELYS MURENA.



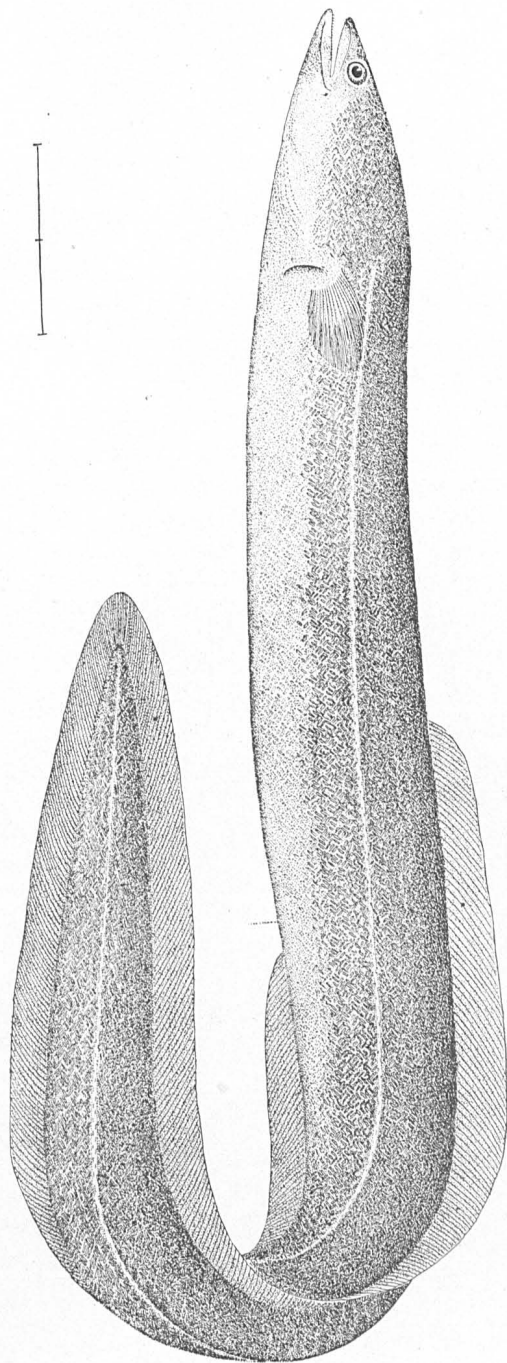
QUASSIREMUS EVIONTHAS.





LEPTOCEPHALUS CONGER. The Common Conger; Conger Eel.





ANGUILLA CHRYSOPTERA. The American Eel.

