

REPORT ON THE JAPANESE MACROUROID FISHES
COLLECTED BY THE UNITED STATES FISHERIES
STEAMER "ALBATROSS" IN 1906, WITH A SYNOPSIS
OF THE GENERA.

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INTRODUCTION.

During the summer of 1906 the United States Fisheries Steamer *Albatross* made extensive explorations about the islands of Japan. After a few dredge hauls about the Kuril Islands the course was continued through the Tsugaru Strait and southward, in the Sea of Japan, along the west coast of Hondo to Tsuruga; and from there across the Sea of Japan to the east coast of Korea by way of the Oki Group; then southward, through the Eastern Channel of Korea Strait, to the Eastern Sea; thence through Vincennes Strait to Kagoshima Gulf; and northward, through Bungo Channel and the Inland Sea, to Yokohama. The *Albatross* then circumnavigated Hokkaido (Yezo), and, returning southward, dredged extensively in Suruga Gulf and Sagami Bay.

The Macrouroid fishes obtained during this expedition are made the subject of the present report. Large numbers of these deep-sea fishes were dredged off the southern and southeastern coasts of Japan, chiefly in the Eastern Sea, Suruga Gulf, and Sagami Bay. They were found in the Okhotsk Sea and everywhere to the eastward of the islands, but they were not to be discovered in the Sea of Japan nor the Gulf of Tartary, although numerous and successful hauls of the trawl were made at appropriate depths.

SYNOPSIS OF THE GENERA.

It has long been apparent to students of Macrouroid fishes that many of the current genera are incapable of exact definition, forming more or less unnatural groups. This statement is especially true of the genus *Macrourus*, with which widely different groups have been repeatedly identified.

The authors have had the privilege of further examining a large number of species, including nearly all those obtained by the *Albatross* in extensive expeditions in the North Atlantic Ocean, on both coasts of South America, about the Galapagos Archipelago, in Panama Bay, off the west coast of North America, in Bering Sea, about the Hawaiian Islands, and about the Philippine Islands.¹ The senior author critically studied the material in the United States National Museum in 1905. On the basis of the study of these collections a revision of the subfamilies and genera is proposed.

The characters heretofore used to define the genera or subgenera in the large subfamily Coryphaenoidinae (=Macrourinae) have largely proved to be of minor or only specific value, because of the great variation shown by obviously related species as regards these characters. Among these may be mentioned the dentition, which has been used heretofore in the primary division of the subfamily. The dentition of the lower jaw has proved to be of no generic value, as in closely related species of *Coryphaenoides* and *Lionurus* the teeth vary from a single series to a wide band. The enlargement of the outer premaxillary series, forming the heterodont dentition of "*Chalinura*," is not a reliable generic character because of its great variation in different species of *Coryphaenoides*. But in each of three distinct groups there are found two genera or subgenera, one of which contains only one or two series of teeth in both jaws while the other has a distinct premaxillary band. *Nematonurus* is thus separated from *Coryphaenoides*, *Abyssicola* from *Coelorhynchus*, and *Malacocephalus* from *Lionurus*. Other characters are correlated with this difference in dentition. The amount of rostral projection is usually characteristic of the genera, but no value can apparently be placed on this character in the large genera *Coryphaenoides* and *Lionurus* (as here defined). The roughness of the scales is subject to wide variation in the larger genera and apparently distinguishes natural groups in but a single case. In the genus *Lionurus* the subgenus *Lionurus* differs from the subgenus *Nezumia* in the smooth scales of the body. The amount of interdorsal space can only be regarded as of specific value. The serration of the dorsal spine is a valuable character. The serrations are found only in the Coryphaenoidinae (=Macrourinae), and are absent in six genera of that subfamily: *Cynomacrurus*, *Coelorhynchus*, *Abyssicola*, *Hymenocephalus*, *Malacocephalus*, and *Trachonurus*. The serrations are obsolescent in certain species of the large genera *Coryphaenoides* and *Lionurus*. But the strength of the spine and its trenchant anterior edge are retained even in these species. The spine is comparatively

¹The entire Philippine collection of Macrouroid fishes made by the Fisheries steamer *Albatross* during the years 1907 to 1910 has been kindly sent to us by Dr. Hugh M. Smith, Commissioner of Fisheries.

more slender and the anterior edge rounded in those genera characterized by the total absence of serrations. Two serrations were found on the dorsal spine in a paratype of *Coelorhynchus productus*.

The classifications of genera adopted by Jordan and Evermann,¹ Goode and Bean,² Dollo,³ and by other authors are based chiefly upon that of Günther, proposed in the report on the deep-sea fishes of the *Challenger* expedition (p. 124).

The characters used by us to separate the genera related to *Coryphaenoides* (here referred to the subfamily Coryphaenoidinae) are small, but their value lies in their constancy, which has been tested in a large majority of the species.

Many nomenclatural changes follow as a result of this rearrangement of the genera. *Dolloa* (= *Moseleya*), *Albatrossia*, and *Bogosllovius* are regarded as synonyms of *Nematonurus*. *Chalinura* can not be separated from *Coryphaenoides*, and the most of the numerous species heretofore referred to *Macrourus* are now regarded as species of *Coryphaenoides* on the one hand and of *Lionurus* on the other. These changes are further indicated in the list of species and in the generic descriptions.

The number of branchiostegal rays is a character of great value in this group, and is used in the present classification in the primary subdivision of the subfamily Coryphaenoidinae. One group of genera, undoubtedly related to *Coryphaenoides*, has six branchiostegal rays. The species of these genera have the anus immediately anterior to the anal fin, with the exception of *Coryphaenoides histomus*, *Abyssicola macrochir*, and several aberrant species of *Coelorhynchus*. Another large group, similarly interrelated, has seven branchiostegal rays, and the anus remote from the anal fin. Alcock⁴ is the only author who has used this interesting correlation in the classification of the group, but he used it merely in his key to the species which he referred to *Macrurus*, and based no genera upon this correlation. The genus *Hymenocephalus* alone has seven branchiostegals and the anus immediately before the anal. This correlation confirms the isolated position of *Hymenocephalus* among the Coryphaenoidinae, as further indicated by the presence of ventral striae, the large lateral and subterminal mouth, the long forward extension of the gill openings, the smooth dorsal spine, the thin and weakly armed scales, the presence of two ventral lens-shaped bodies,

¹ The Fishes of North and Middle America, Bull. U. S. Nat. Mus., No. 47, pl. 3, 1898, p. 2561.

² Oceanic Ichthyology, Smiths. Inst., Sp. Bull., 1895, p. 389.

³ Expédition Antarctique Belge. Rés. du Voy. du S. Y. *Belgica*. Zoologie: Poissons, 1904, p. 32.

⁴ Alcock, Journal of the Asiatic Society of Bengal, vol. 63, pt. 2, 1894, pp. 126 and 127; Goode and Bean, Oceanic Ichthyology, 1895, p. 532 (reprinted from Alcock); and Alcock, A Descriptive Catalogue of the Deep-Sea Fishes in the Indian Museum, 1899, pp. 108 and 109.

and other characters. Further generic division of these two major groups is based largely on dentition, amount of rostral projection, the presence or absence of serrations on the dorsal spine, and other characters, which were formerly used in the primary division of the subfamily.

Most of the genera as here accepted seem to be well-defined groups of doubtlessly related species, to which genera new species may be referred with convenience and with little or no doubt. The value and correctness of the classification as here adopted has been verified in the study of several collections of Macrouroid fishes, which have not been reported on. Future study may further subdivide some of the larger genera into more compact groups, as the species vary within wide limits.

Macrourus berglax Lacépède (1800), the type-species of the genus *Macrourus*, is found to be congeneric with *Coryphaenoides rupestris* Gunner (1765). *Macrourus* (= *Macrurus*, a changed spelling), therefore becomes a synonym of *Coryphaenoides*, and the family name Macrouridae must also be discarded. The oldest and best known genus is taken as the type of the family, which should apparently stand as Coryphaenoididae.

The most remarkable of the Coryphaenoididae collected on the expedition of the *Albatross* to Japan in 1906, is *Squalogadus modificatus*, a new genus and species related to *Macrouroides inflaticeps*,¹ from the Philippine Islands, but differing chiefly in the presence of small ventral fins. On the evidence of this discovery, we do not accept *Macrouroides* as the type of a distinct family. The single dorsal fin of these two fishes is also shared by *Lyconus*,² which has the anterior dorsal rays more or less elevated. *Lyconus*³ appears to be an ally of *Bathygadus*.

The only constant character known, by which the Coryphaenoididae can be separated from the Gadidae, is the absence of a caudal fin, the dorsal and anal fins being continuous around the long, whip-like tail. A pseudocaudal is frequently formed, probably after an injury to the slender tip of the tail, but even in this case the vertical fins are confluent around the tail. The posterior position of the ventrals is not a constant character in the Coryphaenoididae. They are well in advance of the pectorals in *Squalogadus*, *Cetonurus*, and in several species of *Lionurus* (most advanced in position in *Lionurus gibber*,⁴ from the Hawaiian Islands). Regan³ has noticed the close resemblance between *Macruronus* and the Gadidae. The Muraenolepididae have the vertical fins confluent around the tail, but differ widely from the Coryphaenoididae in the rounded caudal; the restricted gill open-

¹ Smith and Radcliffe, Proc. U. S. Nat. Mus., vol. 43, 1913, p. 139, pl. 31, fig. 3.

² Günther, *Challenger Reports*, vol. 23, Deep-Sea Fishes, 1887, p. 158.

³ Regan, *Ann. Mag. Nat. Hist.*, ser. 7, vol. 11, 1903, pp. 464 to 466.

⁴ Gilbert and Cramer, Proc. U. S. Nat. Mus., vol. 19, 1897, p. 426, pl. 44, fig. 2; Gilbert, *Bull. U. S. Fish Com.*, 1903 (1905), pt. 2, p. 668.

ings; the small elongate scales at right angle, as in *Anguilla* and *Otophidium*; and in the increased number of pectoral actinosts. We do not accept Regan's reference¹ of *Melanonus*² to this family, since *Melanonus* has a separate caudal fin.

KEY TO THE SUBFAMILIES AND GENERA.

A¹. No fold of membrane attached to first gill-arch and restricting the gill-slit; gill-rakers not tubercular; pseudobranchiae present or absent; second dorsal ray not modified and spinelike; posterior portion of dorsal better developed than posterior portion of anal.

B¹. Two separate dorsal fins.

C¹. Vomerine teeth present; anterior portion of anal more or less elevated; teeth in one or two series in jaws; "neural arch of first vertebra suturally united to exoccipitals and its neural spine directly and firmly attached to the supraoccipital crest."-----MACRURONINAE.

a¹. Anterior portion of anal forming a pronounced lobe; anus anterior, nearly between ventrals; ventral area with striae, consisting of alternating and parallel streaks of dark and silvery pigment.

Steindachneria.

a². Anterior portion of anal not forming a pronounced lobe; anus posterior, immediately before anal fin; no ventral striae; pectoral actinosts 4⁴-----*Macruronus*.

C². No vomerine teeth; anal low throughout its length; teeth in bands in jaws; "the first vertebra articulating normally with the skull, its neural spine not directly attached to the occipital crest."³

BATHYGADINAE.

b¹. Mouth terminal; no scaleless fossa at side of nape; scales all cycloid, those along bases of dorsal and anal not modified; gill-rakers long and slender; second dorsal much higher than anal; pectoral actinosts 3.⁴

c¹. Barbel vary short or absent; teeth of moderate size--*Bathygadus*.

c². Barbel very long; teeth exceedingly minute-----*Gadomus*.

b². Mouth entirely inferior, the snout being greatly produced; a scaleless fossa on each side of nape; scales rough, especially in a strongly modified series along anterior portions of dorsal and anal bases; gill-rakers styliform; second dorsal not much higher than anal; pectoral actinosts 6⁴-----*Trachyrhynchus*.

B². Dorsal fin single, the anterior rays more or less elevated; head not massive; a few enlarged canines in jaws; teeth present on vomer; mouth terminal; scales cycloid; ventral fins not reduced; no barbel.

LYCONINAE.

Lyconus.

¹ Regan, Ann. Mag. Nat. Hist., ser. 7, vol. 11, 1903, pp. 464 to 466.

² *Melanonus gracilis* Günther, Ann. Mag. Nat. Hist., 1878, vol. 2, p. 19; *Challenger* Reports, vol. 22, Deep-Sea Fishes, 1887, p. 83, pl. 14, fig. B; Brauer, Die Tiefsee Fische, 1906, p. 277, pl. 12, fig. 5; Zugmayer, Rés. Camp. Sci. Monaco, fasc. 35, p. 120, pl. 6, fig. 1.

Melanonosoma acuticaudatum Gilchrist, Mar. Inv. S. Africa, vol. 2, 1902, p. 106 (an ally of *Melanonus gracilis*).

³ Regan, Ann. Mag. Nat. Hist., ser. 7, vol. 11, 1903, p. 465.

⁴ Regan (Ann. Mag. Nat. Hist., vol. 11, 1903, p. 462) gives the number of actinosts in this family as follows: *Bathygadus* and *Gadomus*, 3; *Macruronus*, 4; *Hymenocephalus*, 5; *Macrurus*, *Coryphaenoides*, and *Trachyrhynchus*, 6. We have counted 3 in *Bathygadus antrodes*; 4 in *Hymenocephalus torvus*, *H. striatissimus*, *Lionurus latirostratus*, and *L. proximus*, and 5 in *Coryphaenoides acrolepis* and *C. marginatus*.

- B*³. Dorsal fin single, low throughout its extent; head exceedingly massive and soft; teeth in bands, on jaws only; scales spinigerous; mouth entirely inferior, below or behind eye; ventral fins greatly reduced or absent ----- *MACROUROIDINAE*.
- d*¹. Ventrals small, with 5 rays; pectoral with 25 rays; gill-rakers long; gill-membranes free from the isthmus; mouth behind eye; pseudobranchial filaments present ----- *Squalogadus*.
- d*². Ventrals absent; pectoral with 16 rays; gill-rakers short; gill-membranes joined to the isthmus; mouth below eye; pseudobranchial filaments absent ----- *Macrouroides*.
- A*². A fold of membrane attached to first gill-arch, and restricting the first gill-slit; gill-rakers tubercular; no pseudobranchiae; second dorsal ray a modified spine, often with serrations on its anterior edge; anal better developed than second dorsal; teeth in jaws only.
- D*¹. Pectoral fin not pedunculated; pectoral actinosts 4 to 6.
CORYPHAENOIDINAE.
- e*¹. Six branchiostegal rays; anus immediately before anal fin (except in *Coryphaenoides hyostomus*, *Abyssicola macrochir*, and some aberrant species of *Coelorhynchus*); anus not preceded by a naked area or fossa, except in *Abyssicola* and certain species of *Coelorhynchus*; no striated regions on under side of trunk; scales usually of moderate size (enlarged in some species of *Coelorhynchus*); gill-rakers fewer than 15 on lower limb of second arch; gill-membranes broadly united, scarcely extended forward ventrally; species large and widely distributed, usually reaching a length of over two feet.
- f*¹. No barbel; anal not much higher than second dorsal; dorsal spine slender and smooth; premaxillary teeth unequal, in a narrow band separated by an interspace from the marginal series of small teeth, one of which is enlarged to form a large anterolateral canine; physiognomy as in *Bathygadus*, the mouth terminal ----- *Cynomacrurus*.
- f*². Barbel always present; anal much higher than dorsal; no specialized pair of anterolateral canines; mouth never completely terminal.
- g*¹. Snout little produced; no strongly marked ridges on head, the suborbital ridge not extending to preopercle; dorsal spine trenchant on anterior edge and serrate (serrations rarely obsolescent).
- h*¹. Outer series of premaxillary teeth enlarged, one or two inner series; inner mandibular series enlarged, one outer series in some species; physiognomy usually approaching that of *Bathygadus* ----- *Nematonurus*.
- h*². Teeth in a villiform or cardiform band in upper jaw, varying from a single series to a band in the lower jaw ----- *Coryphaenoides*.
- g*². Snout usually greatly produced; head with prominent ridges, armed with modified scales, the suborbital ridge extending to preopercle; dorsal spine smooth and rounded anteriorly.
- i*¹. Teeth in bands in jaws; ridges of head strong; the side of head strongly angulated at the suborbital ridge ----- *Coelorhynchus*.

- i². Teeth biserial in jaws; ridges of head less prominent; the side of head little angulated at the suborbital ridge ----- *Abyssicola*.
- e². Seven branchiostegal rays; anus immediately before anal; midventral line with two lens-shaped bodies connected by a black ridge on wall of abdominal cavity, one immediately before anus, the other in advance of ventrals; ventral regions marked with striae, consisting of fine parallel lines of alternating dark and silvery pigment; scales large and thin, smooth or weakly spined; more than 15 gill-rakers on lower limb of second arch; gill-membranes narrowly united, the gill-opening extended forward ventrally; species fragile, less than a foot in length, and confined to tropical waters.
Hymenocephalus.
- e³. Seven branchiostegal rays; anus remote from anal fin; anus preceded by a naked area; no ventral striae; scales small; gill-rakers fewer than 15 on lower limb of second arch; gill-membranes broadly united, little extended forward ventrally; species confined to tropical or subtropical waters.
- j¹. Premaxillary teeth biserial, mandibular teeth uniserial; pyloric caeca very numerous and profusely branched; dorsal spine smooth and rounded ----- *Malacoccephalus*.
- j². Premaxillary teeth in a band, mandibular teeth varying from an irregular series to a band; pyloric caeca in moderate numbers, fewer than 100, not branched.
- k¹. Bones of head firm, the sensory canals moderately developed, the skull without high crests; form of body usually slender, the head not very massive, the snout not exceedingly broad and high, the tail not rapidly constricted from trunk; gill-cavity not restricted in size; margin of preopercle not adnate; barbel moderate or long; lateral line pores, as in all genera except *Squalogadus* and *Cetonurus*, along a well marked, continuous, superficial groove (sometimes slightly interrupted); scales along dorsal base not enlarged (except in *Trachonurus*).
- l¹. Scales everywhere well imbricate, their spinules directed backward (except in *Lionurus parvipes* and *L. cetonuropsis*); dorsal spine trenchant on anterior edge, and serrate (serrations obsolescent in some forms); small species, less than 15 inches long.
- m¹. Snout moderately produced ----- *Lionurus*.
- m². Snout greatly produced, much as in *Coelorrhynchus* ----- *Mataeocephalus*.
- l². Scales not imbricate, their spinules erect; dorsal spine slender, smooth and rounded; snout moderately produced ---- *Trachonurus*.

k². Bones of head soft, the sensory canals greatly developed, the skull with high crests; form very robust, the head massive, the snout broad and high, the tail rapidly constricted from trunk; gill-cavity restricted in size; margin of preopercle adnate to interopercle; barbel very short; lateral line consisting of widely spaced pores, without a well-marked superficial groove; an accessory dorsal branch of lateral line pores; scales enlarged and modified in a series along base of dorsal; spinules of scales erect; dorsal spine serrate.....*Cetonus*.

D. Pectoral fin strikingly pedunculated; first dorsal and ventral fins produced.....ATELEBRACHINAE.
Atelobranchium.

LIST OF THE KNOWN SPECIES OF MACROUROID FISHES.

The Japanese species here reported on are marked in the following list by an asterisk (*). Other species examined by the writers are marked with a dagger (†). Nominal species are excluded.

Family CORYPHAENOIDIDAE Collett.

Subfamily MACRURONINAE Regan.

Genus *Steindachneria* Goode and Bean (*argentea*).

S. argentea Goode and Bean.†

Genus *Macrurus* Günther (*novae-zealandiae*).

M. novae-zealandiae (Hector).†

M. magellanicus Lönnberg.

Subfamily BATHYGADINAE Jordan and Evermann.

Genus *Bathygadus* Günther (*cottoides*).

B. cottoides Günther.

B. melanobranchus Vaillant.†

B. favosus Goode and Bean.†

B. antrodes (Jordan and Gilbert).*

B. bowersi (Gilbert).†

B. micronema (Gilbert).†

B. furvesecus Alcock.†

B. macrops Goode and Bean.†

B. nipponicus (Jordan and Gilbert).†

B. filamentosus (Smith and Radcliffe).†

B. sulcatus (Smith and Radcliffe).†

B. garretti, new species.*

Genus *Gadomus* Regan (*longifilis*).

G. longifilis (Goode and Bean).†

G. multifilis (Günther).†

G. melanopterus Gilbert.†

G. arcuatus (Goode and Bean).†

G. dispar Vaillant.

G. colletti Jordan and Gilbert.*

Genus *Trachyrhynchus* Giorna (no type mentioned).

T. trachyrhynchus (Giorna).

T. longirostris (Günther).

T. murrayi Günther.

T. helolepis Gilbert.†

Subfamily LYCONINAE, new name.

(=*Lyconidae* Günther, *Challenger* Reports, vol. 23, Deep-Sea Fishes, 1887, p. 158.)

Genus *Lyconus* Günther (*pinnatus*).

L. pinnatus Günther.

L. brachycolus Holt and Byrne.

Subfamily MACROUROIDINAE, new name.

(=*Macrouroididae* Smith and Radcliffe).

Genus *Squalogadus*, new (*modificatus*).

S. modificatus, new species.*

Genus *Macrouroides* Smith and Radcliffe (*inflaticeps*).

M. inflaticeps Smith and Radcliffe.

Subfamily CORYPHAENOIDINAE, new name.

Genus *Cynomacrurus* Dollo (*piriei*).

C. piriei Dollo.

Genus *Nematonurus* Günther (*armatus*).¹

N. longifilis (Günther).*

N. clarki (Jordan and Gilbert).†

N. firmisquamis (Gill and Townsend).†

N. cyclolepis Gilbert.†

N. pectoralis (Gilbert).*

N. lecointei (Dollo).

N. suborbitalis (Gill and Townsend).†

N. bulbiceps (Garman).†

N. bona-nox (Jordan and Thompson).*¹

N. abyssorum Gilbert.†

N. gigas (Vaillant). (?=*N. armatus*).

N. goodei (Günther).†

N. affinis (Günther).

N. armatus (Hector).

Genus *Coryphacnoides* Gunner (*rupestris*).

C. rupestris Gunner.†

C. murrayi Günther.

C. fernandezianus (Günther).

C. filifer (Gilbert).†

C. liocephalus Günther).

C. leptolepis (Günther).

C. simulus (Goode and Bean).†

C. paradoxus (Smith and Radcliffe).

C. brevibarbus (Goode and Bean).†

C. mediterraneus (Giglioli).

C. carapinus Goode and Bean.†

C. awae Jordan and Gilbert.*

C. spinulosus (Gilbert and Burke).†

C. acrolepis (Bean).†

C. marginatus Steindachner and Döderlein.*

C. ferrieri (Regan).

C. whitsoni (Regan).

C. bucephalus (Garman).†

C. capito (Garman).†

C. boöps (Garman).†

¹ See footnote under *N. bona-nox* on p. 162.

- C. leucophaeus* (Garman).†
C. carminatus (Garman).†
C. anguliceps (Garman).†
C. latinus (Garman).†
C. longicirrhus (Gilbert).†
C. microps (Smith and Radcliffe).†
C. dubius (Smith and Radcliffe).†
C. aequatoris (Smith and Radcliffe).†
C. cinereus (Gilbert).*
C. liraticeps (Garman).†
C. lepturus (Gill and Townsend).†
C. altipinnis Günther.
C. nasutus Günther.*
C. serrulatus Günther.
C. ariommus Gilbert and Thompson.†
C. ingolfi (Lütken).
C. guentheri (Vaillant).
C. sublacvis (Vaillant).
C. hextii (Alcock).
C. wood-masoni (Alcock).
C. macrolophus (Alcock) (= *M. lophotes* Alcock).
C. hoskynii (Alcock).
C. serrulus (Bean).†
C. camurus (Smith and Radcliffe).†
C. orthogrammus (Smith and Radcliffe).†
C. rudis Günther. (The largest specimen, the one figured, may be designated as the type; the other specimen, under 12 inches long, represents some species of *Lionurus*.)
C. asper Günther.
C. denticulatus (Richardson).
C. berglax (Lacépède).†
C. holotrachys (Günther).
C. carinatus Günther.
C. hyostomus (Smith and Radcliffe).†
 Genus *Coelorhynchus* Giorna (*coelorhynchus*).
 Subgenus *Coelorhynchus*.
 C. scaphopsis (Gilbert).†
 C. patagoniae Gilbert and Thompson.†
 C. canus (Garman).†
 C. carminatus (Goode).†
 C. coelorhynchus (Risso).†
 C. caribbaeus (Goode and Bean).†
 Subgenus *Paramacrurus* Bleeker (*australis*).
 C. aspercephalus Waite.
 C. innotabilis McCulloch.
 C. australis (Richardson).
 C. notatus Smith and Radcliffe.†
 C. kishinouyei Jordan and Snyder.*
 C. fasciatus (Günther).†
 C. jordani Smith and Pope.*
 C. gladius Gilbert and Cramer.†
 Subgenus *Oxymacrurus* Bleeker (*japonicus*).

¹ See footnote under *N. bona-nox* on p. 162.

- C. argentatus* Smith and Radcliffe.†
- C. chilensis* Gilbert and Thompson.†
- C. anatrostris* Jordan and Gilbert.†
- C. productus*, new species.*
- C. flabellispinis* (Alcock).
- C. platorhynchus* Smith and Radcliffe.†
- C. commutabilis* Smith and Radcliffe.†
- C. japonicus* (Temminck and Schlegel).*
- C. tokiensis* (Steindachner and Döderlein).*
- C. macrorhynchus* Smith and Radcliffe.†
- C. quadricristatus* (Alcock).
- C. acutirostris* Smith and Radcliffe.†
- C. parallelus* (Günther).*
- C. kermadecus* Jordan and Gilbert.
- C. sp.* (*parallelus* Brauer, not of Günther).
- C. aratrum* Gilbert.†
- C. doryssus* Gilbert.†
- C. occa* (Goode and Bean).†
- C. talismani* (Collett). (= *C. japonicus* Vaillant, not of Temminck and Schlegel.)

Genus *Abyssicola* Goode and Bean (*macrochir*).

- A. macrochir* (Günther).*

Genus *Hymenocephalus* Giglioli (*italicus*).

- H. longibarbis* (Günther).
- H. longiceps* Smith and Radcliffe.†
- H. longipes* Smith and Radcliffe.†
- H. torvus* Smith and Radcliffe.†
- H. striatissimus* Jordan and Gilbert.*
- H. heterolepis* Alcock.†
- H. italicus* Giglioli.†
- H. cavernosus* (Goode and Bean).†
- H. antraeus* Gilbert and Cramer.†
- H. lethonemus* Jordan and Gilbert.*
- H. striatulus* Gilbert.†
- H. papyraceus* Jordan and Gilbert.†
- H. aterrimus* Gilbert.†

Genus *Malacocephalus* Günther (*laevis*).

- M. nipponensis*, new species.*
- M. laevis* (Lowe).
- M. hawaiiensis* Gilbert.†

Genus *Lionurus* Günther (*fllicaudus*).

Subgenus *Nezumia* Jordan (*condylura*).

- L. lucifer* (Smith and Radcliffe).†
- L. nigromaculatus* (Smith and Radcliffe).†
- L. atherodon* (Gilbert and Cramer).†
- L. petersoni* (Alcock) (= *Macrurus hispidus* Alcock).
- L. occidentalis* (Goode and Bean).†
- L. garmani* (Jordan and Gilbert).*
- L. ctenomelas* (Gilbert and Cramer).†
- L. misakius* (Jordan and Gilbert).*
- L. macronemus* (Smith and Radcliffe).†
- L. stelgidolepis* (Gilbert) (= *Macrurus gracillicauda* Garman).†
- L. condylura* (Jordan and Gilbert).*

- L. darus*, new species.*
L. orbitalis (Garman).†
L. loricatus (Garman).†
L. cuspidatus (Garman).†
L. convergens (Garman).†
L. latirostratus (Garman).†
L. trichiurus (Garman).†
L. cctencs (Gilbert and Cramer).†
L. propinquus (Gilbert and Cramer).†
L. holocentrus (Gilbert and Cramer).†
L. gibber (Gilbert and Cramer).†
L. pudens (Gilbert and Thompson).†
L. burragei (Gilbert).†
L. obliquatus (Gilbert).†
L. hebetatus (Gilbert).†
L. bairdii (Goode and Bean).†
L. nigromaculatus (McCulloch).
L. aequalis (Günther).
L. smiliphorus (Vaillant).
L. sclerorhynchus (Valenciennes).
L. hirundo (Collett).
L. polycephis (Alcock).
L. pumiliceps (Alcock).†
L. investigatoris (Alcock).
L. brevisrostris (Alcock).
L. semiquincunciatus (Alcock).
L. spinosus, new species.*
L. proximus (Smith and Radcliffe).*
L. parvipes (Smith and Radcliffe).†
L. cetonuropsis, new species.*
 Subgenus *Lionurus*.
L. filicauda (Günther).
L. holcephis (Gilbert).†
L. fragilis (Garman).†
L. barbiger (Garman).†
L. microlepis (Günther).
 Genus *Mataeocephalus* Berg (*ucipenserinus*).
M. adustus Smith and Radcliffe.†
M. tenuicauda (Garman).†
M. acipenserinus (Gilbert and Cramer).†
M. nigrescens Smith and Radcliffe.†
M. microstomus (Regan).
 Genus *Trachonurus* Günther (*villosus*).
T. villosus (Günther).*
T. sulcatus (Goode and Bean).†
T. scintipellis Gilbert and Cramer.†
T. asperrimus (Vaillant).
 Genus *Cetonurus* Günther (*crassiceps*).
C. crassiceps (Günther).
C. globiceps (Vaillant).†
C. microps Vaillant.
C. robustus, new species.*

ATELEBRACHINAE, new subfamily.

Genus *Atelebrachium* Gilbert and Burke (*pterotum*).¹*A. pterotum* Gilbert and Burke.†

LIST OF DOUBTFUL FORMS.

1. Genus uncertain.

Macrurus serratus Lowe.*Macrurus macrolepidotus* Kaup." *Optonurus* " *denticulatus* (Richardson).*Macrurus labiatus* Koehler.*Macrurus caudani* Koehler.*Macrurus zaniophorus* Vaillant.*Macrurus violaccus* Vaillant.*Macrurus microps* Vaillant.Most of these species are probably referable to *Lionurus*.

2. Larval forms.

The larval forms of certain Mediterranean Macroroid fishes have been described by Italian ichthyologists under the name *Krohnins*.² These larval forms have been referred to other genera, but the identification must be regarded at present as very doubtful. Thus the type-species of *Krohnins*, *K. filamentosus*, has been placed in the synonymy of *Coelorhynchus coelorhynchus*.

3. Fossil forms.

Fossil otoliths³ have been named as species of *Macrurus* and *Hymenocephalus*, but the references must be regarded as extremely doubtful.

METHODS OF MEASUREMENTS AND COUNTS.

In the following descriptions the proportions in each species are given as obtained by measurement on the specimen; for example, the orbit is measured over the lateral curve of the head. In the tables the measurements are expressed in hundredths of the length from the tip of the snout to the center of the anus. The tail is so frequently injured, with or without the regenerated pseudocaudal, that the total length can not be used satisfactorily. These measurements were made with dividers and a proportional scale, and are valuable in discriminating between closely allied species.

The measurements were made and recorded as follows: The total length in millimeters (the fact mentioned in a footnote when a pseudocaudal is developed, and followed by a + mark when the tail is broken); length of head from tip of snout to end of membrane behind upper angle of opercle; greatest length of orbit, whether the longest diameter is horizontal or oblique; the least width of the interorbital; the least width of the entire bony suborbital region; the distance between the posterior margin of the orbit and the angle of the

¹ Possibly a larval form (see Murray and Hjort, *Depths of the Ocean*, 1912, p. 745, fig. 537).

² Cocco, *Lettera al Sig. Augusto Krohn, Pesci del Mare de Messina*, vol. 1, 1884. Emery, *Note ittologiche: Atti della Soc. ital. di Sci. nat. Milano*, 1878; *Contribuzioni all' Ittiologia*, II, *Mittheil. a. d. Zool. Stat. zu Neapel*, 1879, vol. 4, p. 588; *Contrib.*, vol. 9, *Mittheil.* 3, 1883, p. 417 to 418.

³ Schubert, *Jahrb. geol. Reichs.*, vol. 55, p. 615.

Koken, *Z. geol. Ges.*, vol. 43, p. 77 (and other papers).

preopercular margin; the preocular length of the snout; the greatest width of the snout opposite the anterior orbital margins; the length of maxillary from tip of premaxillary; the length of the free portion of the barbel; the greatest depth of the body, usually from the origin of the first dorsal to the midline of the abdomen; the width of the body over the bases of the pectoral fins; the distance between the center of the anus and the origin of the anal; the distance between the center of the anus and the base of the outer ventral ray; the distance from the base of the outer ventral ray to the isthmus, at the anterior end of the scaly area; and the length of the pectoral from the base of the second ray.

The number of scales is counted in a series from the origin of the second dorsal to the lateral line, including the small series along the base of the fin, and also in a series from the lateral line to the origin of the anal, the lateral line scale being excluded in each case. Both the rudimentary and the developed spine of the first dorsal are described, but in the tables only the soft rays are enumerated, including the last ones, which are always short and unbranched; the uppermost pectoral ray, which is counted, is short, unbranched, and inarticulate—stiff and sharp in the Coryphaenoidinae, but flexible in the Bathygadinae; all the serrations of the dorsal spine are counted, including the rudimentary ones. The gill-rakers are counted on the lower limb of the outer arch, unless otherwise indicated; when one is at the angle of the arch, it is counted among those on the lower limb.

When two counts are given of the rays of the paired fins, the first one was made on the left side.

SYSTEMATIC DESCRIPTIONS.

Genus BATHYGADUS Günther.

Bathygadus GÜNTHER, *Challenger Reports*, vol. 22, Deep-Sea Fishes, 1887, p. 154 (*cottoides*).

Melanobranchus REGAN, *Ann. Mag. Nat. Hist.*, ser. 7, vol. 11, 1903, p. 459 (*melanobranchus*).

Regania JORDAN, *Bull. U. S. Fish Comm.*, 1902 (1904), p. 604 (*nipponica*).

Excluding the anomalous *Trachyrhynchus*, we are unable to separate more than two genera of the *Bathygadinae*: *Bathygadus*, which has the teeth comparatively coarse, and the barbel absent or rudimentary,¹ and *Gadomus*, which has the teeth very minute, and the barbel very long. We do not accept the genus *Melanobranchus*, which was described as differing from *Bathygadus* in the presence of four gills, and a slit behind the last arch. Mr. C. Tate Regan, of the British Museum, having kindly examined the type of *B. cottoides*, writes us that it agrees with *B. melanobranchus* in the character of the gills, contrary to Günther's description, in which it is stated that *B. cot-*

¹ In *B. melanopterus*, *macrops*, *sulcatus*, and *garretti*.

toides has but $3\frac{1}{2}$ gills, with no slit behind the last arch. We also fail to recognize *Regania*, as the firmness of the head varies widely among the species of both *Bathygadus* and *Gadomus*.

A reexamination of the coracoid foramen in a number of species of *Bathygadus* and *Gadomus* indicates that its position is not of generic value in this group, since it is apparently variable in groups of evidently related species. The foramen is within the hypercoracoid in *Gadomus melanopterus*, but between the hypercoracoid and the hypocoracoid in our specimens of *G. multifilis* and *G. colletti*. Moreover, the foramen lies between the two bones in *B. macrops* and *B. garretti*, but perforates the hypercoracoid in *B. sulcatus* and *B. filamentosus*. These four species closely resemble one another, and are probably closely related. Finally, an intermediate condition is evident in *B. antrodes*, in which species the walls of the foramen lie almost entirely within the hypercoracoid, but remain in contact with the suture. The position of the coracoid foramen has been used as a generic character by Regan,¹ Jordan,² Gilbert,³ and Radcliffe.⁴

Branchiostegals 7; first pectoral ray flexible, unbranched, and inarticulate; no scaleless pits, grooves, nor ventral striae present in any species. A very peculiar type of squamation is found in the species of *Bathygadus*. The large sensory canal just anterior to the origin of the lateral line is covered by a group of large imbricating scales, several times the ordinary size, marked with radii and concentric striae, and overlapping normal scales posteriorly. These large scales are completely covered by normal scales. The same type of squamation is developed in *Hymenocephalus*, in which the sensory canals are also enlarged. In both the Bathygadinae and the Coryphaenoidinae, then, these scales are best developed in genera in which the sensory canals are excessively developed.

1. BATHYGADUS ANTRODES (Jordan and Gilbert).

Melanobranchus antrodes JORDAN and GILBERT, Bull. U. S. Fish. Comm., 1902 (1904), p. 606, pl. 4, fig. 1.

Sixteen specimens, from 104 to 483 mm. in total length, 37 to 163 mm. to anus, were dredged off the east coast of central Hondo.

<i>Albatross</i> station.	General locality.	Depth of fathoms.	Number of speci- mens.
4969.....	Off Shio Misaki.....	587	5
4971.....	.....do.....	649	2
4972.....	.....do.....	440	1
4973.....	.....do.....	600	3
4975.....	.....do.....	545-712	1
5080.....	Off Omi Saki.....	505	1
5082.....	.....do.....	662	1
5083.....	.....do.....	624	1
5085.....	Sagami Bay.....	622	1

¹ Ann. Mag. Nat. Hist., ser. 7, vol. 11, 1903, p. 459.

² Bull. U. S. Fish. Comm., 1902 (1904), p. 602.

³ Idem., 1903 (1905), pt. 2, pp. 559 to 661.

⁴ Proc. U. S. Nat. Mus., vol. 43, 1913, p. 105.

This excellent material makes it possible to give a number of additions and corrections to the original description.

The premaxillary band of teeth is of nearly uniform width, narrowing on its posterior third. A modified inner portion of much smaller teeth is constantly present. It is sharply defined from the outer portion, being separated from it by a longitudinal groove, and is widest somewhat behind the middle of the maxillary, narrowing in both directions, and extending forward to the anterior third of the outer band. In the young, about 130 mm. long, this modified inner portion of the band is nearly as wide as the outer portion, and is separated from it by a groove more distinct than that of the adult. The mandibular band is very narrow, comparatively little curved in cross section, and consisting of about 3 or 4 irregular rows of teeth similar to those of the outer premaxillary band. No trace of a barbel can be found on any of the specimens. The pseudobranchial filaments are always present, and are located at the edge of a deep conic pit.

Inner edge of shoulder girdle naked.

Pyloric caeca in five specimens: 10, 15, 16, 16, 18.

Anus located immediately before the anal fin.

The slender fin filaments were evidently broken in the type of the species, none of the fins being described as longer than the head. In our specimens the dorsal, pectoral, and ventral filamentary rays, when entire, are all longer than the head. In a paratype of *B. bowersi*,¹ from the Hawaiian Islands, the pectoral filamentary ray appears entire, and is much shorter than the head. Further comparison with *B. bowersi* is made in the table of measurements.

Table of measurements in hundredths of length to anus.

<i>Albatross</i> station.....	4969	4971	5082	4975	4969	5080	4969	5083	24151
Total length, mm.....	426	483	368+	353+	335	325+	335+	297+	265
Length to anus, mm.....	163	154	127	126	106	107	109	96	86
Length, head.....	55	56.5	55.5	56.5	60	58	59	60	62.5
Length, orbit.....	11	11	13	12.5	14	13	12.5	13	14
Length, interorbital.....	17.5	18	20	20	21	21	21	23	24.5
Width, suborbital.....	10	10.5	9.5	12	12	11	11	12	9
Orbit to preopercle.....	26.5	25.5	27	29	29	28.5	27.5	27.5	32
Length, snout.....	17	16.5	17	17	18	17.5	18	17.5	18
Length, maxillary.....	30	31.5	32	32.5	35	34	33	32	36
Depth, body.....	45	40	47	43	49	48	44	49	45
Width, body.....	23	20.5	23	21	24	23	24	23	21
Anus to ventral.....	.....	.....	42	.....	.....	.....	.....	.....	40
Ventral to isthmus.....	.....	.....	29	.....	.....	.....	.....	.....	306
Height, second dorsal spine.....	.....	.....	60	.....	70	66	.....	.....	.....
Length, dorsal base.....	17	15.5	16	18	17	17	16	15	20
Height, second dorsal.....	.....	14+	.....	16	.....	.....	13	.....	.....
Height, anal.....	.....	.....	.....	.....	.....	.....	7.5	.....	.....
Length, first P. ray.....	11	11	10.5	12	8	110.5	10.5	10	12.5
Length, second P. ray.....	.....	58.5	63	63	65	.....	.....	.....	32
Length, outer ventral ray.....	.....	.....	72	65+	65+	57+	.....	81	32
Length, second ventral ray.....	.....	.....	.....	22	20	17	.....	.....	.....
Soft rays, first dorsal.....	9	7	8	8	8	8	8	8	.....
Ventral rays.....	9	9	9	9	9	9	9	9	.....
Pectoral rays.....	15	14	16	16	14	14	14	14	.....
Gill-rakers, lower limb.....	4+21	5+21	5+21	6+23	5+24	6+22	6+21	6+20	.....
Length, gill-rakers.....	7.5	6	7	8	8.5	8.5	8	8	.....

¹ Gilbert, Bull. U. S. Fish Comm., 1903 (1905), pt. 2, p. 659, fig. 257.

² Paratype of *B. bowersi*.

³ A pseudocaudal developed.

2. *BATHYGADUS GARRETTI*, new species.

Plate 8, fig. 1.

Bathygadus garretti differs from the type description of the related species, *B. nipponicus*,¹ in the presence of a small barbel; in the more numerous gill-rakers, 18 or 19 instead of 16, on the lower limb of the outer arch; in the narrower interorbital, 4 instead of 3.43 in head; in the smaller orbit, 4.7 instead of 4.2; in the whitish color of the second dorsal fin anteriorly; in the fewer dorsal rays, II, 9 instead of II, 10; and in the more numerous ventral rays, 10 or 11 instead of 9. It differs widely from the remaining species of *Bathygadus* with comparatively firm heads, from *B. macrops*,² in the much smaller eye, coarser teeth, and darker color; from *B. filamentosus*,³ in the much larger eye, narrower interorbital, firmer head, absence of long fin filaments, lighter color, and the presence of a barbel; and from *B. sulcatus*⁴ (which it closely resembles) in the wider interorbital, lighter color, and lower curve in the lateral line.

Type-specimen.—Cat. No. 76863, U.S.N.M.; length 513 mm., 176 mm. to anus; from *Albatross* station 5059, at a depth of 197–297 fathom, in Suruga Gulf.

Dorsal, II, 9; ventral, 10; pectoral, 17.

Dorsal and ventral contours about equally curved; snout, near axis of body, angulated at the upper end of the premaxillary spine; head and trunk with subvertical sides; the width of the body over the pectoral bases about equal to the postorbital length of the head, and about three-fourths the vertical depth of the body; width of the tail twice the length of the head behind tip of snout, $2\frac{1}{4}$ in the depth at that vertical.

Head comparatively firm, about as in *Gadomus multifilis*, its length 4.9 in the total length (the tail entire). Orbit 4.7 in head, 1.2 in the bony interorbital width, which is contained 4 times in the head; length of snout 3.5; least width of suborbital 1.9 in orbit; the thin suborbital ridge little oblique, and not prominent. Opercle with two weak, divergent ridges, the upper one ending in a weak flat spine; margin of interopercle produced backward at its upper angle in the form of a rounded lobe, visible behind the margin of the preopercle, which forms a semicircular curve. Mouth terminal, little oblique; maxillary 1.9 in head, extending past vertical from

¹ Jordan and Gilbert, Bull. U. S. Fish Comm., 1902 (1904), p. 605, figure.

² Goode and Bean, Proc. U. S. Nat. Mus., vol. 8, 1885, p. 598; Günther, *Challenger Reports*, vol. 22, Deep-Sea Fishes, 1887, p. 156; Goode and Bean, *Oceanic Ichthyology*, 1895, p. 423; Jordan and Evermann, *Fishes of North and Middle America*, vol. 3, 1898, p. 2566.

³ Smlth and Radcliffe, Proc. U. S. Nat. Mus., vol. 43, 1912, p. 107.

⁴ Idem., p. 108.

posterior margin of orbit; premaxillary teeth in a band consisting of an outer portion with moderate teeth, not closely set, including the entire band anteriorly, but narrowing posteriorly; and an inner portion of specialized teeth, much finer and more closely set than those of the outer portion, and including the entire band posteriorly, but disappearing at the end of the anterior third of the band; the two portions separated by a groove, which is less distinct than that found in *B. antrodes*; the change in size of the teeth of the two portions also less abrupt than in *B. antrodes*, an intermediate portion being indicated, but poorly defined; mandibular band much narrower, with a small symphyseal knob; barbel minute and slender; branchiostegals 7; gill-openings extending forward to below pupil; 19 smooth gill-rakers on the lower limb of the outer arch, the longest half the interorbital width; pseudobranchiae rudimentary, covered with skin, located at the edge of a deep conic pit. Coracoid foramen on the suture between the hypercoracoid and the hypocoracoid.¹ Fifty pyloric caeca (in the paratype), the longest 2.3 in head.

Lateral line extending nearly parallel to the dorsal outline of the body for a distance greater than the postorbital length of the head, thence obliquely downward to a point behind the origin of the anal, and then straight along the tail, below the middle of its depth.

First dorsal spine rudimentary, its distance from the end of the occipital spine 2.4 in the distance from the end of the occipital spine to the tip of the snout (2.6 times in the paratype; 2.25 times in the type of *B. nipponicus*); the second spine slender, round, and smooth, with a short slender filament, its length 2.4 in head; interdorsal space very short; second dorsal much better developed than the anal, high throughout its extent; origin of anal under twelfth ray of second dorsal, its distance from anus 2 in orbit (2.5 in paratype); ventral rays broken, the outer one weak, probably not reaching past anus when entire; pectoral without a filament, its length 1.7 in head (1.6 in paratype), the first ray short, flexible, unbranched and inarticulate, the second ray also unbranched. Ventral inserted slightly more anteriorly than the base of the pectoral or the origin of the dorsal.

Color in alcohol light grayish-brown, the breast and belly not darker; branchiostegal membranes light, becoming dusky opposite the opercle; buccal, branchial, and peritoneal cavities blackish, except for a narrow whitish margin on the inner side of the branchiostegal membrane. First dorsal, pectorals and ventrals dusky; pectorals and ventrals slightly overlaid with a bluish-gray color; second dorsal and anal whitish anteriorly, shading into bluish-black posteriorly.

¹ Hypercoracoid said to be perforate in *B. nipponicus*.

The firmer texture and lighter color of this species is correlated with the fact that it occurs in warmer, shallower water than *B. antrodes*.

One paratype from the type station. Only the two specimens known; they agree in all essential respects, but differ in a few proportions, as indicated in the following table:

Table of measurements in hundredths of length to anus.

	Type.	Paratype.
<i>Albatross</i> station.....	5059	5059
Total length, mm.....	513	1 487
Length to anus, mm.....	176	1163
Length, head.....	59.7	57
Length, orbit.....	13.5	13
Width, interorbital.....	15.5	14.5
Width, suborbital.....	7	7.5
Orbit to preopercle.....	26.5	26.5
Length, snout.....	17	15.5
Length, maxillary.....	32	29
Length, barbel.....	1	1
Depth, body.....	40.5	38.5
Anus to anal.....	7	5
Anus to ventral.....	41.5	43
Ventral to isthmus.....	33	33.5
Height, second dorsal spine.....	26	25
Length, first dorsal base.....	17	16.5
Height, second dorsal.....	16	16
Height, anal.....	11	11
Length, first pectoral ray.....	9.5	10.5
Length, second pectoral ray.....	34	36
Length, third pectoral ray.....	37	
Length, outer ventral ray.....	4	31.5+
Length, second ventral ray.....		22.3
Scales, above lateral line.....	7	7
Soft rays, first dorsal.....	9	9
Ventral rays.....	10	10-11
Pectoral rays.....	17	18
Gill-rakers, lower limb, first arch.....	4+19	5+18
Length, gill-rakers.....	7	7.5

¹ A small pseudocaudal developed.

This species is named for the late Lieut. Commander L. M. Garrett, U. S. N., who was in command of the *Albatross* during the expedition in the Northwest Pacific and contributed largely to the success of that expedition. He was lost overboard during a storm on the return voyage from Japan.

3. GADOMUS, species.

One specimen, 106 mm. long (tip of tail broken), from *Albatross* station 4973, in 600 fathoms, off the east coast of Hondo.

This species is readily separable from *G. colletti*. The head is wider, and the sensory canals larger, the structure of the head approaching the type found in *Bathygadus cottoides*, *B. antrodes*, *B. bowersi*, and related species; interorbital wider, as wide as the eye (about two-thirds the eye in *G. colletti*); color darker, the branchial cavity without the diagnostic light margin on the branchiostegal

membranes; the anus less remote from the origin of the anal. Correlated with these differences is the difference in bathymetric distribution of the two species, as this form inhabits much deeper water than *G. colletti*.

The single young specimen obtained differs from our larger Philippine specimens of *B. multifilis*¹ chiefly in the longer gill-rakers, which are nearly as long as the interorbital width; and in having fewer pyloric caeca, 16 instead of 35 to 52.

First dorsal, II, 9; ventral, 8; pectoral, 16; gill-rakers 6+27, including the most anterior gill-raker (which is tubercular).

Measurements in hundredths of length to anus (35 mm.): Length of head, 62; length of orbit, 16; least width of interorbital, 14; least width of suborbital, 8; distance between orbit and preopercle, 28; length of snout, 19; distance from center of anus to base of outer ventral ray, 38; distance from base of outer ventral ray to isthmus, 27; length of first dorsal base, 19; length of second pectoral ray, 107 (the second dorsal spine and outer ventral ray also thickened, and evidently produced, but broken in the specimen at hand); length of longest gill-rakers, 13.

4. GADOMUS COLLETTI Jordan and Gilbert.

Gadomus colletti JORDAN and GILBERT, Bull. U. S. Fish Comm., 1902 (1904), p. 603, text fig.

<i>Albatross station.</i>	General locality.	Depth in fathoms.	Number of specimens.	Length, mm.
5062.....	Suruga Gulf.....	250	1	302
5065.....	.....do.....	211-235	1	190
5067.....	.....do.....	293	2	68-76

In our specimens the coracoid foramen is in the suture between the hypercoracoid and the hypocoracoid, contrary to the original description, in which the hypercoracoid is said to be perforate. The lateral line is angulated anteriorly as in the other species of the genus, not "rising anteriorly by a gently concave curve." On the tail, the lateral line is below the median line of the body, abruptly rising anteriorly above the anus, in the direction of the end of the first dorsal, for a distance equal to the length of the snout, thence forward to the nape, along a line which is slightly curved downward.

¹ *Bathygadus multifilis* Günther, *Challenger Reports*, vol. 22, Deep-Sea Fishes, 1887, p. 155, pl. 42, fig. B.

Further differences between our specimens and the type, and between specimens of different size, are tabulated below.

	Type.	Station 5062.	Station 5065.
<i>Total length, mm.</i>	332	302	190
Depth of body in total length.....	7.33	6.5	6.5
Length of head in total length.....	5.4	5.3	5.4
Snout in head.....	3.57	3.8	3.9
Vertical width of the suborbital below middle of orbit.....	5.6	6.7	7.4
Interorbital width.....	6	5.9	5.6
Maxillary.....	2	1.9	1.9
Barbel (fraction of head).....	0.66	0.8	0.9
Dorsal spine in total length.....	3.66	-----	4.75
Filamentous pectoral ray.....	3	3	4
Outer ventral ray.....	5.5	5.8	5.3
Gill-rakers.....	4 or 5+19	5+22	6+21
Pectoral rays.....	21	20	18
Dorsal soft rays.....	10	10	10
Ventral rays.....	9	8	8

Ninety-five pyloric caeca were counted in the specimen 190 mm. long.

First dorsal, pectoral, and ventral fins dark, overlaid with bluish-gray pigment; the pectoral and ventral with elongate dark spots.

In the young specimens, 68 and 76 mm. long, the snout is blunter than in the adult; the first dorsal spine better developed, sharp instead of concealed; the pectoral and dorsal filamentous rays shorter, and the outer ventral ray longer. These differences are indicated in the table of proportional measurements. The pseudobranchial filaments are conspicuous in the young, small in the specimen 190 mm. long, and absent in the specimen 302 mm. long, and in the type, 332 mm. long.

Table of measurements in hundredths of length to anus.

<i>Abatross</i> station.....	5062	5065	5067
<i>Total length, mm.</i>	302	190	68
<i>Length to anus, mm.</i>	99.5	60	22.5
Length, head.....	56	60	61
Length, orbit.....	14.3	17	22
Width, interorbital.....	9	10.5	13
Width, suborbital.....	7	6	-----
Orbit to preopercle.....	25	26	-----
Length, snout.....	15	16	14
Length, maxillary.....	29.6	32	37
Length, barbel.....	47	56	57
Depth, body.....	45	48.5	-----
Width, body.....	26.5	27	-----
Anus to anal.....	11.7	11.5	10
Anus to ventral.....	38	37	36
Ventral to isthmus.....	37	39	-----
Height, second dorsal spine.....	91	71	41
Height, third dorsal ray.....	31	36	-----
Length, first dorsal base.....	18	19	20
Height, second dorsal.....	20	23	21
Height, anal.....	8	11	-----
Length, first pectoral ray.....	10	11	-----
Length, second pectoral ray.....	100	84	43
Length, third pectoral ray.....	33	36	-----
Length, outer ventral ray.....	41	55	72
Length, second ventral ray.....	31.6	36	33
Scales, above lateral line.....	9	9	-----
Soft rays, first dorsal.....	10	10	10
Ventral rays.....	8	8	8
Pectoral rays.....	20	18	-----
Gill-rakers.....	5+22	6+21	-----
Length, gill-rakers.....	5.5	8	-----

SQUALOGADUS, new genus.

This remarkable genus is an ally of *Macrouroides* Smith and Radcliffe,¹ and together with it forms the subfamily Macrouroidinae (=Macrouroididae Smith and Radcliffe), a group which resembles the Bathygadinae closely in the following characters: The free gill arches, the first not being united to the wall of the pharyngeal cavity by a membrane; the slender, numerous gill-rakers; the pseudobranchial filaments, located beside a conic pit; the forward and ventral extension of the gill openings; the dorsal better developed than the anal; the second dorsal ray not a modified spine; and the seven branchiostegal rays correlated with the position of the anus immediately before the anal fin. The Macrouroidinae resemble the Coryphaenoidinae and differ from the Bathygadinae in the rough scales and the spinous uppermost pectoral ray. The many peculiar characters of the Macrouroidinae are listed in the Key to the Subfamilies and Genera.

Squalogadus differs from *Macrouroides* in the presence of ventral fins; in the wide pectorals, with 25 rays; in the long gill-rakers; in the presence of pseudobranchial filaments; and in the more posterior mouth, which is wholly behind the eye.

Generic description.—Head extremely massive, ellipsoidal, and covered with a lax skin, and everywhere rounded in outline, without any prominent ridges; trunk short, strongly compressed; a single long dorsal of low rays, confluent around the leptocercal tail with the still lower anal; ventrals small, with only five rays, inserted in advance of pectorals; eye very small; mouth inferior, wholly behind orbit; teeth small, in bands, on jaws only; four gills on short arches, the first free, without a fold of membrane, a slit behind the last gill; gill-rakers long and slender; short pseudobranchiae; gill membranes free from the isthmus, united anteriorly; seven branchiostegals; anus immediately before anal fin; lateral line with scattered pores; scales small, covered with spinules, and very irregular on head.

(*Squalus*, a shark; *Gadus*, the cod.)

Type of the genus.—*Squalogadus modificatus*, new species.

5. SQUALOGADUS MODIFICATUS, new species.

Plate 8, fig. 2.

Type-specimen.—327 mm. in total length, 124 mm. from tip of snout to anus; from *Albatross* station 4956, in Bungo Channel, off Kyushu, at a depth of 720 fathoms; Cat. No. 76864, U.S.N.M.

Dorsal contour of trunk and tail gently descending posteriorly, ventral contour straight and nearly horizontal; body strongly com-

¹ Radcliffe, Proc. U. S. Nat. Mus., vol. 43, 1912, p. 138.

pressed, the greatest width across the pectoral bases less than half the depth of the trunk, the greatest width directly above the anus little more than one-fourth the depth at the vertical through that point; tail one-fifth as wide as deep at a distance behind the anus equal to half length of head.

Head soft and greatly enlarged; the sensory canals excessively developed; contours of the head evenly curved from the snout to the dorsal fin, and from the snout to the mouth; snout exceedingly massive, rounded, and produced, its preocular length 3.4, its preoral length 2.3; tip of snout slightly below horizontal through middle of eye; nostrils nearly round, small, the anterior about two-thirds the size of the posterior, the diameter of nasal fossa 1.5 in eye, the interspace between nasal fossa and eye half the diameter of the fossa; eye nearly round, on the vertical passing through the anterior third of head, the distance from its lower margin to front of mouth equal to preocular length of snout; eye 9.5 in head, 6.25 in the highly convex interorbital space, but only 4 times in the straight distance from eye to eye; opercle placed high, very short, its length 4.5 in postorbital length of head, an even rounded portion of the interopercle visible behind the margin of the preopercle, the width of the exposed portion one-fourth length of eye; mouth U-shaped, wholly inferior, the front of premaxillaries slightly behind posterior margin of eye; maxillary as long as the snout, its tip acuminate; teeth equal, all minute, the premaxillary band widest at the end of its anterior third; mandibular band much narrower; no barbel; seven branchiostegal rays, the lower flexible; gill openings not extending forward to tip of maxillaries, the membranes narrowly joined to the isthmus, with a moderate free fold; gill-rakers 6+22 on the first arch, 0.4 as long as eye, their inner edges rough, those on succeeding arches short and compressed; gill arches short, the first one not bound down by a fold of membrane, the gill slit before it as long as the arch, and contained 4.5 times in length of head; fourth arch much shorter, with a double series of filaments, followed by a slit only two-thirds the diameter of the small eye; eight short pseudobranchial filaments, near a conic pit, which is smaller than the similar pit found in *Bathygadus*; sensory papillae of head well developed, located in small, oblong, scaleless areas, which align themselves as shown in the figure.

Scales small, in about 12 series from origin of dorsal fin to lateral line; scales of body poorly imbricate, arranged in definite series, and hispid with small suberect spinules in irregular quincunx order, of variable number, 7 to 17 on several scales counted; scales of head non-imbricate, large, without definite form or arrangement, hispid with nearly erect spinules, which are in more or less definite quincunx order, much shorter, more numerous, and more crowded than those on the body. Rami of mandibles and the gular and branchiostegal

membranes scaled; a small naked area behind pectoral, none on belly; inner edge of shoulder girdle naked. Lateral line high, consisting of widely spaced pores, parallel to the dorsal base (position on tail uncertain, owing to loss of scales).

Origin of the single low dorsal over the ventrals, anterior to the pectoral base and the end of opercle; origin of anal immediately behind anus, its distance from base of ventrals about one-fourth head; anal rays more slender and probably shorter than the dorsal rays; ventrals greatly reduced in size, with 5 rays; pectorals with 25 rays, the uppermost unbranched, inarticulate and stiff, as in the *Coryphaenoidinae*.

Color in alcohol brown, the head somewhat lighter than the body. Dorsal, anal, and pectorals blackish; ventrals light brown; nasal fossa dark; lips and lining of buccal cavity dusky bluish; branchial cavity lined with bluish black; peritoneal cavity lined with black.

A single small paratype, 124 mm. long, 40 mm. to anus, was dredged with the type. Scales with fewer spinules than in the larger type, those of the body with but one, as in the small type of *Macrouroides inflaticeps*. Pseudobranchial filaments relatively larger than in the type. Ventral rays, 5; pectoral rays, 25.

Table of measurements in hundredths of length to anus.

	Type.	Paratype.
Total length, mm.....	327	124
Length to anus, mm.....	124	40
Length, head.....	89	90
Length, eye.....	10	12
Width, interorbital.....	40	.....
Orbit to preopercle.....	53	.....
Preocular length, snout.....	27	26
Preoral length, snout.....	38.5	.....
Length, maxillary.....	27	25
Depth, body.....	53	.....
Width, body.....	33	30
Anus to ventral.....	21	.....
Ventral to isthmus.....	11.5	.....
Length, second ventral ray.....	.....	12

Genus NEMATONURUS Günther.¹

Nematonurus GÜNTHER, *Challenger Reports*, vol. 22, Deep-Sea Fishes, 1887, p. 124 (*armatus*); (as a subgenus of *Maerurus*).

Moseleya GOODE AND BEAN, *Oceanic Ichthyology*, 1895, p. 417.—JORDAN AND EVERMANN, *Fishes of North and Middle America*, vol. 3, 1898, p. 2570 (*longifilis*).

Albatrossia JORDAN AND EVERMANN, *Fishes of North and Middle America*, vol. 3, 1898, p. 2573 (*pectoralis*).

Bogoslovius JORDAN AND EVERMANN, *Fishes of North and Middle America*, vol. 3, 1898, p. 2574.—GILBERT AND CRAMER, *Bull. U. S. Fish Comm.*, 1910 (1912), p. 93 (*clarki*).

Dolloa JORDAN, *American Naturalist*, vol. 34, 1900, p. 897 (substitute for *Moseleya*, preoccupied).

¹ *Nematonurus* must be regarded as a subgenus of *Coryphaenoides*; see note under *N. bona-nox*.

The characters which have been used to separate the nominal genera included in the synonymy vary to such an extent among the different species that we are forced to regard them as of only specific value. The strength of the serrations of the dorsal spine range, with intermediate forms, from an obsolescent condition on the one hand, as in *N. abyssorum*,¹ to a well developed condition on the other hand, as in *N. clarki*.

This genus probably forms a natural group, but the dentition is the only character by which it is constantly separated from *Coryphaenoides*. The premaxillary teeth are in a double series, instead of a band, and the mandibular teeth are never in bands, as usual in *Coryphaenoides*. The mouth is usually more nearly terminal, and the physiognomy frequently approaches that of *Bathygadus*.

6. NEMATONURUS LONGIFILIS (Günther).

Coryphaenoides longifilis GÜNTHER, Ann. Mag. Nat. Hist., vol. 20, 1877, p. 439.

Macrurus longifilis GÜNTHER, Challenger Reports, vol. 22, 1887, p. 151, pl. 35.

Moseleya longifilis GOODE AND BEAN, Oceanic Ichthyology, 1895, p. 417.

Dolloa longifilis JORDAN, American Naturalist, vol. 34, 1900, p. 897.

This species, hitherto known only from the type, collected by the *Challenger* south of Hondo, at a depth of 565 fathoms, was rediscovered by the *Albatross*, which dredged three specimens, one at station 4956 in 720 fathoms, and two at station 4980 in 507 fathoms, both off the southeast coast of Hondo.

The two specimens from station 4980 (the head 130 mm. long) are in very poor condition. They differ in several respects, chiefly in the weakly armed scales, and in the stronger pectoral, from the smaller specimen, which was dredged at station 4956 (head 96 mm. long). The larger specimens agree more closely than the smaller one with the type description, as regards the character of the scales and the pectoral. This may be due to the fact that the type was a large specimen.

Dorsal, II, 12 to 14; ventral, 8-9, 9, and 10 (in the three specimens); pectoral, 17 or 18.

The form of the body is well shown in Günther's figure, except that the artist probably rounded out the snout too much; depth of body about 1.6 in length of head; width over pectoral bases less than half depth. Head compressed, with subvertical sides, its width 2.4 to 2.7 in its depth; orbit suborbicular, the vertical diameter 0.9 the horizontal diameter, which is contained 4.6 to 5.2 times in the head; interorbital width 4 to 4.6 in head; length of snout about equal to interorbital width; width of suborbital 9 to 11 in head; the free portion of the barbel shorter than the anterior canines in the jaws; length of

¹ Gilbert, Proc. U. S. Nat. Mus., vol. 48, 1915, p. 374, pl. 21, fig. 23, from off Santa Catalina Island, California.

maxillary 2.2 to 3.33; teeth biserial in both jaws,¹ those of the outer premaxillary series sharp, conic, and strongly curved inward, enlarged anteriorly, being twice as long as and much stronger than those of the inner series; teeth of the inner mandibular series (9 to 16 on each side) much enlarged, and of nearly uniform size, about as long as those of the outer premaxillary series, but less curved; those of the outer mandibular series small, and close to the inner series; six branchiostegals; gill membranes with a wide, free fold, 2+14 short, broad, movable gill-rakers on the first arch, better developed than usual in the Coryphaenoidinae, each provided with a group of terminal spines; width of gill slit before first arch 1.2 in orbit, the slit behind the last arch 1.4 to 1.6; no pseudobranchiae.

About 12 scales in a series between the origin of the second dorsal and the lateral line; scales thin, and almost unarmed on anterior sides, with about three feeble ridges, cycloid in an area just behind pectoral; other scales of body with 5 to 7 ridges, some strongly divergent, others nearly parallel, the ridges with a few weak spines in the two larger specimens, but well armed with imbricating spines in the smallest one; scales on opercle and top of head similar to those on tail, becoming smaller on the snout, suborbital region, and the cheeks; gular and branchiostegal membranes scaleless. Lateral line with a very wide surface groove, and with widely spaced pores, about one-fourth as numerous as the scale rows on the trunk.

First dorsal spine minute and concealed; the second spine nearly as long as the head, compressed, and ending in an extremely fine filament, its anterior edge trenchant, and armed with about 32 weak, recumbent serrations, except on the proximal and distal ends; first soft ray 1.8 in head; last 2 or 3 rays simple. Pectoral long and wide in the two larger specimens, as shown in Günther's figure, the first ray a short spine; the second compressed, stiff, unbranched, and inarticulate, 1.6 in head; the third and longest ray unbranched, 1.2; pectoral in the smallest specimen longer and narrower, the second ray weaker and less strongly compressed, 1.2 in the head, the third ray 1.07 times the length of the head. Outer ventral ray strengthened and greatly produced, nearly twice the length of the head in the smallest specimen (broken near tip).

Color uniform brown, blackish on mandibles and branchiostegal membranes; fins dusky; buccal, branchial, and peritoneal cavities with a black lining, excepting the narrow interrupted whitish margin of the branchial cavity along the inner edge of the opercle.

Table of measurements in hundredths of length to anus (148 mm.), of a specimen 552 mm. long, from *Albatross* station 4956.

Length of head, 65; length of orbit, 15; least interorbital width, 15; least suborbital width, 5.8; distance between orbit and margin

¹ Described as uniserial in the lower jaw by Günther.

of preopercle, 26.7; length of snout, 16; length of maxillary, 30; length of barbel, 1.5; greatest depth of body, 42; width of body over pectoral bases, 21; distance from anus to base of outer ventral ray, 31; distance from base of outer ventral ray to isthmus, 31; height of second dorsal spine, 63; length of first dorsal base, 22; interdorsal space, 11.5; height of second dorsal, 5; height of anal, 13; length of pectoral rays—first, 8.7; second, 56; third, 77; outer ventral ray, 120+, second ventral ray, 32.

7. NEMATONURUS PECTORALIS (Gilbert).

Macrurus (Malacocephalus) pectoralis GILBERT, Proc. U. S. Nat. Mus., vol. 14, 1891, p. 563.

Macrurus (Nematonurus) magnus GILL and TOWNSEND, Proc. Biol. Soc. Washington, vol. 2, 1897, p. 234.

Albatrossia pectoralis JORDAN and EVERMANN, Fishes of North and Middle America, vol. 3, 1898, p. 2573.

<i>Albatross</i> station.	General locality.	Depth in fathoms.	Number of specimens.
5015.....	Off southeast coast, Sagkalin Island.	510	1
5029.....	Off east coast, Sagkalin Island.	440	1
5044.....	Off south coast, Hokkaido (Yezo).	309-359	1

Other specimens were dredged, but not preserved, at stations 5044 and 5045 (in 359 fathoms).

The Japanese specimens are identical with a series from Alaska.

Contrary to the type description, the ventral filament usually reaches not more than two-thirds, instead of five-sixths, the distance from the ventral base to the anus. Interdorsal space 0.4 to 0.9 the base of the first dorsal.

Pyloric caeca very long, about as long as the head, 16 in number in two specimens counted.

The scales show great variation in the same individuals as regards their spination. Those on the head and belly usually bear a nearly smooth median ridge, and frequently a divergent lateral pair; those on the back and sides usually bear three moderately divergent ridges, armed with 3 to 7 nonimbricated spinules; other scales, however, bearing about 7 (4 to 10) nearly parallel ridges, are grouped in certain very definite areas, which are located as follows in six large Alaskan specimens:

1. Left side, none. Right side, about eight rows of scales extending obliquely backward and downward from the first dorsal, across the back and sides.

2. Left side, several scales scattered at intervals between lateral line and dorsal base. Right side, a few scales above middle of anal base.

3. Left side, the scales in an area between pectoral, ventral, and gill-opening; eight rows of scales extending obliquely forward at a distance behind the pectoral equal to the length of the head; this group followed, after an interspace two-thirds length of head, by an area about eight scale rows wide, and parallel to the first; a few scales irregularly placed near these areas. Right side, no scales with more than five ridges.

4. Scales largely lost; a few with many ridges on the right side below origin of the second dorsal.

5. Left side, none. Right side, a few scales in oblique series below anterior end of second dorsal; four horizontal scale rows below middle of dorsal base.

6. Left side, the scales in an area above the lateral line, below the first dorsal base and the interdorsal space; about 30 continuous oblique scale rows on middle of sides below lateral line. Right side, scales largely lost, but a large area indicated behind pectoral.

From these descriptions it is apparent that the many-ridged scales occur in definite areas, usually on continuous scale rows, which may extend obliquely forward, obliquely backward, or horizontally; and it is further apparent that these areas are not similar on the two sides of the fish.

Ventral rays in Alaskan specimens:

Rays -----	6	7	7-8	8
Specimens -----	1	6	1	1

8. NEMATONURUS BONA-NOX (Jordan and Thompson).¹

Coryphaenoides bona-nox JORDAN and THOMPSON, Mem. Carnegie Mus., vol. 6, pt. 4, 1914, p. 305, pl. 38, fig. 1 and 1a.

Two large specimens, overlooked by Jordan and Thompson, are here reported on. One of them bears the label: "Enoshima- 22 II 05."

This species differs from the description of *Coryphaenoides altipinnis*,² a Japanese species not obtained by the *Albatross*, in the lower dorsal spine, and especially in the more strongly armed scales, which are excessively rough, usually with 7 to 9 strongly spinous ridges; but a few of the scales in certain regions, as in *N. pectoralis*, have an increased number of spines (as many as 18).

Premaxillary teeth biserial, rather blunt, and slightly arrow-shaped, the inner series the smaller, rather irregular, becoming bi-

¹ Subsequent study has shown *C. bona-nox* to be identical with *C. acrolepis* (Bean) of California and Bering Sea. The dentition of *C. acrolepis* is intermediate between that of *Coryphaenoides* and that of *Nematonurus*. *Nematonurus* should be merged with *Coryphaenoides*, but may be retained as a subgenus; it should include *C. acrolepis* (Bean) and *C. lepturus* (Gill and Townsend).

² *Coryphaenoides altipinnis* Günther, Ann. Mag. Nat. Hist., ser. 4, vol. 20, 1877, p. 439. *Macurus altipinnis* Günther, Challenger Reports, vol. 22, Deep-Sea Fishes, 1887, p. 138, pl. 39, fig. A (in explanation of plate erroneously stated to be from the Japanese Sea).

serial posteriorly. Inner series of mandibular teeth similar to the outer premaxillary series, the outer mandibular series smaller, becoming very irregular at the symphysis. Thirteen pyloric caeca, two-thirds as long as the head.

Table of measurements in hundredths of length to anus.

Locality.	Enoshima.	Enoshima.
Total length, mm.....	1780	
Length to anus, mm.....	268	256
Length, head.....	62	62
Length, orbit.....	15	17
Width, interorbital.....	13.3	15
Width, suborbital.....	7.7	7.5
Orbit to preopercle.....	26	27
Length, snout.....	17.5	18.3
Length, maxillary.....	23.5	25.3
Length, barbel.....	9	
Depth, body.....	45	52
Width, body.....	26.7	
Anus to anal.....	4	4
Anus to ventral.....	33.7	36.5
Ventral to isthmus.....	27.5	26
Height, second dorsal spine.....	38.6	
Height, third dorsal ray.....	33.3	
Length, first dorsal base.....	16.2	16
Interdorsal space.....	8.2	9
Height, second dorsal.....	7.6	
Height, anal.....	15.5	
Length, first pectoral ray.....	4	6
Length, second pectoral ray.....	20	
Length, fourth pectoral ray.....	31	
Length, outer ventral ray.....	33.5	
Length, second ventral ray.....	18.5	
Scales, above lateral line.....	9	9
Soft rays, first dorsal.....	10	8
Ventral rays.....	8	8
Pectoral rays.....	22	
Serrations of the dorsal spine.....	17	17

Genus CORYPHAENOIDES Gunner.

Coryphaenoides GUNNER, Trondhjem Selskabs. Skrifter, vol. 3, 1765, p. 50, pl. 3, fig. 1 (*rupestris*).

Macrorurus BLOCH, Naturgeschichte der ausländ. Fische, vol. 2, 1786, p. 152, pl. 177; Ichthyologie, vol. 5, 1787, p. 122, pl. 177 (*rupestris*=*berglaax*).

Maerurus BLOCH (Ed. Schneider), Systema Ichthyologie, 1801, p. 103, pl. 26.—GÜNTHER, Cat. Fishes Brit. Mus., vol. 4, 1862, p. 390 (changed spelling).

Branchiostegus RAFINESQUE, Analyse de la Nature, 1810, p. 86 (substitute for *Coryphaenoides*).

Chalinura GOODE and BEAN, Bull. Mus. Comp. Zool., vol. 10, 1883, p. 5 (*simula*).

Chalinurus GÜNTHER, Challenger Reports, vol. 22, Deep-Sea Fishes, 1887, pp. 124, 144 (changed spelling).

?*Optonurus* GÜNTHER, Challenger Reports, vol. 22, Deep-Sea Fishes, 1887, pp. 124, 147 (*denticulatus*).

This large genus possibly contains several natural groups, but our analysis of the species has failed to define them. The physiognomy, the dentition, and the size and position of the mouth vary, with many intermediate species,² between two extremes. On the one hand are

¹ A pseudocaudal developed.

² As intermediate species may be mentioned: *C. carapinus* Goode and Bean, *C. spinulosus* (Gilbert and Burke), and *C. paradoxus* (Smith and Radcliffe).

those species formerly referred to *Chalinura*, such as *C. simula*, with a large, nearly terminal mouth, and other characters closely approaching the typical species of *Nematonurus*, including further the enlarged outer series of teeth in the upper jaw and the single series of the lower jaw. The other extreme is typified by such species as *C. nasutus* Günther, with small, inferior mouth, and villiform bands of teeth in the jaws. The form of the snout, the serration of the dorsal spine, the spination of the scales, and other characters are also widely variable, but apparently do not mark natural divisions of the genus. *C. holotrachys* Günther¹ seems to approach *Coelorrhynchus* in the form of the snout and the ridges of the head. *C. hyostomus* (Smith and Radcliffe)² differs from all other species of the genus in having the anus remote from the anal fin.

The shoulder girdle is naked in all the species of *Coryphaenoides* and *Nematonurus* examined.

9. CORYPHAENOIDES MARGINATUS Steindachner and Döderlein.

Coryphaenoides marginatus STEINDACHNER and DÖDERLEIN, Fische Japans, vol. 4, 1887, p. 284.

<i>Albatross station.</i>	General locality.	Depth in fathoms.	Number of specimens.	Length to anus, mm.
4906.....	Eastern Sea.....	369-406	1	68
4907.....	do.....	496	1	100
4908.....	do.....	434	5	51 to 83
4909.....	do.....	434	6	60 to 84
4911.....	do.....	391	1	86.5
4912.....	do.....	391	1	81
4915.....	do.....	427	2	82.5 to 98
4919.....	do.....	440	1	66.5
5054.....	Suruga Gulf.....	282	1	115
5056.....	do.....	258	1	81.5
5059.....	do.....	197-297	6	54 to 97.5
5060.....	do.....	197	7	26 to 56
5065.....	do.....	211-235	6	25.5 to 30
5067.....	do.....	293	3	39 to 106
5072.....	do.....	148-284	1	86.5

The large type of this species, 53 cm. long, was well described by Steindachner and Döderlein. Smaller specimens differ markedly in the long filament of the dorsal spine, which is more than twice the length of the head in some specimens. The spine is also short in the young of about 30 mm. The serrations of the dorsal spine are more numerous in the young, which is an unusual condition, as the reverse is usually true; the serrations are also much stronger in the young.

¹ Ann. Mag. Nat. Hist., vol. 2, 1878, p. 24; *Challenger Reports*, vol. 22, Deep-Sea Fishes, p. 136, pl. 28, fig. 13.

² Radcliffe, Proc. U. S. Nat. Mus., vol. 43, 1912, p. 121, pl. 27, fig. 1.

The ridges on the scales are more numerous in the larger specimens. These variations with size are indicated in the following table:

Length to anus.	Head in dorsal spine.	Serrations of dorsal spine.	Ridges on the scales.
115.....	1.25	4	15
106.....	1.5	6	13
98.....	1.6	5	11
96.....	2	8	8
90.....	1.6	6	11
83.....	2.1	-----	-----
74.....	2.25	9	8
65.....	2.1	9	-----
52.....	2	10	-----
30.....	1.15	13	3

Nine scales from origin of second dorsal to lateral line, excluding the lateral line scale.

The terminal rostral tubercle is similar to that of *C. nasutus*; it is rounded, transversely oval, but with only about 7 ridges, each of which is strongly armed with about 5 nearly erect spines, somewhat stronger on the upper than on the lower half of the tubercle; lateral tubercles less prominent and less convex than the median tubercle, with similar ridges and spines.

Pyloric caeca about as long as the orbit, numbering in the five specimens counted 12, 13, 13, 14, 14.

Branchiostegals 6; gill membranes without a free fold; gill-rakers of first arch represented by rudimentary tubercles; gill slit before first arch one-fourth as wide as orbit. The distances between the anus and base of ventral, and between the isthmus and the base of ventral are each about equal to the postorbital length of the head.

Color in alcohol, light brownish on back and sides; under side of head whitish; lower part of opercles, breast, and belly silvery, with brown chromatophores; upper part of opercles dusky. First dorsal whitish centrally, the base and the tips of the soft rays and the filament of the spine dusky; second dorsal light anteriorly, dark posteriorly; anal whitish anteriorly, with a dusky margin, entirely dusky posteriorly; base and tip of ventral dusky, the middle of rays whitish; base of pectoral, the uppermost rays, and the tips of all the rays dusky, leaving a well defined whitish area. Buccal, branchial, and peritoneal cavities lined with black.

This species is common in southern Japan, especially in the Eastern Sea and Suruga Gulf. *C. nasutus* is also common in southern Japan, but the two species were never taken at the same station, *C. marginatus* inhabiting warmer, shallower water than *C. nasutus*. The much lighter color, the more compressed body, the firmer flesh, and the general appearance of *C. marginatus* is correlated with this distribution.

The relationships of this species are with species of the Indian and Philippine faunas, from all of which it differs in the larger eye, which is about as long as the snout. *C. marginatus* further differs from *C. hyostomus* (Smith and Radcliffe)¹ in the posterior position of the anus, which is immediately before the anal fin, and in the spination of the scales, the spinules being arranged in definite parallel series, as also in *C. microps* (Smith and Radcliffe), instead of being in quincunx order, as in *C. hyostomus*.

The smallest specimen of *Coryphaenoides* obtained by the *Albatross* in Japan is 59 mm. long. It was dredged at a depth of 406 fathoms, in the Eastern Sea, at station 4907, at which *C. marginatus* was also obtained. The specimen can not be specifically identified, owing to its small size and the poor state of preservation; it shows none of the characters of the larval forms described as *Krohnii*.

Table of measurements in hundredths of length to anus.

<i>Albatross station</i>	4915	4907	4911	5072	4909	4908	4908	5067
<i>Total length, mm.</i>	296	312	298	328	272	240+	192	100
<i>Length to anus, mm.</i>	94	100	86	86.5	84	74	51	38.5
<i>Length, head</i>	65	62.5	68	62	63	65	66	68
<i>Length, orbit</i>	17	17	19.5	20	18	20	21	22
<i>Width, interorbital</i>	12	11	16	12.5	14	13	15	12.5
<i>Orbit to preopercle</i>	26	24	26	23	24	25	25	24
<i>Length, snout</i>	19	18	20.5	18	18.5	19	20	19
<i>Length, maxillary</i>	20	20	20.5	17.5	18.5	19	20	20.5
<i>Length, barbel</i>	5	4	7	5	6	5	5	6.5
<i>Depth, body</i>	51	51	51	49	52.5	52.5	54	52
<i>Width, body</i>	25	22	22	26	27	26	28	23
<i>Height, second dorsal spine</i>	126	114	125	106	112	142	129	120
<i>Height, third dorsal ray</i>	51	40.5	.....	.....	.....	.....	.....	.....
<i>Length, first dorsal base</i>	18	18	17.5	19.5	18	19	18	19
<i>Interdorsal space</i>	14	14	19.5	17	17	11	11.5	10
<i>Height, second dorsal</i>	7.5	.....	.....	.....	.....	.....	.....	9
<i>Height, anal</i>	17	.....	17.5	.....	.....	.....	.....	.....
<i>Length, first P. ray</i>	4.5	5	6	4	7	5	7	6.5
<i>Length, second P. ray</i>	24.5	21.5	29	22.5	22	24.5	24	23.5
<i>Length, third P. ray</i>	30.5	27	31	30.5	27	29.5	29	30
<i>Length, outer ventral ray</i>	31.5	33	44	38	37	38	37	38
<i>Length, second ventral ray</i>	18	17.5	21	21	20	20.5	.....	23
<i>Soft rays, first dorsal</i>	9	11	10	11	10	10	10	9
<i>Ventral rays</i>	8	8-9	8	8-7	8	8	8	7
<i>Pectoral rays</i>	22	21	20	.....	20	20	21	21
<i>Serrations, dorsal spine</i>	8	6	12	7	9	11	10	7

[CORYPHAENOIDES AWAE Jordan and Gilbert.³

This species is known only from the type, a mature female 620 mm. long, from off Nanaura, in Awa, in the entrance to the Bay of Tokyo. As stated in the type description, it is related to *C. marginatus*. A series of proportional measurements has been prepared for further comparison with that species.

Length to anus, 185 mm.; length of head, 63 hundredths of the length to the anus; length of orbit, 14.3; least width of interorbital, 12.3; least width of suborbital, 9; distance between orbit and margin of preopercle, 27; length of snout, 18; length of maxillary, 20; length

¹ Radcliffe, Proc. U. S. Nat. Mus., vol. 43, 1912, pp. 116 to 122.

² A pseudocaudal developed.

³ Bull. U. S. Fish Comm., 1902 (1904), p. 608, text figure.

of barbel, 6; depth of body, 58; width of body over pectoral bases, 34; distance from middle of anus to base of outer ventral ray, 33; distance from ventral to isthmus, 30; height of second dorsal spine, 62.2; length of first dorsal base, 19; length of outer ventral ray, 32.5; length of second ventral ray, 18.2.]

10. CORYPHAENOIDES CINEREUS (Gilbert).

Macrourus cinereus GILBERT, Rept. U. S. Fish Comm., 1893 (1896), p. 457.—

JORDAN and GILBERT, Rept. Fur Seal Invest., vol. 3, 1898, p. 487.—GIL-

BERT and BURKE, Bull. U. S. Fish Comm., vol. 30, 1910 (1912), p. 92.

Two specimens, dredged in 510 fathoms off the southeastern coast of Sagkalin Island at *Albatross* station 5015, extend the southern range of this species from Kamchatka. *C. cinereus* is an abundant species in Bering Sea, and comparison of the Japanese specimens with material from Bering Sea has disclosed no constant differences.

The number of radiating ridges on the strong median rostral tubercle varies from 6 to 10, each ridge being composed of stiff spinules; the tubercle is flat, the lower half vertical, the upper half oblique.

Pyloric caeca much shorter than the orbit, 5 to 7 in number, as counted on the two Japanese and three Alaskan specimens.

The distance between the ventral base and the anus is about nine-tenths the distance from the ventral base to the isthmus, which is about equal to the postorbital length of the head.

The following measurements illustrate the large variation in the length of the filamentous outer ventral ray.

Table of measurements in hundredths of length to anus.

<i>Albatross</i> station.....	5015	5015	13340	23338
Total length, mm.....	364	390	368	3359
Length to anus, mm.....	93	94.5	83	104
Length, head.....	66	68	62	71
Length, orbit.....	21.5	21.5	22	23
Width, interorbital.....	20	18.5	19	21
Width, suborbital.....	10	8	10	9
Orbit to preopercle.....	28	28	31	31
Length, snout.....	17.5	18.	17.5	19
Length, maxillary.....	23	24	24	27
Length, barbel.....	6	4.5	4	6
Depth, body.....	51	50	52	53.5
Width, body.....	32	30	32.5	33
Anus to ventral.....	28	27	25	26.5
Ventral to isthmus.....	30.5	31.5	26	28
Height, second dorsal spine.....	70	65	60.5	61
Height, third dorsal ray.....	59	42	.....	50
Length, first dorsal base.....	26	22.5	21.5	23
Interdorsal space.....	11.5	12	11	15
Length, first pectoral ray.....	7.5	7	.....	8
Length, second pectoral ray.....	41	38	39	44.5
Length, third pectoral ray.....	51	48	45	52
Length, outer ventral ray.....	74	42.5	48	75
Length, second ventral ray.....	.....	28	31	36
Scales, above lateral line.....	7	6	7	8
Scales, below lateral line.....	23	18	.....	.....
Soft rays, first dorsal.....	14	11	11	11
Ventral rays.....	9	8	9	9
Pectoral rays.....	20	21	21	20
Gill rakers, lower limb.....	10	11	.....	.....
Serrations, dorsal spine.....	33	39	44	37

¹ Station 3340, off Chirikof Island, Alaska, one of the types.

² Station 3338, off Shumagin Island, Alaska.

³ A pseudocaudal developed.

11. CORYPHAENOIDES NASUTUS Günther.

Coryphaenoides nasutus GÜNTHER, Ann. Mag. Nat. Hist., ser. 4, vol. 20, 1877, p. 440.

Macrurus nasutus GÜNTHER, Challenger Reports, vol. 22, Deep-sea Fishes, p. 132, pl. 30, fig. B.

Macrourus nasutus JORDAN AND GILBERT, Bull. U. S. Fish Comm., 1902 (1904), p. 616 (exclusive of the specimen from Izu, which is here referred to *Lionurus proximus*).—FRANZ, Abh. math.-phys. kl. k. Bayer. Akad. der Wissensch., vol. 4, Suppl. Bd. 1, 1910, p. 26.—JORDAN and THOMPSON, Mem. Carnegie Mus., vol. 6, pt. 4, 1914, p. 306.

Macrurus nasutus DOLLO, Expéd. Antarctique Belge, Res. du Voy. du S. Y. Belgica, Poissons, 1904; pl. 8, figs. 1 and 3 (from Günther's types; to illustrate pseudocaudal).

Albatross station.	General locality.	Depth in fathoms.	Number of specimens.
4957.....	Bungo Channel.....	437	7
4958.....	do.....	405	1
4969.....	Kii Channel.....	587	6
4971.....	do.....	649	1
4972.....	do.....	440	11
4973.....	do.....	600	5
4977.....	do.....	544	2
4980.....	SW. of Suruga Gulf.....	507	4
5045.....	Off south coast of Hokkaido (Yezo).....	359	2
5053.....	Suruga Gulf.....	503	1
5061.....	do.....	250-332	2
5080.....	Off Omai Saki, east coast of Hondo.....	505	2
5087.....	Sagami Bay.....	614	1

The smallest specimen (data lost) is 148 mm. long.

Seven or eight scales from origin of second dorsal to lateral line, excluding the lateral line scale. The terminal rostral tubercle is hemispheric in shape, with about 12 radiating, strongly spinous ridges; lateral tubercles oval, less convex, with about 10 strongly spinous ridges, stronger above than below. The preopercular ridge is strongly produced backward at its angle, more strongly than the preopercular margin.

The distance from the base of the outer ventral ray to the isthmus is about 0.9 the distance from the ventral to the center of the anus, a distance which is equal to the postorbital length of the head.

Pyloric caeca shorter and fewer than in *C. marginatus*, but longer and more numerous than in *C. cinereus*. They are shorter than the orbit, and number, in five specimens counted, 8, 9, 10, 10, 10.

Fins proximally overlaid with a bluish gray pigment. Under side of head and trunk underlaid with silvery pigment which is scarcely apparent where the scales remain.

The specimens dredged in comparatively shallow water, off the south coast of Hokkaido, greatly extend the northern limit of the known distribution of *C. nasutus*. It is of further interest to note that these specimens were dredged with *Nematonurus pectoralis*, which has Bering Sea for its center of distribution.

Table of measurements in hundredths of length to anus.

Albatross station.....	5080	4973	4980	4973	4972	4969	4969
Total length, mm.....	¹ 365	375	¹ 350	380	265	263	197
Length to anus, mm.....	111	115	113	121	104	57	54
Length, head.....	66	67	63.5	63.5	64.5	68	68
Length, orbit.....	18	18	16.7	17.3	19.5	21	21
Width, interorbital.....	17	13	15	12.5	14	14	16
Orbit to preopercle.....	28	28.5	27.5	27	28	27	26.5
Length, snout.....	20	20	19	18.5	19.5	21	21
Length, maxillary.....	20	22	20	19	19	20	20
Length, barbel.....	5	4.5	5	3.5	4	4	3.7
Depth, body.....	49	46	50	50	46	46	48
Width, body, over pectorals.....	31	30	33	32	28	27	26
Height, second dorsal spine.....	62	63.5	52	52	71	72	64
Height, third dorsal ray.....	46	43					
Length, first dorsal base.....	17	17	16.5	17	16	18	17
Interdorsal space.....	51	53	59	49	52	54	54
Height, second dorsal.....	11						8
Height, anal.....	17+						14+
Length, first pectoral ray.....	5	4	4.5	4	4	7	5
Length, second pectoral ray.....		22	24.7	23	25	23.5	17
Length, third pectoral ray.....	31		29	30	27.5		22
Length, outer ventral ray.....	40	34	42	31	31	39	40
Scales below lateral line.....	28						
Soft rays, first dorsal.....	10	10	10	10	10	10	10
Ventral rays.....	9	9	9	9	9-10	9	9
Pectoral rays.....	22	22	21	20	21	21	23
Serrations, second dorsal spine.....	30	20	24	27	28	20	19

Genus COELORHYNCHUS Giorna.

Coelorhynchus GIORNA, Memoire della R. Accademia della Scienze di Torino (Turin), vol. 16, 1803, p. 178 (*coelorhynchus*).

Paramacurus BLEEKER, Verslagen en Mededeelingen der k. Akademie van Wetenschappen, Amsterdam (2), vol. 8, 1874, p. 370 (*australis*).

Orymocerurus BLEEKER, Verslagen en Mededeelingen der k. Akademie van Wetenschappen, Amsterdam (2), vol. 8, 1874, p. 370 (*japonicus*).

Coelorhynchus is a natural group of species, being constantly characterized by the presence of six branchiostegal rays; by the projecting snout; the wholly inferior, U-shaped mouth; the smooth, rounded second dorsal spine;² and the presence of definite ridges on the head, covered with modified scales. The suborbital ridge is the most prominent; it is continuous from the tip of the snout to the preopercle, and forms a prominent angle on the side of the head. *Mataeocephalus*, formerly regarded as differing from *Coelorhynchus* only in the presence of serrations on the dorsal spine, has seven branchiostegals, and is closely related to *Lionurus*. The sturgeon-like snout evidently has been independently derived in the two genera, as it has surely been in *Trachyrhynchus*, a genus of the Bathygadinae.

In some species of *Coelorhynchus* the anus is remote from the anal fin; in some one or two scaleless fossae are developed on the mid-ventral line anterior to the anus.

This genus contains a large series of species, one extreme of which is typified by *C. coelorhynchus*, with a comparatively short snout,

¹ A pseudocaudal developed.

² A few rudimentary serrations are present on the dorsal spine of a paratype of *C. proeductus*. The same condition was noted on the type of *C. gladius* Gilbert and Cramer (Proc. U. S. Nat. Mus., vol. 19, 1896, p. 422).

the other extreme by species with a very long sturgeon-like snout. Several apparently natural groups can be defined, and are here regarded as subgenera.

KEY TO THE SUBGENERA AND THE JAPANESE SPECIES OF COELORHYNCHUS.

- A¹. Subopercular margin rounded; snout moderate, not greatly produced, with a prominent double terminal tubercle.....*Coelorhynchus*.
- A². Subopercular margin produced backward at the angle in a pointed flap; snout without a prominent double terminal tubercle.
- B¹. Snout usually only moderately produced; scales with equal parallel spinous ridges; body usually with distinctive bars or spots.
Paramacrurus.
- a¹. An elongate scaleless thoracic fossa present on mid-ventral line; body with a large round spot behind pectoral and below first dorsal, and another below second dorsal; orbit longer than postorbital length of head; pectoral with 17 rays; pyloric caeca 19 to 23; inner edge of shoulder girdle scaled.....*kishinouyei*.
- a². No naked thoracic fossa; spot near pectoral smaller, posterior spot absent; orbit shorter than postorbital length of head; pectoral with 14 to 15 rays, weaker and shorter; pyloric caeca 25 to 31; inner edge of shoulder girdle scaled.....*jordanii*.
- B². Snout greatly produced, sturgeon-like; spinules of scales variously arranged, but never on equal parallel ridges; inner edge of shoulder girdle naked.....*Oxymacrurus*.
- b¹. Spinules on scales in strongly divergent series.
- c¹. Snout, with a terminal spine, less than twice as long as head in adults.
- d¹. Four or five rows of scales in a series from origin of second dorsal to lateral line; under side of head naked.
- e¹. Three to five spinous ridges on scales; snout longer, not shaped like a duck's bill; eye 1.8 in snout; barbel 6 in orbit.....*productus*.
- e². Six to nine spinous ridges on scales; snout shaped like a duck's bill; eye 1.5 in snout; barbel about half orbit.....*anatirostris*.
- d². Six or seven rows of scales in a series from origin of second dorsal to lateral line; under side of head scaled; barbel 3 to 4.5 in orbit.....*japonicus*.
- e². Snout without a terminal spine, more than twice as long as eye in adult.....*tokiensis*.
- b². Spinules on scales strongest on a median keel, the other spinules arranged in one or two parallel rows, but not on ridges; under side of head scaled.....*parallelus*.

12. COELORHYNCHUS KISHINOUEI Jordan and Snyder.

Coelorhynchus kishinouyei JORDAN and SNYDER, Proc. U. S. Nat. Mus., 23, 1901, p. 376, pl. 20.

Albatross station.	General locality.	Depth in fathoms.	Number of specimens.
5060.....	Suruga Gulf.....	197	1
5062.....	.....do.....	250	1
5065 (from fishermen).	.....do.....	211-235	5

Pyloric caeca shorter than the orbit, numbering, in four specimens, 19, 20, 22, 23.

The scales are strong on the ridges of the head, on which the suberect spinules radiate from the center of the scale. The median rostral ridge composed of about 10 wide scales and extending half the distance from the tip of the snout to the occiput, widening posteriorly. The median occipital scute well marked and preceded on each side by a similar scale; these scales similar to those along the ridges of the head. The scales on top of the head are larger than the scales of the body, and bear 3 to 5 strongly divergent ridges; these scales are in definite rows, one median, extending from the occiput to the rostral ridge, a row extending just within the occipital ridges and just without the rostral ridge, and a row of small scales extending forward from the anterior end of the occipital ridge to the anterior end of the nasal fossa. The upper margins of the nasal fossa and the orbit are armed with linear scales forming a continuous ridge. The occipital ridges are similar to the median rostral ridge, but stronger; they extend backward from above the middle of the pupil and curve outward; another ridge extends from the upper orbital margin to the end of the gill opening; between this ridge and the occipital ridge the scales are arranged in three longitudinal rows, with other smaller scales. The scales on the opercle and preopercle are similar to those on the body, but their crests are somewhat more divergent; those on the cheeks are smaller. The suborbital ridge is strong, strongest posteriorly, covered by two rows of scales below the posterior half of the orbit. Under side of head completely naked. The scales of the body bear a variable number of parallel spinous ridges, the largest number, about 20, occurring on scales above the lateral line, near the second dark spot. The spinules on the sides of the trunk, and on the posterior half of the tail are parallel with the axis of the body, but those between these regions are directed obliquely downward. The scales before the dorsal are small and bear a few divergent ridges.

Color in alcohol light brownish, underlaid with silvery on the lower sides of trunk, and with blackish on the belly. A large, dark brown, round spot, nearly two-thirds the diameter of the large eye, located above and behind the pectoral, below the lateral line, covering about six scale-rows; another dark brown spot, about five scale-rows wide, extending from dorsal base to a little below the lateral line, its anterior edge constantly twice the length of the head from the tip of snout; indistinct traces of other dark areas are present, but the two spots are constant in size and position, and are highly diagnostic of the species. Iris with dark brown chromatophores along its margin, its upper half blue, its lower half silvery; opercle and preopercle dark

brown, underlaid with silvery; region behind and below eye silvery, with large dark brown punctulations; nasal fossa dark brown, except on margins of nostrils; top of head lighter than the color of the body; underside of head colorless anteriorly, silvery posteriorly, with large dark brown punctulations scattered near tip of snout, on midline of snout, about mouth, and laterally on the posterior half of this region; rami of the mandibles almost uniform blackish brown; gular and branchiostegal membranes black, except for a narrow posterior whitish margin. First dorsal gray, the base with a narrow blackish band, the second spine and the tips of the soft rays black; second dorsal whitish; anal dusky on posterior third, lighter on middle third, and with a blackish margin of variable width on the anterior third; ventral blackish near base, the outer ray dusky, except on the white filament, the other rays light proximally, dark distally; ventral in some specimens nearly uniform blackish; pectoral base black on inner surface, silvery on outer surface, the fin gray, with dark punctulations, thickest near base of lower rays. Buccal cavity whitish; branchial cavity lined with whitish or gray, except for a well-defined black bar near margin of opercular membrane, leaving a narrow whitish border; peritoneum silvery, with blackish brown punctulations.

The firm texture and light, variegated color of this species, and of *C. jordani*, are correlated with the fact that they live in comparatively warm and shallow water.

The small specimen from *Albatross* station 5060 differs from those described in having 12 or fewer series of spines on the scales, and in proportions, as shown in the following table:

Table of measurements in hundredths of length to anus.

<i>Albatross</i> station.....	5065	5065	5065	5065	5065	5062	5060
Total length, mm.....	¹ 290	293	295	283	265	253	192
Length to anus, mm.....	84	78	77.5	76	75	71	48
Length, head.....	71	73	77	74	72	73	76
Length, orbit.....	26	29	28	27	25	27	27
Width, interorbital.....	16	16	18	16.5	15	16.5	15
Width, suborbital.....	10	10	12	11	9	11	10
Orbit to preopercle.....	30	28	30	29	29	29	27
Length, snout.....	23	25	27	26	26	26	30
Length, maxillary.....	20	20	19	19	19	19	18
Length, barbel.....	5	6	6	6	4	.....	5
Depth, body.....	53	52	54	52	51	51	46
Width, body.....	32	31	35	33	31	32	28
Anus to anal.....	.....	10	9	9.5	11	12	8
Anus to ventral.....	21	21	21	21	20	21	17
Ventral to isthmus.....	25.5	25	23	25	26	25	23
Height, second dorsal spine.....	51	51	54	.....	45	51	45
Length, first dorsal base.....	18	19	19	19	20	18	17.5
Interdorsal space.....	39	28	28	20	25	33	28
Length, pectoral.....	47	50	56	55	44	45	42
Length, outer ventral ray.....	36	38	37	38	27	33	34
Length, second ventral ray.....	24	25	26	26	23	22	22
Scales, above lateral line.....	5	5	5	5	5	5	5
Scales, below lateral line.....	16	16	15	15	17	16	.....
Soft rays, first dorsal.....	9	9	9	9	9	9	9
Ventral rays.....	7	7	7	7	7	7	7
Pectoral rays.....	17	17	17	17	17	17	17

¹ A pseudocaudal developed.

13. COELORHYNCHUS JORDANI Smith and Pope.

Coelorhynchus jordani SMITH and POPE, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 494, fig. 11.

Albatross station.	General locality.	Depth in fathoms.	Number of specimens.
4897.....	Kagoshima Market.....		5
4898.....	Eastern Sea.....	207	1
4898.....	do.....	207	1
4940.....	Kagoshima Gulf.....	115	1
4941.....	do.....	117	2
4942.....	do.....	118	4
4943.....	do.....	119	10

This species is very closely related to *C. kishinouyei*, and appears to represent that form in Kagoshima Gulf and Eastern Sea. *C. kishinouyei* is known only from Suruga Gulf and Sagami Bay.

C. jordani is the smaller form, and differs constantly from *C. kishinouyei* in a number of details, as follows:

1. The absence of the naked thoracic fossa between the ventrals. (A gland-like body is located in the muscles between the ventral fins, similar to that found beneath the fossa in *Abyssicola macrochir*.)
2. The orbit much smaller in the adult, apparently decreasing more rapidly with age, being shorter instead of longer than the postorbital length of the head.
3. The longer barbel.
4. The pectoral fin shorter and narrower; its rays weaker and fewer, 14 or 15, instead of 17, as constantly found in *C. kishinouyei*.
5. The ventral fin usually shorter.
6. The scales on the head, especially on the ridges, much smoother and more regularly imbricate; the scales between the occipital ridges not in the three definite rows characteristic of *C. kishinouyei*; scales otherwise similar in the two species.
7. The posterior margin of the preopercular ridge, and of the subopercle, more strongly curved.
8. The backward projection of the subopercle, its lower angle longer and slenderer.
9. Pyloric caeca more numerous, slenderer, and shorter, about half as long as the orbit, numbering in the six specimens counted: 25, 26, 28, 29, 31, 31.
10. Coloration agreeing in almost every detail, but generally lighter; the posterior of the two spots on the body absent in all but one young specimen, the anterior spot in the same position, but much more indistinct, and much narrower, covering only 2 or 3, instead of about 6 scale-rows. The outer ventral ray white, the blackish base overlaid with gray, the rays not lighter in the middle than at their distal ends.

The original description, based on four small specimens from Kagoshima, the only specimens hitherto known, may be corrected and supplemented by the following measurements of mature specimens. Snout 2.9 to 3.1 in head, orbit equal to or shorter than snout; interorbital about 5; $4\frac{1}{2}$ or 5 scales in a series from origin of second dorsal to lateral line, not including the scale on the lateral line, 5 or 6 below the second spine of the first dorsal; pectorals with 14 or 15, instead of 17, rays; vertical diameter of orbit 1.1 in horizontal diameter; median rostral ridge extending somewhat beyond vertical through anterior margins of eye; length of second spine of first dorsal about 0.8 the distance between its base and the anterior margin of orbit; pectoral a little more than half as long as head; ventral filament usually reaching well beyond origin of anal. Neither the length of the snout, nor the number of spinous ridges on the scales distinguish *C. jordani* from *C. kishinouyei*, these being the two differences held by Smith and Pope to separate the two.

The two young specimens from the Eastern Sea differ from those taken in Kagoshima Gulf in the longer snout, more acutely angulated preopercular ridge, shorter distance from ventral to isthmus, but the material is too limited to form definite conclusions.

Length of specimens 80 to 225 mm., 26 to 70 mm. to anus.

Table to show the number of spinous ridges on the scales.

<i>Albatross station.</i>	Length to anus, mm.	Number of ridges.
4897.....	29	3 to 5
4898.....	35.5	4 to 7
Kagoshima market.....	40	6 to 11
4941.....	41	7 to 11
4942.....	44	10 to 13
Kagoshima market.....	45	7 to 11
Do.....	50	8 to 20
4942.....	51	11 to 20
4941.....	57.5	8 to 18
4940.....	62.5	9 to 18
4943.....	63	9 to 18
Kagoshima market.....	70	10 to 23
Do.....	70	12 to 23

Table of fin ray counts.

Dorsal.		Ventral.		Pectoral.	
Rays.	Specimens.	Rays.	Specimens.	Rays.	Specimens.
11, 8	3	7	16	14	5
11, 9	10	-----	-----	15	12
11, 10	2	-----	-----	-----	-----

Table of measurements in hundredths of length to anus.

<i>Albatross station</i>	Kagoshima.		4940	4941	4942	4898
<i>Total length, mm</i>	¹ 219	225+	¹ 201	192	¹ 170	¹ 123
<i>Length to anus, mm</i>	70	70	62.5	57.5	51	35.5
<i>Length, head</i>	71	72	77	82	76	76
<i>Length, orbit</i>	22.5	24	26	29	28	27
<i>Width, interorbital</i>	15	14	16	16	17	18
<i>Width, suborbital</i>	10	10	11	10	10	11
<i>Orbit to preopercle</i>	29	29	30	30	26	31
<i>Length, snout</i>	25	24	26	29	27	30
<i>Length, maxillary</i>	20	20	21	21	21	21
<i>Length, barbel</i>	8.5	7	9	8	8	8
<i>Depth, body</i>	52	51				44
<i>Width, body</i>	32	34	34			29
<i>Anus to anal</i>				5		6
<i>Anus to ventral</i>	24			20		20
<i>Ventral to isthmus</i>	25	24	25			21
<i>Height, second dorsal spine</i>	50	51	52			51
<i>Length, first dorsal base</i>	19	21	19	20	21	19
<i>Interdorsal space</i>	26	25	27	28	26	20
<i>Length, pectoral fin</i>	38	36	41	40	41	35
<i>Length, outer ventral ray</i>	30	27	31	30	36	37
<i>Length, second ventral ray</i>	22	18	22	19	22	20
<i>Scales, above lateral line</i>	5	5	5	5	5	
<i>Scales, below lateral line</i>	17	16				

14. COELORHYNCHUS PRODUCTUS, new species.

Plate 9, fig. 1.

This species is a close ally of *C. anatirostris* Jordan and Gilbert,² described from a specimen from Misaki, Japan. *C. anatirostris* has been recorded twice since the original description: by Franz, as *C. antirostris*,³ from Aburatsubo, Sagami Bay, and by Jordan and Thompson, as *C. anagiostrostris*,⁴ from Misaki, also in Sagami Bay. *C. productus* is described from ten specimens dredged in Suruga Gulf. It differs from *C. anatirostris* in the longer snout, not shaped like a duck's bill; the eye, in the largest specimen, 1.8 in the snout, instead of 1.5; the barbel shorter, about 6 in orbit, instead of about half eye; maxillary 4.6 in head instead of 4; gill membranes without a free fold; scales with 3 to 5, instead of 6 to 9, divergent spinous ridges, those on the top of the head not similar to those on body, bearing but one to three ridges; length of orbit little less than distance from ventral to anus, instead of 1.4 in this distance, as measured on the figure of *C. anatirostris*.

Type-specimen.—306 mm. long, 109 mm. to anus, from *Albatross station* 5059, Suruga Gulf, Japan, depth, 197 to 297 fathoms; Cat. No. 76865, U.S.N.M.

Dorsal, II, 8 (8 to 10); ventral, 7; pectoral, 18 (17 to 19).

Dorsal contour of snout slightly concave, but evenly convex from middle of snout to the dorsal fin; the base of first dorsal nearly hori-

¹ A pseudocaudal developed.² Bull. U. S. Fish Comm., 1902 (1904), p. 619, text fig.³ Abh. math.-phys. Kl. K. Bayer. Akad. der Wissensch., vol. 4, Suppl. Bd. 1, 1910, p. 27.⁴ Mem. Carnegie Mus., vol. 6, pt. 4, 1914, p. 306; a specimen smaller than the type. 21 cm. long, with a shorter snout and a larger eye.

zontal; ventral contour little convex. Depth of body about half length of head; width of body over pectoral bases about 1.3 in its depth; width of tail 2.25 in its depth at a point twice length of head from tip of snout.

Head 3.95 in total length; snout 2.15 in head, its sides little convex, straight from tip backward a distance equal to length of orbit; tip of snout acuminate and spinigerous, its width, opposite anterior orbital margins, 1.3 in its length; its depth vertically above front of premaxillaries 1.9; suborbital ridge strong, continuous to preopercular angle; occipital ridges slightly converging toward their middle, and slightly diverging to the posterior ends; ridge above nasal fossa and orbit continuous with the postorbital ridge; denticulate membranous margin of preopercle produced backward as a rounded lobe; margin of subopercle, at lower angle, sharply produced downward and backward, as in all related species. Orbit oblong, the vertical diameter two-thirds the horizontal diameter, which is contained 1.8 times in the snout, nearly 4 in head; least interorbital width 0.8 orbit. Mouth small, extending to below middle of pupil; maxillary 4.6 in head; teeth in bands, the outer premaxillary series scarcely enlarged. Barbel short and slender, about 6 in orbit. Six branchiostegals; gill membranes attached to isthmus, without a free fold.

Pyloric caeca scarcely shorter than the orbit; 27 were counted in a paratype.

Distance from center of anus to origin of anal fin 3 in orbit, its distance from base of outer ventral ray a little greater than length of orbit; distance from ventral to isthmus equal to length of orbit. No thoracic scaleless pit.

Scales large, $4\frac{1}{2}$ or 5 in a series from origin of second dorsal to the lateral line (excluding lateral line scale); those on the body bear usually five very strongly spinous, divergent ridges, the median ridge strongest, armed with about five imbricate spines, these becoming larger posteriorly on all the ridges, the last spine extending beyond the margin of the scale; some scales have 3 or 4 ridges, but none have more than 5; the scales before the first dorsal and those on the belly smaller than those on sides of body; the scales on the median rostral ridge are not strongly specialized and are elliptical in outline, bearing one to four divergent crests; the medirostral ridge is bounded on each side by a definite series of scales, each of which bears several ridges; toward the tip of the snout the scales become smaller and usually bear but a single keel composed of suberect spinules; the median occipital scute and the scales on the occipital ridges and on the ridge above the orbit bear each a single strongly spinous keel; scales on ridge on upper margin of nasal fossa with about three keels; a series of large scales, similar to those of the body, extend backward from

the orbit, midway between the occipital and postorbital ridges, the remaining scales between these ridges being small; scales on opercles similar to those on body, but those on suborbital region are small; tip of snout with a spinigerous plate above and below; underside of head wholly scaleless, even below the angle of preopercle.

First dorsal spine small but sharp, entirely smooth (with two small spinules in a paratype), longer than the snout, and slightly longer than the soft rays; base of first dorsal 1.5 in orbit, 1.75 in interdorsal space. Pectoral 2.9 in head. Outer ventral ray reaching past anus, but not to origin of anal, the other rays not reaching anus.

Color in alcohol brownish, underlaid with silvery on breast and anterior part of sides and with blackish on belly; underside of head grayish anteriorly, silvery posteriorly, with small grayish brown punctulations; buccal and branchial cavities lined with blackish, excepting a narrow border on inner edge of opercular membrane; peritoneum blackish, underlaid with silvery.

Six paratypes, five from *Albatross* station 5059, at which the type was dredged, and one from station 5066, also in Suruga Gulf; depth, 211 to 293 fathoms. Some of these have a shorter, broader snout than the type. In addition, three small specimens, 86 to 90 mm. long, 27 to 30 mm. to anus, were dredged at stations 5059, 5066, and 5072, 148 to 297 fathoms; Suruga Gulf. These differ from the larger specimens in several characters probably due to the difference in size: Orbit, 3.4 to 3.6 in head, 1.4 to 1.5 in snout; snout, 2.3 to 2.4 in head; maxillary, 4.4 to 4.6; distance from ventrals to anus, about equal to orbit; distance from anus to anal, 3.3 in orbit; scaly ridges of head strong; scales of body bearing one to three ridges.

Table of measurements in hundredths of length to anus.

<i>Albatross</i> station.....	5059	5059	5059	5059	5059	5059	5066
Total length, mm.....	396	286	261+	217	1 220	1 190	223
Length to anus, mm.....	109	93	93	83	80	73.5	75
Length, head.....	72	72.5	72	70	71	71.5	73
Length, orbit.....	18.5	19.5	19	20	20	20	20
Width, interorbital.....	14.7	14.5	15	13	13	14.7	14
Width, suborbital.....	10	9.5	8.5	9	8.5	9.5	9.5
Orbit to preopercle.....	22	22	22.5	22	21	22	21
Length, snout.....	33.5	33.5	33	31	31.5	31.7	33
Width, snout.....	26	23.5	23	24	25	26	24
Length, maxillary.....	16	16	16	15	.....	16	16
Length, barbel.....	3.5	2.5	2.7	4	3.5	3.5	3.5
Depth, body.....	33.5	32	32	31	31.5	30.2	31
Width, body.....	28	26	27	26	26	22.5	26
Anus to anal.....	6.5	5	5	5	6	5.5	6
Anus to ventral.....	23.5	22	23	23	20	19.5	20
Ventral to isthmus.....	19	20.5	19.5	.....	18.5	18	19
Height, second dorsal spine.....	37	38	38.5	36	36.3	37	.....
Length, first dorsal base.....	11.8	14	15	15	14.5	13	13
Interdorsal space.....	19	19.3	18	16	18	20	16
Length, pectoral fin.....	27	.....	27	27	25	29	.....
Length, outer ventral ray.....	24.2	26	25	26	25	25.5	25
Length, second ventral ray.....	18	16.2	17	18	.....	19	16
Scales, above lateral line.....	5	5	5	5	5	5	5
Scales, below lateral line.....	16	18	17	17	18	18	.....
Soft rays, first dorsal.....	8	8	10	5	9	9	9
Ventral rays.....	7	7	7	9	7	7	7
Pectoral rays.....	17	18	18	18	18	19	18

¹ A pseudocaudal developed.

15. COELORHYNCHUS JAPONICUS (Temminck and Schlegel).

Macrurus japonicus TEMMINCK and SCHLEGEL, Fauna Japonica, 1846, p. 256, pl. 112, fig. 2.—GÜNTHER, *Challenger Reports*, vol. 22, Deep-Sea Fishes, 1887, p. 127, pl. 29, fig. C.—STEINDACHNER and DÖBERLEIN, *Fische Japans*, vol. 4, 1887, p. 283.

Coelorhynchus japonicus JORDAN and GILBERT, Bull. U. S. Fish Comm., 1902 (1904), p. 617.—FRANZ, Abh. math.-phys. kl. k. Bayer. Akad. der Wissensch., vol. 4, Suppl. Bd. 1, 1910, p. 26.—JORDAN and THOMPSON, Mem. Carnegie Mus., vol. 6, pt. 4, 1914, p. 306.

Albatross station.	General locality.	Depth in fathoms.	Number of specimens.
4967.....	Off east coast of central Hondo.....	214-253	1
4968.....	.....do.....	253	1
5059.....	Suruga Gulf.....	197-297	2
5062.....	.....do.....	250	1

Scales with 3 to 5 strongly divergent spinous ridges; 6 or 7 scales from origin of second dorsal to the lateral line; those on ridges of head moderately strengthened; the median rostral ridge extends to opposite the anterior margins of orbits, and bears a series of about 12 subquadrate scales with 4 to 8 spinous ridges, which radiate from a point near the anterior margin of the scale; the occipital and postorbital ridges bear a series of narrow scales with one or two ridges armed with a few conic spines; a similar scale forms the occipital scute; the ridge on the upper orbital margin bears a series of scales with conic spines along several divergent ridges; the ridge on the posterior half of the upper margin of the nasal fossa bears four scales which become smaller and narrower anteriorly; the scales in a series midway between the occipital and postorbital ridges are similar to the scales of the body, but larger; those on the next series below, and those on the opercles, are similar to those on the body; a patch of small scales, with a single crest, on the upper end of the preopercle; the tip of the snout is covered with a modified triangular scale, with suberect spinules; scales elsewhere on the head are mostly with a single ridge armed with sharp spinules. Posterior half of nasal fossa, and the gular and branchiostegal membranes are naked.

Lateral margins of snout but slightly convex, the dorsal contour concave.

Fifty pyloric caeca, shorter than the orbit, were counted in one specimen.

The young, as usual in the genus, have a shorter, broader snout, larger eye, and other differences brought out in the following table:

Table of measurements in hundredths of length to anus.

<i>Albatross station</i>	4968	4967	5059	5059	5062
<i>Total length, mm.</i>.....	.....	307	182	158	166
<i>Length to anus, mm.</i>	142	120	55	49	58
<i>Length, head</i>	73	75	77	77	76
<i>Length, orbit</i>	23	20	23	23	22
<i>Width, interorbital</i>	18.3	14	16	16	15
<i>Width, suborbital</i>	9.5	9	10	9	8
<i>Orbit to preopercle</i>	25	25	25	26	24
<i>Length, snout</i>	31	33.5	33	33	34
<i>Length, maxillary</i>	20	19.5	20	18	18
<i>Length, barbel</i>	6.5	6.5	7	5	6
<i>Depth, body</i>.....	.....	34	36	36	34
<i>Width, body</i>.....	.....	24	27	23	24
<i>Anus to anal</i>	6	5	5	4	4
<i>Anus to ventral</i>	22	23	22	19	20
<i>Ventral to isthmus</i>	20	20	21	20	20.5
<i>Height, second dorsal spine</i>	26	24	31	31	31
<i>Length, first dorsal base</i>	9.5	11	13	13	12
<i>Interdorsal space</i>	17	16	19	17	17
<i>Length, pectoral</i>.....	.....	.....	28	.....	26
<i>Length, outer ventral ray</i>	22	23	34	34	30
<i>Scales, above lateral line</i>	7	7	7	.....	.....
<i>Soft rays, first dorsal</i>	8	10	9	9	8
<i>Ventral rays</i>	7	7	7	7	7
<i>Pectoral rays</i>	19	19	.....	.....	.....

16. COELORHYNCHUS TOKIENSIS (Steindachner and Döderlein).

Macrurus tokicnsis STEINDACHNER and DÖDERLEIN, Fische Japans, vol. 4, 1887, p. 283.

<i>Albatross station.</i>	General locality.	Depth in fathoms.	Number of specimens.
4911	Eastern Sea.....	391	1
4916	.....do.....	361	1

Description of a specimen 212 mm. long, from station 4916:

Dorsal contour of head evenly convex, the sides nearly straight forward and backward from the prominent rounded lateral angle; depth of body equal to length of snout, 2.3 in head; width of snout at base 1.3 in its length; vertical depth over front of premaxillaries 1.66 in its length; preoral length of snout 1.2 in preocular length; suborbital ridge armed anteriorly by a single row, and posteriorly by a double series of strongly spinous scales; scales on the rounded tip of snout and on the lateral angles somewhat strengthened and more strongly armed than the neighboring ones, but not forming prominent tubercles; median rostral ridge with a series of quadrate scales; occipital ridges strong and nearly parallel, but slightly converging towards the middle of their length from both ends, the least width between the ridges half the interorbital; a weaker postorbital ridge from the upper orbital margin to the upper margin of the opercle; lower angle of subopercle sharply produced backwards. Orbit oval, its vertical diameter 1.3 in its horizontal diameter, which is contained 1.8 times in the snout, 4.2 times in head. Maxillary longer than orbit, 1.66 in snout, extending past vertical from pupil. Barbel short and slender, 3.8 in orbit. Six branchiostegals; gill-membranes with a

wide free fold; gill slit before first arch 1.5 in orbit, slit behind fourth arch 2.9.

Six scales between origin of second dorsal and lateral line, excluding the lateral line scale; most of the scales of the body with 5, some with 3, strong divergent ridges, armed with about 5 strong procumbent imbricate spines, the posterior one strongest, and extending beyond the scale margin. Lower surface of head completely naked, with the exception of a very well defined, elliptical patch of scales below the angle of the preopercle. A few prickly scales on the lower acute end of the large pyriform nasal fossa, which is as long as the eye; a pair of naked grooves near tip of snout, converging anteriorly; scales of the median rostral ridge anteriorly with two divergent ridges, posteriorly with a single keel, and with a few lateral spinules; two well-defined series of scales on each side of the rostral ridge between it and a lateral groove parallel to it; the scales in these series are armed each with a single spinous ridge; the two series on each side diverge opposite the end of the rostral ridge, the inner series of each side meeting above the middle of the orbit, and forming a median occipital series, the outer series becoming continuous with the occipital ridge; two lateral occipital series, between the occipital ridge and the median series, not extending on the snout; scales small and prickly outward from the lateral rostral grooves; scales in the modified series midway between occipital and postorbital ridges, and on the opercles, with 3 spinous divergent ridges, those on the suborbital ridge with several spinous ridges; other scales of the head with a single trenchant spinous crest, strongest on the occipital and postorbital ridges.

Color light brown (dark on belly), with about six distinct dark brown bars extending across the body, and about as wide as the interspaces between them; one is located behind the occiput, the second below the first dorsal, one below the interdorsal space, three broad ones on the anterior half of tail, and several indistinct ones behind these. Head grayish, except on the dusky opercle. Vertical fins dusky, the anal with a blackish margin; ventral dark, but with a light filament; two uppermost pectoral rays, and the distal ends of the other rays dark. Buccal, branchial, and peritoneal cavities lined with blackish, the branchial cavity with a whitish margin on the opercular membranes, the peritoneal lining spotted, underlaid with silvery.

A larger specimen, in poor condition, about 535 mm. long, from station 4911, differs from the smaller specimen in the following characters: Scales on anterolateral angle of snout scarcely enlarged; length of snout 2.27, width 1.55 in its length; depth over tip of premaxillaries 1.65; orbit smaller, 2.1 in snout; maxillary 3.65; scaly ridges less prominent; scales with 5 to 7 ridges; nasal fossa more completely scaled anteriorly; a few lateral spinules besides the median keel on the scales on top of head; scales on median rostral ridge with 5

spinous ridges; those on the opercles, and on the series between the occipital and postorbital ridges with 3 to 7 spinous ridges. First dorsal spine concealed (sharp in the smaller specimen). Fifty pyloric caeca, shorter than the orbit.

C. tokiensis is probably most closely related to *C. macrorhynchus* Smith and Radcliffe,¹ a Philippine species, and to *C. quadricristatus* (Alcock),² an Indian species. From *C. macrorhynchus*, it differs in the absence of scales on the under side of the head, excepting the definite small posterior patch; the dark bars of the body; the blunt snout; and the shorter interdorsal space, which is shorter, instead of longer, than the base of the first dorsal. From *C. quadricristatus*, it differs in the shorter blunter snout; the larger eye; the naked under-side of head; in the more numerous pectoral rays, 18 or 19, instead of 16; and in the ventral extension of the dark bars to the anal base.

Table of measurements in hundredths of length to anus.

Albatross station.....	4911	4916
Total length, mm.....	529	212
Length to anus, mm.....	231	73.5
Length, head.....	71	77.5
Length, orbit.....	16	19
Width, interorbital.....	14.6	17.5
Width, suborbital.....	7	9
Orbit to preopercle.....	26.3	28
Length, snout.....	32.5	33.5
Width, snout.....	20.5	26
Length, maxillary.....	20.5	20
Length, barbel.....	5	5
Depth, body.....	32	33.5
Width, body.....	23.5	24
Anus to anal.....	7	7
Anus to ventral.....	21	21
Ventral to isthmus.....	20	21
Height, second dorsal spine.....	26.5	.....
Length first dorsal base.....	12	12.5
Interdorsal space.....	11.5	9
Length, outer ventral ray.....	26	37
Length, second ventral ray.....	14.5	18
Scales, above lateral line.....	6	6
Soft rays, first dorsal.....	9	9
Ventral rays.....	7	7
Pectoral rays.....	18	19

17. COELORHYNCHUS PARALLELUS (Günther).

Macrurus parallelus GÜNTHER, Ann. Mag. Nat. Hist., ser. 4, vol. 20, 1877, p. 439; *Challenger* Reports, vol. 22, Deep-Sea Fishes, 1887, p. 125 (in part).

Coelorhynchus parallelus JORDAN and GILBERT, Bull. U. S. Fish Comm., 1902 (1904), p. 618.—FRANZ, Abh. math.-phys. kl. k. Bayer. Akad. der Wissensch., vol. 4, Suppl. Bd. 1, 1910, p. 26.

Albatross station.	General locality.	Depth in fathoms.	Number of specimens.
4906	Eastern Sea.....	369-406	1
4908	.....do.....	434	1
4909	.....do.....	434	2

¹ Radcliffe, Proc. U. S. Nat. Mus., vol. 43, 1912, p. 127, pl. 29, fig. 1.

² Alcock in Wood-Mason and Alcock, Ann. Mag. Nat. Hist. (6), vol. 8, 1891, p. 119; Alcock, Journ. Asiatic Soc. Bengal, vol. 63, pt. 2, 1894, p. 126; Illustrations of the Zoology of the *Investigator*, 1894, pl. 3, fig. 1; A Descriptive Catalogue of the Indian Deep-sea Fishes, 1889, p. 106.

Under side of head completely scaled; scales between the strong ridges of the head small, mostly with a single median keel, excepting a series of scales midway between the occipital and postorbital ridges.

Subopercle sharply produced downward and backward at its lower angle. Branchiostegals 6. Only 9 pyloric caeca, two-thirds as long as the eye.

Table of measurements in hundredths of length to anus.

Albatross station.....	4909	4909	4906	4908
Total length, mm.....	249	.....	104	83
Length to anus, mm.....	99	72	32	27
Length, head.....	69.5	73	76	79
Length, orbit.....	19	21	22	22
Width, interorbital.....	15.5	17	17	16
Width, suborbital.....	9	10	10	.....
Orbit to preopercle.....	23	23	26	.....
Length, maxillary.....	16.5	16.5	.....	19
Length, snout.....	30	32	30	33
Length, barbel.....	4	5	.....	.....
Depth, body.....	33	30	29	32
Width, body.....	28	.....	25	.....
Anus to anal.....	3	2.5	.....	.....
Anus to ventral.....	27	25	23	24
Ventral to isthmus.....	17	16	16	16
Height, second dorsal spine.....	26	.....	.....	.....
Length, first dorsal base.....	11	11	.....	.....
Interdorsal space.....	13.5	12.5	.....	.....
Length, pectoral.....	25	25	.....	.....
Length, outer ventral ray.....	25	27	.....	.....
Length, second ventral ray.....	12.5	15	.....	.....
Scales, above lateral line.....	5	5	.....	.....
Soft rays, first dorsal.....	8	8	.....	.....
Ventral rays.....	7	7	.....	.....
Pectoral rays.....	18	18	.....	.....

Genus ABYSSICOLA Goode and Bean.

Abyssicola GOODE AND BEAN, Oceanic Ichthyology, 1895, p. 417.

This genus is doubtless a close ally of *Coelorhynchus*, having the snout produced, the suborbital ridge continuous to the preopercle, the median rostral, occipital, and postorbital ridges present, and the dorsal spine smooth. *Abyssicola* differs from *Coelorhynchus* chiefly in dentition, having the teeth biserial in both jaws (crowded on sides of upper jaw) instead of in bands. The ridges of the head are weaker and the sides of the head much straighter, being much less angulated at the preorbital ridge. The sharp, backward projection of the subopercle at its lower angle and the strongly divergent ridges on the scales seem to place *Abyssicola* near those species of *Coelorhynchus* here referred to the subgenus *Oxymacrus*, but the snout is less produced and the anus more remote from the anal than in any species in that section of *Coelorhynchus*. The anus is preceded by a large naked fossa, containing a gland-like body covered by thickly pigmented tissue.

Only the type-species is known, and this is rather common off the east coast of Hondo.

18. ABYSSICOLA MACROCHIR (Günther).

Macrurus macrochir GÜNTHER, Ann. Mag. Nat. Hist. (4), vol. 20, 1877, p. 438; *Challenger* Reports, vol. 22, Deep-Sea Fishes, 1887, p. 148, fig. 29, fig. B. (off Enoshima, 345 fathoms).

Abyssicola macrochir GOODE AND BEAN, Oceanic Ichthyology, 1895, p. 417, pl. C, fig. 348.—JORDAN and SNYDER, Proc. U. S. Nat. Mus., vol. 23, 1900, p. 376 (off Tokyo; *Albatross*, 1896).—JORDAN and GILBERT, Bull. U. S. Fish Comm., 1902 (1904), p. 607 (Sagami Bay, *Albatross*, 1900).—FRANZ, Abh. math. phys. kl. k. Bayer. Akad. der Wissensch., vol. 4, Suppl. Bd. 1, 1910, p. 26.

<i>Albatross</i> station.	General locality.	Depth in fathoms.	Number of speci- mens.
4916.....	Eastern Sea	361	1
4957.....	Bungo Channel, off Kyushu.....	437	2
4958.....	do.....	405	1
5048.....	Off Matsushima Bay.....	129	29
5049.....	do.....	182	3

Owing to the incompleteness of the original description, five large specimens are here described, all more than 500 mm. long.

Width of body over pectoral bases 2.4 to 3 in length of head to upper angle of opercle. Head with subvertical sides, its width 2.1 to 2.3 in its length. Vertical diameter of orbit 0.8 the horizontal diameter, which is contained 3.3 to 3.7 times in head, an anterior crescent-shaped portion scaled, the iris yellow, about one-third as wide as pupil, membrane connecting iris with margin of orbit light brown, the two colors sharply contrasted. Interorbital region convex, not abruptly widened posteriorly, its width about equal to length of orbit; snout 3.25 to 3.6, conic and produced, the tip on a horizontal through middle of pupil; terminal and lateral tubercles little strengthened; median superior rostral ridge extending from tip of snout to past front of orbit; lateral ridges well marked, but feebly developed when compared to the ridge in *Coelorhynchus*, curved downward below the orbit, and extending to the preopercular angle, which is acutely produced backward, as in *Coelorhynchus*; occipital ridges converging rather strongly from both ends toward the middle of their length, the least width between them 2.5 to 3 in the interorbital width; margin of subopercle sharply produced downward and backward at its lower angle, opposite the end of the lower limb of the opercle, as in the subgenera *Oxymacrurus* and *Paramacrurus* of the genus *Coelorhynchus*; interopercle and subopercle concealed behind the preopercle. Barbel 5.5 to 7 in orbit. Mouth a little oblique, large, extending from below nostrils to beyond orbit; maxillary 2.3 to 2.4 in head; teeth biserial in both jaws,¹ crowded posteriorly in

¹ Teeth incorrectly described by Günther as being "coarsely villiform in a narrow band on the upper jaw, and in a single series in the lower."

upper jaw to form three series, the outer premaxillary series either larger or smaller than the inner series; teeth of inner mandibular series always enlarged, the outer series close to the inner series, as in *Nematonurus*. Six branchiostegals; gill membranes with a wide free fold; width of slit before first arch 1.6 to 1.7 in orbit, the slit behind last arch 2 to 2.5; gill-rakers tubercular.

Seven scales in a series from the origin of the second dorsal to the lateral line, 18 or 19 in a series from origin of anal to lateral line, counted obliquely forward and upward, exclusive of the lateral line scale. Scales on back and sides with 7 to 10 strongly divergent ridges, armed with retrorse spinules, the last of which does not project beyond the margin of the scale; those on belly smaller, with 3 to 5 ridges. Under side of head completely scaled excepting the gular and branchiostegal membranes. Nasal fossa less than half as long as orbit, and naked, with the exception of a few scales near its anterior end. Inner edge of shoulder girdle with cycloid scales near outer margin. The scales of the head are considerably differentiated in certain areas, and along the ridges, but are apparently not so highly differentiated as in *Coelorrhynchus*. Those on the occipital ridges are little modified anteriorly, bearing about 5 divergent ridges, but become stronger posteriorly, the median ridge forming a strong keel, the lateral ones smaller, entirely obsolete on some scales; those on top of head with 3 to 7 divergent spinous ridges, becoming smaller anteriorly, being scarcely more than prickles between the indistinct rostral groove and the anterolateral margin of snout; median superior rostral ridge with a series of subquadrate scales, widening posteriorly, each armed with about ten rows of spinules radiating from near the center of the scale, the last spine pointed posteriorly; those on the lower half of cheeks, and on the under side of the head, similar to those on the belly, not being so greatly reduced as in *Coelorrhynchus*; suborbital ridge sharp, accompanied above by one row of small scales before pupil, becoming smaller anteriorly, and by two series of large irregular scales from below pupil to preopercle; those on opercle and preopercle enlarged, bearing 7 to 12 ridges.

Twenty-nine and 31 pyloric caeca were counted in two southern specimens, and 29 in one northern specimen, the longest in each case shorter than the orbit.

Anus preceded by an oval black scaleless fossa. A large glandular body is located in the body wall, above this fossa. A similar fossa is found in some species of *Coelorrhynchus*, in *Malacocephalus*, and in some species of the large genus *Lionurus*.

Color light brown, underlaid with silvery on the lower half of trunk and head, belly somewhat darker; ventrals blackish; other fins dusky, the first dorsal blackish near tips of rays. Young lighter in

color, with much more silver; fins light, ventral blackish near base only.

First dorsal spine small but sharp, compressed anteroposteriorly; the second spine rounded and smooth.

The specimens dredged in comparatively shallow water, off Matsushima Bay, greatly extend the northern limit of distribution of this species. They are evidently the young of *A. macrochir*; they differ from the southern specimens in the much lighter color, as described, and in the proportions of the head, having the eye larger, the snout longer, and the postorbital length of head shorter. These differences are assumed to be due to the difference in size between the northern and southern specimens, and are well illustrated in the tables of proportional measurements. The specimens from station 5048 are from 91 to 268 mm. long, 24 to 72 mm. to anus. A similar specimen, 19 mm. long to anus, was dredged in the Eastern Sea.

Tables of measurements in hundredths of length to anus.

SOUTHERN SPECIMENS.

<i>Albatross</i> station.....	(1)	(²)	4957	4957	4958
Total length, mm.....		+550	³ 570	554	634
Length to anus, mm.....	191	162	161	157	156
Length, head.....	75	71	72.5	73.5	71.5
Length, orbit.....	23.5	20.5	22.5	23	21.5
Width, interorbital.....	21.5	21.5	22.5	22.5	22
Width, suborbital.....	9	8			8.5
Orbit to preopercle.....	35	32.5	33	34.5	33
Length, snout.....	22.5	22	21.5	22	21
Length, maxillary.....	33	28	30.5	31.5	29.5
Length, barbel.....	4.5	3.5	4	4	3
Depth, body.....		47	50	49	49
Width, body.....	28.5	29	29	31	29.5
Anus to anal.....	10	11.5	12.5	12	13
Anus to ventral.....	20	18.5			20
Ventral to isthmus.....	27	25.5			29
Height, second dorsal spine.....			36	34	38
Height, third dorsal ray.....					
Length, first dorsal base.....	18	15.5	18	19	18
Interdorsal space.....	40.5	26.5	38	43.5	38
Height, second dorsal.....	9				
Height, anal.....	22				20
Length, pectoral fin.....		42.5			48
Length, first pectoral ray.....	3	3.5	3	3.5	4
Length, second pectoral ray.....			30	39	39
Length, third pectoral ray.....			38		40
Length, outer ventral ray.....	22	25	27.5	28	27.5
Length, second ventral ray.....	20	20	19.5		22.5
Soft rays, first dorsal.....	9	10	10	10	11
Ventral rays.....	7	7	7-8	7	7
Pectoral rays.....	18	18-17	18	18	17

¹ Tokyo market; K. Otaki; No. 8442, Stanford Univ. Museum.

² Sagami Bay, Japan; *Albatross*, 1900; No. 8307, Stanford Univ. Museum.

³ A pseudocaudal developed

NORTHERN SPECIMENS.

<i>Albatross station</i>	5049	5049	5049	5048	5048	5048	5048
Total length, mm.....	385	355	356	268	+150	134	91
Length to anus, mm.....	100	95	95	72	43.5	34	24
Length, head.....	76	74	76	74	76	78	76
Length, orbit.....	23	23	23	24	28	27	30
Width, interorbital.....	24	25	24	25	27	25	27
Width, suborbital.....	9	9	9	8.5	9	10	9
Orbit to preopercle.....	34	33	32	31	31	31	30
Length, snout.....	26	26	26	26	27	27	26
Length, maxillary.....	28.5	27	29	27	27	29	26
Length, barbel.....	4	3.5	4	4	5	4	.....
Depth, body.....	52	50	50	47	49	46	41
Width, body.....	29	33	32	30	31	29	28
Anus to anal.....	12	11	10	12	11	11	11
Anus to ventral.....	20	18	20	20	19	20	22
Ventral to isthmus.....	26	27.5	26	27	28	30	29
Height, second dorsal spine.....	.....	39	.....	40.5	43	.....	40
Height, third dorsal ray.....	.....	.....	.....	40	42	.....	.....
Length, first dorsal base.....	19	17	17	16.5	20	18	19
Interdorsal space.....	32	35	34	31	34	33	34
Length, pectoral fin.....	43	44.5	42.5	43	42	41	40
Length, first pectoral ray.....	.....	.....	.....	5	7	.....	.....
Length, second pectoral ray.....	.....	.....	.....	35	40	.....	.....
Length, third pectoral ray.....	.....	.....	.....	40	40	.....	.....
Length, outer ventral ray.....	29	27	30	31.5	36	37	41
Length, second ventral ray.....	23	.....	.....	26.5	26	.....	.....
Soft rays, first dorsal.....	11	9	10	9	10	10	10
Ventral rays.....	7	7	7	7	7	7	7
Pectoral rays.....	17	17	17	17	18	.....	.....

Genus HYMENOCEPHALUS Giglioli.

This genus is the most distinct of any in the subfamily. It is distinguished from all other Macrouroid fishes, with the exception of *Steindachneria argentea*, by the presence of ventral striae, consisting of fine parallel lines of dark, alternating with silvery, pigment, on the ventral areas of the body. There are invariably two "lens-shaped bodies," possibly photophores, on the mid-ventral line, one immediately before the anus and one before the ventrals, connected by a black ridge along the wall of the abdominal cavity. The large thin scales with weak spinules, the papery structure of the bones of the head, and the narrow pectoral are characteristic of *Hymenocephalus*. In several characters, *Hymenocephalus* resembles *Bathygadus* and its allies. Among these may be mentioned the large modified scales over the sensory canal on the side of the head, anterior to the origin of the lateral line; the large sensory canals; the anteroventral extension of the gill opening; the comparatively wide slit before the first arch; the numerous gill-rakers (more than 15 on the lower limb of the outer arch); the large lateral and subterminal mouth; the thin scales; the variation in the barbel, which is absent, rudimentary, or well developed in different species within each group. It resembles the *Bathygadus* group also in having seven branchiostegals, correlated with a posterior position of the anus, which is immediately before the anal fin.

The 13 known species are all fragile and small, less than 1 foot in length, and are confined entirely to tropical or subtropical waters.

19. HYMENOCEPHALUS STRIATISSIMUS (Jordan and Gilbert).

Hymenocephalus striatissimus JORDAN and GILBERT, Bull. U. S. Fish Comm., 1902 (1904), p. 612, text figure.

<i>Albatross station.</i>	General locality.	Depth in fathoms.	Number of specimens.
4897.....	Eastern Sea.....	207	1
4966.....	Off east coast of Hondo.....	244-290	1
4967.....	do.....	244-253	8
4968.....	do.....	253	4
5059.....	Suruga Gulf.....	197-297	1

The posterior of the two lens-shaped bodies is characteristically bilobed in this species.

The fins were all injured in the type-specimens. The height of the second dorsal spine is contained nearly 1.3 times in the head; third dorsal ray, 1.3; height of anal, 3.75; length of first articulated pectoral ray, 1.5; the second and longest, 1.4; length of outer ventral ray, 1.6, reaching to second anal ray; second ventral ray, 2.1, not nearly reaching to anus.

Shoulder girdle naked on inner edge.

Table of fin rays.

<i>Albatross station.</i>	First dorsal.	Ventral.	Pectoral.
4897.....	II, 8	8	15
4966.....	II, 9	8	15
4967.....	II, 9	8	16
4967.....	II, 8	8	14
4967.....	II, 8	8	14
4967.....	II, 8	8	14
4967.....	II, 8	8	14
4967.....	II, 9	8	14
4967.....	II, 9	8	14
5059.....	II, 8	8	13

Tables of measurements in hundredths of length to anus.

<i>Albatross station.</i>	5059	4966	4897	4968	4968	4968
Total length, mm.....	160	170	159	170	183	178
Length to anus, mm.....	41	43	40.5	43	46	45
Length, head.....	63	66	63	63	63	61
Length, orbit.....	26	29	26	26	29	26
Width, interorbital.....	19	19	19	19	20	20
Width, suborbital.....	7.5	8	7	7	8	8
Orbit to preopercle.....	27	28.5	29	30	30	28
Length, snout.....	14	16	14	15	15	15
Length, maxillary.....	32	37	36	35	37.5	34
Length, barbel.....	10	11	10.5	10	9	10
Depth, body.....	48	49	50	44	47	43
Width, body.....	29	32	31	25	26	29
Anus to ventral.....	38					
Ventral to isthmus.....	41					
Height, second dorsal spine.....	50				51	
Height, third dorsal ray.....	50				49	
Length, first dorsal base.....	22	22.5	21	23	22	21
Interdorsal space.....	49	52	55	55	51	54
Height, second dorsal.....	10	10				
Height, anal (first ray).....	19	19.5	19	18	20	18
Length, first pectoral ray.....	3.5			3.5	3	
Length, second pectoral ray.....	41		40	38	40.5	39
Length, outer ventral ray.....	43	43	37	43	41	
Length, second ventral ray.....	32	31	30	32	32	31
Scales, above lateral line.....	3	3	3		3	
Gill-rakers, lower limb, second arch.....	20	19	18	18	20	

Table of measurements in hundredths of length to anus—Continued.

<i>Albatross station</i>	4967	4967	4967	4967	4967	4967	4967	4967
<i>Total length, mm</i>	129	137	127	134	141	131	160	144
<i>Length to anus, mm</i>	44	34	38	35.5	36	42	36	35
<i>Length, head</i>	62.5	63	63	67	66	68	69	63
<i>Length, orbit</i>	25	28	26	28	.....	25	29	29
<i>Width, interorbital</i>.....	.....	21	19	20	.....	20	20	20
<i>Orbit to preopercle</i>	30	30	29	31	.....	31	32	29
<i>Length, snout</i>	13	16	16	14	17	16	17	14
<i>Length, maxillary</i>	37	34	35	37	36	36	39	36
<i>Length, barbel</i>	11	11.5	9	12	12	11	11	14

20. HYMENOCEPHALUS LETHONEMUS (Jordan and Gilbert).

Hymenocephalus lethonemus JORDAN and GILBERT, Bull. U. S. Fish Comm., 1902 (1904), p. 615, text figure.

<i>Albatross station.</i>	General locality.	Depth in fathoms.	Number of specimens.
4918.....	Eastern Sea.....	361	2
4919.....	do.....	440	7
4968.....	Off east coast of Hondo.....	253	2
5059.....	Suruga Gulf.....	197-297	1
5060.....	do.....	197	2
5066.....	do.....	211-293	1
5067.....	do.....	293	2
5086.....	Sagami Bay.....	292	3
5093.....	Uruga Strait.....	302	2

The lens-shaped body just before the anus is round, as usual in the genus, or slightly oval transversely, but never bilobed, as in *H. striatissimus*.

Height of second dorsal spine, 1.4 in head; height of anal fin, 3.1; length of first articulated pectoral ray, 1.8, second and longest, 1.7; outer ventral ray nearly as long as head, and reaching to about twelfth anal ray, when unbroken; second ventral ray reaching the posterior lens-shaped body, 2.35.

Scales from the back, near base of dorsal, with about 24 sharp weak spines; those from the sides and belly appear entirely cycloid. Shoulder girdle naked on inner edge.

Table of Fin Rays.

<i>Albatross station.</i>	First dorsal.	Ventral.	Pectoral.
4919.....	II, 10	12	15
4919.....	II, 10	11	17
5060.....	II, 11	11	16
4918.....	II, 10	11	16
4918.....	II, 10	11	14
4968.....	II, 10	11	16
5066.....	II, 11	11	17
5086.....	II, 11	11	17
5086.....	II, 11	11	16
5093.....	II, 11	11	15

Table of measurements in hundredths of length to anus.

Albatross station.....	4919	5060	4919	4919
Total length, mm.....	180+	122	182	177
Length to anus, mm.....	49.5	45	50	49
Length, head.....	67	63	67	65
Length, orbit.....	23	20	20	19
Width, interorbital.....	19	20	20	20
Width, suborbital.....	9	9	9	8.5
Orbit to preopercle.....	29	30	30	29
Length, snout.....	20	19	22	19
Length, maxillary.....	35	33	36	34
Depth, body.....	45	40	40	43
Anus to ventral.....		33.5		
Ventral to gill membrane.....		37		
Height, second dorsal spine.....			58	51
Height, third dorsal ray.....		46		47
Length, first dorsal base.....	23	22	26	24
Interdorsal space.....	42	37	38	47
Length, first pectoral ray.....	2	4		
Length, second pectoral ray.....	40	37	35	33
Length, third pectoral ray.....	40	40	38	35
Length, outer ventral ray.....	70		59	
Length, second ventral ray.....		30	30	28
Gill-rakers, lower limb, second arch.....	18	19		

¹ A small pseudocaudal developed.

Genus MALACOCEPHALUS Günther.

Malacocephalus differs from *Lionurus*, and the other genera of the Coryphaenoidinae with seven branchiostegal rays, in the dentition and in the profuse branching of the numerous pyloric caeca. Teeth biserial in upper jaw; uniserial in lower jaw.

21. MALACOCEPHALUS NIPPONENSIS, new species.

Plate 9, fig. 2.

Type-specimen.—460 mm. long (a small pseudocaudal developed), from Albatross station 4967, off the east coast of central Hondo, at a depth of 244 to 253 fathoms; Cat. No. 76866, U.S.N.M.

Comparison of specimens from the Hawaiian Islands, Japan, and the Philippine Islands indicates the presence of three species in the Pacific Ocean, one in each locality mentioned. Although we have no specimens of *M. laevis*, the Atlantic species, it seems unsafe to identify any one of the Pacific species with it, as certain differences appear in the descriptions. The relationships of the species are indicated in the following key:

- a*¹. Snout short blunt and low, its bony tip on a horizontal through lower edge of pupil; preoral length of snout 3.7 in postorbital length of head; dorsal rays II, 10; pectoral rays, 16 or 17; fins uniformly dusky; teeth much stronger than in other species.....*M. species* (Philippine Is.).
- a*². Snout more pointed and higher, the bony tip on a horizontal through upper part of pupil; preoral length of snout, 2.2 to 2.5 in postorbital length of head.
- b*¹. Eye less than two-thirds postorbital length of head; ventral fins uniform blackish.
- c*¹. Dorsal rays II, 11 or 12; pectoral rays 17 or 18; ventral fossa (before anus) triangular, larger; pectoral more than half as long as head.

laevis.

- c*². Dorsal rays II, 10; pectoral rays 20; ventral fossa (before anus) smaller, round; interorbital wider than eye; pectoral less than half as long as head-----*nipponensis*.
- b*². Eye more than two-thirds postorbital length of head; ventrals with a light base and a blackish tip; dorsal rays II, 11 to 13; pectoral rays 19 or 20; ventral fossa round; interorbital narrower than eye; pectoral half as long as head-----*hawaiiensis*.

When compared directly with paratypes of *M. hawaiiensis*,¹ the type of *M. nipponensis* is found to differ in the following characters: The eye smaller, the head longer, especially the postorbital length; the interorbital wider; the maxillary longer; the snout longer; the spinules of the scales more numerous, more densely crowded and shorter; the soft dorsal rays fewer, 10, instead of 11 to 13; and in the uniform coloration of the ventral fin. These differences are brought out in the table of measurements, and have been verified in four comparable paratypes of *M. hawaiiensis*.

Nothing can be said of the relationships of *M. nipponensis* with the species found in the Indian Ocean, and identified with *M. laevis* by Alcock² and Brauer.³

Dorsal II, 10; ventral, 9; pectoral, 20; 15 scales above lateral line.

Contours of body little arched. Head rather pointed; snout high, its bony tip above middle of eye; preoral length of snout 2.2 in postorbital length of head; preocular length of snout 0.4 in head; orbit, 3.25; interorbital space wider than orbit; preopercular angle produced backward, the angle sharply rounded; mouth large, the maxillary half as long as head; teeth uniserial in lower jaw, becoming irregular at the symphysis, and similar to but less strongly curved than those of the outer premaxillary series, which is the stronger of the two premaxillary series; the teeth about as in *M. hawaiiensis*, but much smaller than in the Philippine species, the longest one-tenth as long as orbit; barbel slender, one-third the orbit; branchiostegals seven; about nine short, movable, spinigerous gill-rakers on the lower limb of the outer arch.

Scales small, with numerous (about 20 to 30) small, suberect spinules arranged in quincunx order in a diamond-shaped patch on each scale; these spinules more numerous, more crowded, and shorter than in either larger or smaller specimens of *M. hawaiiensis*. Anterior curve of lateral line low, about 1.5 times as long as the head. Gular membrane naked; a series of scales on the branchiostegal membrane over each ray; inner edge of shoulder girdle mostly scaled, as in the other Pacific species.

¹ Gilbert, Bull. U. S. Fish Comm., 1903 (1905), pt. 2, p. 677, fig. 265.

² Alcock, Ann. Mag. Nat. Hist. (6), vol. 4, 1889, p. 398, and (6), vol. 8, 1891, p. 123; A Descriptive Catalogue of the Indian Deep-Sea Fishes, 1899, p. 119.

³ Brauer, die Tiefsee-Fische, p. 270.

The numerous pyloric caeca are profusely branched. Anus midway between anal and ventrals. A small, round, naked fossa between ventrals, its diameter one-fourth that of orbit, separated by a scaly region from the oval naked area surrounding the anus.

The stomach contained the remains of the eyes of a cephalopod.

First dorsal spine sharp, the second spine 1.45 times as long as orbit, not greatly strengthened, its anterior edge rounded, separated by a well marked longitudinal groove from the rest of the spine; base of first dorsal nearly as long as the snout, about half the interdorsal space. Pectorals nearly half as long as head. Outer ventral ray as long as orbit, with a short filament.

Color light brown above, silvery on the sides, shading into blackish on belly. Lining of buccal cavity white; that of branchial cavity white, with a blackish band just within the narrow whitish border of the opercular membrane; gular membrane blackish; branchiostegal membrane gray, punctate; peritoneum silvery. Dorsal fins, ventral, and pectoral black; anal whitish, punctate, and margined with blackish.

Only the type known.

Table of measurements in hundredths of length to anus.

	Type.	Paratypes, <i>M. hawaiiensis</i> .		
<i>Albatross station</i>	4967	4134	4134	4134
Total length, mm	1 406	340+	330+	285+
Length to anus, mm	77	69	66	53
Length, head	92	85	84.5	86.5
Length, orbit	30.5	31	29	31
Width, interorbital	32	26	28	29
Width, suborbital	11	10	9	9
Orbit to preopercle	42	37	36	39
Length, snout	27	23	24.5	24
Postorbital length, head	43	35	36	36.5
Length, maxillary	47	40.5	40	42
Length, barbel	15	13.5	16	17
Depth, body	45	74	71	84
Width, body	45	44	42.5	39
Anus to anal ¹	17	7.5	10	9
Anus to ventral	17	17	17	16.5
Ventral to isthmus	34	29	30	27
Height, second dorsal spine	44	26	52	28
Height, third dorsal ray	26	26	24.5	28
Length, first dorsal base	50	53	52.5	57
Interdorsal space	45	45	46	46
Length, pectoral fin	4	4	4	6
Length, first pectoral ray	42	41	41	41
Length, second pectoral ray	41	41	41	41
Length, third pectoral ray	30	31	31	31
Length, outer ventral ray	24	24	24	24
Length, second ventral ray	10	13	12	11
Soft rays, first dorsal	9	9	9	9
Ventral rays	9	9	9	9
Gill-rakers, lower limb	9	7-8	7	9

¹ A pseudocaudal developed.

² In the figure of the type of *H. hawaiiensis* the anus is represented as remote from the anal as in the type of *M. nipponensis*.

Genus LIONURUS Günther.

Lionurus GÜNTHER, *Challenger Reports*, vol. 22, Deep-Sea Fishes, 1887, pp. 124, 141.—JORDAN and EVERMANN, *Fishes of North and Middle America*, vol. 3, 1898, p. 2592 (*filicauda*).

Nczumia JORDAN, in Jordan and Starks, *Bull. U. S. Fish Com.*, 1902 (1904), p. 620.—McCULLOCH, *Records Australian Mus.*, vol. 6, pt. 5, 1907, p. 34 (*condylura*).

?*Macruroplus* BLEEKER, *Typi non nulli generici piscium neglecti*, *Verslagen en Mededeelingen der k. Akademie van Wetenschappen*, Amsterdam, (2), vol. 8, 1874, p. 369; based on *Macrourus serratus* Lowe, a species not identified by other authors. Lowe's short description indicates that his species is probably referable to this genus. If *M. serratus* is ever recognized, and proves to belong to the present genus, the name *Macruroplus* must replace *Lionurus*.

This genus as here characterized is very extensive, including most of the species of Coryphaenoidinae which have seven branchiostegal rays. The other genera with seven branchiostegal rays are closely related to *Lionurus*. They are: *Malacocephalus*, *Mataeocephalus*, *Trachonurus*, and *Cetonurus*. The species of *Lionurus* vary within wide limits. On the one hand are species closely resembling *Malacocephalus*, with a large, subterminal mouth, the maxillaries more than one-third the length of the head, and other characters indicating a natural group. These species are as follows: *L. lucifer*, *L. nigromaculatus*, *L. atherodon*, *L. petersoni*, *L. occidentalis*, *L. garmani*, *L. ctenomelas*, *L. misakia*, and *L. macronema*. On the other hand is a series with a small mouth, the maxillaries being decidedly less than one-third the length of the head (except in *L. stelgidolepis*). At one end of this series of small-mouthed forms are the more typical species, such as *L. bairdii*, *L. aequalis*, and *L. sclerorhynchus*, with conical projecting snout and slender form, with the ventrals containing but few rays and located below the pectorals, and with the origin of the anal behind the first dorsal. At the other end of the series are species in which some or all of the following modifications are shown: Anterior profile of snout subvertical; form robust; base of first dorsal oblique; ventrals far anterior to pectorals; origin of anal under first dorsal base; and the ventrals with an increased number of rays. Two species, *L. parvipes* and *L. cetonuropsis*, are evidently related to *Cetonuropsis*, as discussed in detail in the description of *L. cetonuropsis*. Five species with smooth scales are grouped in the subgenus *Lionurus*, as originally proposed by Günther. Generic rank is not assigned them because the group is characterized only by the smooth scales (a character which may have been independently derived in the different species). Moreover, the scales of the head are spinigerous in *L. liolepis*.

The dorsal spine is smooth or weakly armed in the subgenus *Lionurus*. All the species of *Lionurus* with rough scales are provisionally

referred to the subgenus *Nezumia*, which was originally proposed to include species with an increased number of ventral rays. But the ventral rays vary in different species, with all intermediate numbers, from 5 to 17.

22. LIONURUS GARMANI (Jordan and Gilbert).

Coryphaenoides garmani JORDAN and GILBERT, Bull. U. S. Fish Comm., 1902 (1904), p. 610, text fig.—FRANZ, Abh. math.-phys. kl. k. Bayer. Akad. der Wissensch., vol. 4, Suppl. Bd. 1, 1910, p. 26.—JORDAN and THOMPSON, Mem. Carnegie Museum, vol. 6, pt. 4, 1914, p. 306.

Albatross station.	General locality.	Depth in fathoms.	Number of specimens.
4917.....	Eastern Sea.....	361	1
4966.....	Kii Channel.....	244-290	1
4967.....	.....do.....	244-253	4
4968.....	.....do.....	253	6
5048.....	Off Matsushima Bay.....	129	1
5054.....	Suruga Gulf.....	282	1
5059.....	.....do.....	197-297	3
5060.....	.....do.....	197	4
5062.....	.....do.....	250	2
5065.....	.....do.....	211-235	1
5066.....	.....do.....	211-293	1
5069.....	.....do.....	108-131	1
5072.....	.....do.....	148-284	1
5086.....	Sagami Bay.....	292	2
5088.....	.....do.....	369-405	1

Franz correctly counted 8 scales between the lateral line and the second dorsal spine, but stated that Jordan and Gilbert gave 5. The original description, however, expressly enumerates those "between the lateral line and the origin of the second dorsal," and these are $5\frac{1}{2}$ in number. A band of cycloid scales near margin of inner edge of shoulder girdle. Contrary to the original description, there is a naked fossa directly between the ventrals, but it is very much smaller than in *L. misakia* or in *Malacocephalus*. As usual, this fossa is separated from the naked area surrounding the anus by a scaly area.

The snout in our larger specimens is contained 3.7 to 4 times in the head; orbit, 2.8 to 3.25; interorbital, 3.3 to 3.6; barbel, 3.8 to 4.2; second dorsal spine, 1.25 to 1.33; outer ventral ray, 2.5 to 2.7; pectoral fin, 0.9 to 1.1 times length of snout plus orbit.

A specimen 87+ mm. long has about 4 spinules on the scales; one 138 mm. long has 6; another, 280 mm. long, has 18 to 22; the type, 292 mm. long, has 30 to 40. The spinules are strongest near the dorsal base.

The serrations on the dorsal spine are much coarser in small specimens; one 87+ mm. long has 3; one 138 mm. long has 12; 190 mm., 21; 232 mm., 41; a paratype, 255+ mm. long, has 49.

The sides, especially below the lateral line, and an area extending backward from below origin of second dorsal, are coarsely punctate

with dark brown chromatophores, similar to those covering the posterior sides of *L. misakia*, but finer.

Table of measurements in hundredths of length to anus.

								Paratypes, Sagami Bay.	
	5054	5059	5059	5059	5060	5066	5048		
<i>Albatross station</i>	5054	5059	5059	5059	5060	5066	5048		
Total length, mm.....	1255	1272	282	253	247	232	87+	263	190
Length to anus, mm.....	53.5	53.5	59.5	50	49	45	15	54	40
Length, head.....	85.5	85.5	83	88	87	86	88	86	83
Length, orbit.....	30.5	31	28	31	30	31	35	30	32
Width, interorbital.....	25.5	25.5	26	26	27	27		24	26
Width, suborbital.....	11	10.5	10.5	12	10.5	10		11	11
Orbit to preopercle.....	36	38	37.5	38	35	37		38	37
Length, snout.....	23		27	23	23	23	22	25	22
Length, maxillary.....	40	40	43	42	40	39	42	39	39
Length, barbel.....	23	24	23	23	23	25	22	24	26
Depth, body.....	76	78	72	76	74	77			72
Width, body.....	40	43	40	39	38	37		41	38
Anus to anal.....	17.5	17	16	14	17	16		16	14
Anus to ventral.....	11	13	13	13	13	13			
Ventral to isthmus.....	41	42	43	43	42	43			
Height, second dorsal spine.....				69		70			
Height, third dorsal ray.....			67	69					
Length, first dorsal base.....	59	66		68		68			
Interdorsal space.....	26.5	31	25	29	26	26		26	25
Height, second dorsal ray.....	59	59	61	55	56	51		61	49
Length, pectoral.....		8		8		8		7.5	
Length, first pectoral ray.....	50	51	47	49	48	48		48	48
Length, second pectoral ray.....	5	5	5	5	4	7		3	4
Length, outer ventral ray.....			38	40	37	43		37.5	
Length, second ventral ray.....		37	32	34	33	36		34	
Scales, above lateral line.....	28	30	30	30	27	26		29	
Soft rays, first dorsal.....		6	6	6		6			
Ventral rays.....	11	12	11	10	10	11	12	11	10
Pectoral rays.....	8	9-8	8	9-8	8	8	8	9	9
Serrations, dorsal spine.....	20	20	21	21	23	21		21	
Gill-rakers, lower limb, second arch.....			41	43		43	3		
	14	13	14	13	15	14			

¹ A pseudocaudal developed.

23. LIONURUS MISAKUS (Jordan and Gilbert).

Coryphaenoides misakius JORDAN and GILBERT, Bull. U. S. Fish Comm., 1902 (1904), p. 611, text fig.—JORDAN and THOMPSON, Mem. Carnegie Mus., vol. 6, pt. 4, 1914, p. 306.

Macrourus asper JORDAN and THOMPSON, Mem. Carnegie Mus., vol. 6, pt. 4, 1914, p. 306, pl. 38, fig. 2 (not *Coryphaenoides asper* Günther).

A single small specimen of this well-marked species is included in the present collection. The data for this specimen have been unfortunately lost. It is smaller than the type-specimens and differs from the type in several proportions, as shown in the table. These differences are doubtless due to the difference in size.

Shoulder girdle with cycloid scales near margin of inner edge.

Table of measurements in hundredths of length to anus.

	Type.	
Total length, mm.	340+	113+
Length to anus, mm.	80	30
Length, head.	85	90
Length, orbit.	30	41
Width, interorbital.	28	29
Width, suborbital.	10	12
Orbit to preopercle.	38.5	37
Length, snout.	21.5	.....
Length, maxillary.	35	38
Length, barbel.	4	4
Depth, body.	63	62
Width, body.	36	28
Anus to anal.	11.5	13
Anus to ventral.	11.5	13
Ventral to isthmus.	28	26
Height, second dorsal spine.	59	.....
Height, third dorsal ray.	59	.....
Length, first dorsal base.	22.5	22
Interdorsal space.	37	.....
Length, pectoral.	50	.....
Length, outer ventral ray.	31.5	.....
Length, second ventral ray.	28	.....
Soft rays, first dorsal.	11	11
Ventral rays.	8	8

24. LIONURUS CONDYLURA (Jordan and Gilbert).

Nezumia condylura JORDAN AND GILBERT, Bull. U. S. Fish Comm., 1902 (1904), p. 620, pl. 4, fig. 2.

Albatross station.	General locality.	Depth in fathoms.	Number of specimens.
4957.	Bungo Channel.	437	3
4972.	Kii Channel.	440	1
5059.	Suruga Gulf.	197-297	1
5060.	do.	197	9
5061.	do.	250-332	1
5062.	do.	250	2
5065.	do.	211-235	4
5066.	do.	211-293	4
5067.	do.	293	1
5086.	Sagami Bay.	292	2
5088.	do.	360-405	1

Table of fin ray counts.

Albatross station.	Soft rays, first dorsal.	Ventral rays.	Pectoral rays.
4957.	12	14-15	21-21
5059.	12	15-15	22
5059.	11	15-15	20-20
5060.	11	14-12	20-20
5060.	11	15-14	20-19
5062.	13	16-16	22-22
5062.	12	16-17	21-21
5065.	11	14-14	21-22
5065.	11	15-15	19-19
5067.	10	15-15	22-19
5086.	11	14-14	21-20
5086.	11	14-14	20-19

Table to show the variation, with size, of the number of spinules on the second dorsal spine, and of the average number of spinous ridges on the scales:

Total length, mm.	Spinules on dorsal spine.	Ridges on scales.
103	5	3
116	9	3
117	8	3
136	9	4
160	12	7
164	11	6
172	10	7
187	17	8
200	16	10
204	15	9

When the specimens listed in the foregoing table had an incomplete tail, the total length was estimated from specimens of similar length to anus.

A small naked fossa is present between the ventrals, separated by a band of scales from the naked area surrounding the anus.

The pyloric caeca in five specimens vary in number from 24 to 36. They are shorter than the orbit.

We find no series of cycloid scales along each side of the dorsal fin anteriorly, as mentioned in the type description. The scales in that area bear spinous ridges similar to those on neighboring scales. The lateral line rises anteriorly in the form of a rather strong arch, as long as the orbit plus the postorbital length of the head. Inner edge of shoulder girdle naked.

The specimens from deeper water than 350 fathoms (from stations 4957, 4972, and 5088) are more darkly colored than those from depths less than 300 fathoms.

This species differs from all other known Macrouroids, with the exception of three other species of *Lionurus*, in the increased number of ventral rays. A Hawaiian species, *L. gibber*,¹ has 12 or 13 rays, but differs greatly, among other characters, in having the ventrals far in advance of the pectorals. Another Hawaiian species, *L. propinquus*,² has 16 ventral rays, but differs in the deeper body, and the more oblique first dorsal base. An Australian species, *L. nigromaculatus*,³ is closely related to *L. condylura*, having 13 to 15 ventral rays, but has a much larger eye, which is contained $2\frac{1}{4}$ times in the head, instead of 3.

¹ *Macrourus gibber* Gilbert and Cramer, Proc. U. S., Nat. Mus., vol. 19, 1897, p. 426, pl. 44, fig. 2; Gilbert, Bull. U. S. Fish Comm., 1903 (1905), pt. 2, p. 668.

² *Macrourus propinquus* Gilbert and Cramer, Proc. U. S. Nat. Mus., vol. 19, 1897, p. 424, pl. 42, fig. 2; Gilbert, Bull. U. S. Fish Comm., 1903 (1905), pt. 2, p. 667.

³ *Macrourus nigromaculatus* McCulloch, Records Australian Mus., vol. 6, pt. 5, 1907, p. 347.

Table of measurements in hundredths of length to anus.

<i>Albatross station</i>	5067	5086	5059	5060	5065	5062	5060
Total length, mm.....	205	¹ 180	¹ 187	¹ 204	186	184	187
Length to anus, mm.....	42	41	39	45	36	37.5	36
Length, head.....	74	72	73	72	73	74	74
Length, orbit.....	24	24	23	24	26	27	25
Width, interorbital.....	19	18	19	18	18	17.5	20
Width, suborbital.....	11	11	11	10	11	12	12
Orbit to preopercle.....	27	29	28	28	29	28	29
Length, snout.....	21	21	21	20	21	21	20.5
Length, maxillary.....	23	24	23	24	26	25	25
Length, barbel.....	12.5	12	12	14	14	13	11
Depth, body.....	76	66	72	70	70	71	68
Anus to anal.....	16	17	-----	14	-----	14	13
Anus to ventral.....	18	19	-----	18	-----	18	19
Ventral to isthmus.....	32	33	30	33	39	35	30
Height, second dorsal spine.....	72	70	68	64	79	76	70
Height, third dorsal ray.....	67	66	62	60	76	70	-----
Length, first dorsal base.....	23	23	23	25	26	27	26
Interdorsal space.....	31	31	41	22	28	23	33
Length, pectoral.....	42	40	42	42	36	43	45
Length, outer ventral ray.....	50	55	50	51	55	55	57
Length, second ventral ray.....	27	23	28	29	26	26	30
Scales, above lateral line.....	11	11	11	11	11	11	11
Serrations, dorsal spine.....	16	16	15	16	13	18	13
Gill-rakers, lower limb.....	8	8	-----	-----	-----	-----	-----

¹ A pseudocaudal developed.

25. LIONURUS DARUS, new species.

Plate 10, fig. 1.

This species is represented only by the type-specimen, 132 mm. long; dredged at a depth of 197 fathoms, at *Albatross station* 5060, in Suruga Gulf, Hondo; Cat. No. 76867, U.S.N.M.

Dorsal II, 10; ventral, 9; pectoral, about 19.

Body robust; the greatest depth, below the origin of the first dorsal, 1.15 in head; width of body over pectorals less than half the depth. Origin of first dorsal high, on the crest of a sharp elevation of the dorsal contour; the base of the first dorsal very oblique. Ventral contour evenly and rather strongly curved. Tail very slender.

Head firm; the sensory canals comparatively little developed. Snout 3.7 in head, its anterior edge nearly vertical; tip of snout apparently with a scaleless groove just within each lateral margin, and armed with a strongly spined terminal tubercle. Lateral margins and lateral tubercles not prominent. Preopercular margin bluntly rounded, not projecting backward at angle, the ridge evenly rounded; a triangular portion of the interopercle visible behind preopercle; suborbital ridge rather sharp, rising forward at an angle of about 50 degrees; the median rostral ridge, and the two lateral ridges, which curve inward above the nostrils, are prominent (possibly due to shrinkage in alcohol); occipital crests convergent backward, meeting the supraoccipital crest, which extends backward to within a distance equal to length of snout from the origin of the dorsal. Orbit round, 3.1 in head. Interorbital, at its narrowest point above the anterior edge of pupil, 1.4 in orbit, widening rather abruptly posteriorly. Suborbital about half as wide as orbit. Mouth

located farther forward than usual, the maxillary scarcely extending to the vertical from front of pupil. Teeth rather coarse, in moderate bands on jaws, the outer premaxillary series enlarged. Barbel slender, two-thirds as long as the orbit. Branchiostegals 7. About 7 tubercular gill-rakers.

Eleven scales from origin of second dorsal to lateral line, excluding the lateral line scale. Scales round, with prominent concentric striae, armed with one to five long, slender, recumbent spinules (the number of spinules would probably be greater in larger specimens). The scales on the head and belly are smaller than on the sides. Lateral line rising anteriorly, forming a high curve, as long as the snout plus the orbit. Gular and branchiostegal membranes and inner edge of shoulder girdle naked.

First dorsal spine short, triangular, compressed; the second spine rather robust, broken in the type, the remaining portion, a little longer than the postorbital length of the head, with ten sharp serrations, which are small near the base of the spine; base of first dorsal about as long as the snout, equal to the interdorsal space; second dorsal low, little more than half as high as the orbital diameter; anal nearly three times as high as the second dorsal, its origin below the middle of the first dorsal base; pectoral 1.4 in head, inserted midway between the verticals from the origin of the dorsal and the insertion of the ventral; outer ventral ray with a filament reaching the eighth anal ray, the second ray extending about to origin of anal; ventral inserted anterior to the vertical from the origin of the first dorsal a distance nearly equal to the interorbital width.

Anus far forward, its distance from the base of outer ventral ray about two-thirds its distance from origin of anal; distance from ventral base to isthmus equal to orbit, about 0.9 the distance between the origin of the anal and the base of the ventral. A large naked area about anus, extending forward to between ventrals.

Body light brown, shading into blackish on belly; branchiostegal membranes brownish black; gular membrane and opercle with dark punctulations. First dorsal, pectoral, and the bases of a few of the anterior anal rays, dusky; ventral blackish, except for the light tips of the rays, including the filament; second dorsal and anal light. Buccal cavity light, a little dusky on roof of mouth, and just within the mandibular series of teeth; branchial cavity dusky under the opercles, with a narrow whitish border on the edge of the branchiostegal membranes, whitish on the membrane covering the hyoid arch; isthmus silvery, with large punctulations; peritoneum silvery, mottled with brownish.

This species is apparently not closely related to any East Indian or Japanese species, but closely approaches two Hawaiian forms: *L.*

ectenes (Gilbert and Cramer),¹ from which it differs in the lighter color and much smaller eye (2.4 in head in *L. ectenes*); and *L. hebetatus* (Gilbert),² from which it differs in the color, lacking the cross-bars, and in the fin formula (D. II, 12; V. 8; P. 24, in *L. hebetatus*).

(*Darus*, from "Dara," the Japanese name of certain Macrouroid fishes.)

26. *LIONURUS SPINOSUS*, new species.

Plate 10, fig. 2.

Type-specimen.—280 mm. long, from *Albatross* station 4915, in the Eastern Sea; depth, 427 fathoms; Cat. No. 76868, U.S.N.M.

Dorsal II, 10; ventral, 8; pectoral, 21.

Dorsal contour slightly and gently curved from tip of snout to origin of dorsal; base of first dorsal only moderately oblique; width of body over pectoral bases 1.8 in head; width of tail, near middle of its length, one-third its depth.

Head firm, the sensory canals little developed. Snout conic, its preocular length 3.4 in head, preoral length equal to diameter of orbit; a scaleless groove behind anterolateral margin of snout between the lateral and the terminal tubercles; a groove above the scale-row of the suborbital ridge; terminal tubercle strong, double, each half with about six rows of strong spines, arranged on a hemispheric base; lateral tubercles, and the margin of the snout between the tubercles with similar but smaller spines. Margin of preopercle a little curved, nearly vertical, its angle rounded; a triangular portion of the interopercle visible behind the preopercle; no ridges except the suborbital, which is little oblique and extends to below posterior margin of pupil. Orbit round, 3.7 in head. Least interorbital width, above middle of pupil, one-fourth length of orbit; least suborbital width 2.2 in orbit. Mouth wide, the maxillary as long as the snout, extending to below posterior margin of pupil. Teeth in wide villiform bands in jaws, the outer premaxillary series consisting of enlarged teeth, larger than usual in *Lionurus*, the longest 0.15 the length of orbit. Barbel slightly more than half as long as orbit. Seven branchiostegals. Seven tubercular gill-rakers on the lower limb of the outer arch.

Eight scales in a series from origin of second dorsal to the lateral line, not including the lateral line scale. Scales with long retrorse spinules, arranged in quincunx order, the longest frequently extending beyond the scale a distance equal to one-third the width of the scale. Those anterior to the dorsal and on the head (excepting the

¹ *Macrourus ectenes* Gilbert and Cramer, Proc. U. S. Nat. Mus., vol. 19, 1897, p. 423, pl. 44, fig. 1; Gilbert, Bull. U. S. Fish Comm., 1903 (1905), pt. 2, p. 667.

² *Macrourus hebetatus* Gilbert, Bull. U. S. Fish Comm., 1903 (1905), pt. 2, p. 671, fig. 262.

opercular regions) with shorter, stronger, and more numerous spines; under side of head completely naked; inner edge of shoulder girdle naked; nasal fossa naked, its longer axis horizontal, 0.4 that of orbit; nostrils without raised edges. Lateral line rising anteriorly from below origin of second dorsal in a low convex curve.

First dorsal spine short, but comparatively well developed, its anterior portion conic, separated by a groove from the posterior portion, which is lower and much more compressed than the anterior portion; the second spine very long and slender distally, its length exceeding that of head by a distance equal to length of snout, armed with 16 widely and irregularly spaced serrations; base of first dorsal about as long as snout, 1.2 in interdorsal space; pectoral pointed, half as long as head; outer ventral ray with a filament extending to the seventh anal ray, the second ray extending to between anus and origin of anal.

Anus nearly midway between origin of anal and a line joining the ventral bases, preceded by a black naked area, which extends forward in a triangular shape to between ventrals. The anterior end of this scaleless area is occupied by a small round area covered with papillae. This structure is evidently homologous with the ventral fossa mentioned in the descriptions of other species.

Light brown on back and sides of trunk, and on tail; shading into black on belly. Branchiostegal membrane grayish-brown; gular membrane and under side of snout dusky; lining of buccal, branchial, and abdominal cavities black; no lighter margin on the branchiostegal membrane. Dorsal spine, and proximal half of soft rays of first dorsal blackish, the distal half of the soft rays white; second dorsal light; ventral black; pectoral and anal dusky.

Measurements of the type in hundredths of length to anus (64.5 mm.): Length of head, 73; length of orbit, 20; least interorbital width, 15.5; least suborbital width, 9; distance between orbit and preopercular margin, 24; length of snout, 22; length of maxillary, 22; length of barbel, 10; depth of body, 56; width of body over pectorals, 39; distance from center of anus to origin of anal, 13.5; anus to base of outer ventral ray, 16.5; base of outer ventral ray to isthmus, 26; height of second dorsal spine, 96.5; height of third dorsal ray, 68; base of first dorsal, 22; interdorsal space, 27; height of second dorsal, 9; height of anal, 20; length of pectoral, 37; length of outer ventral ray, 40; length of second ventral ray, 22.

L. spinosus differs from the following species, *L. proximus*, in the naked under side of the head; longer dorsal spine; longer spinules on scales; longer teeth in the outer premaxillary series; and in numerous other details.

Only the type known.

27. LIONURUS PROXIMUS (Smith and Radcliffe).

Macrourus proximus SMITH and RADCLIFFE, in Radcliffe, Proc. U. S. Nat. Mus., vol. 43, 1912, p. 119, pl. 26, fig. 2.

Macrourus nasutus JORDAN and GILBERT, in Jordan and Starks, Bull. U. S. Fish Comm., 1902 (1904), p. 618 (the specimen from off Izu; not *Coryphaenoides nasutus* Günther).

Albatross station.	General locality.	Depth in fathoms.	Number of specimens.
4915.....	Eastern Sea.....	427	1
4918.....	do.....	361	1
4957.....	Bungo Channel.....	437	1
4958.....	Off Shio Misaki.....	253	1
4977.....	do.....	544	1
4980.....	34° 09' N., 137° 55' E.....	507	6

Careful comparison of our material from southern Japan with the type and two paratypes from the Philippine Islands, has disclosed no constant differences.

This species bears a strong superficial resemblance to *Coryphaenoides nasutus*, with which it was dredged at several stations. This close resemblance has led to the identification by Jordan and Gilbert of a specimen of *L. proximus* from off Izu with *C. nasutus*. Smith and Radcliffe were likewise misled by the similar appearance of the two forms, stating in the description of this species that it is closely related to *C. nasutus*, and the name *proximus* was evidently applied because of this supposed relationship. Alcock¹ similarly confused his *Macrurus brevirostris*, a species of *Lionurus*, with *C. nasutus*. But *C. nasutus* differs generically from both the above in having 6 instead of 7 branchiostegal rays, and in the posterior position of the anus.

L. proximus differs from the descriptions of *L. brevirostris*, from the Indian Ocean, in having 9 (rarely 8 or 10) ventral rays, instead of 10, and in the shorter dorsal spine, which is much shorter instead of longer than the head.

The eye is much longer in the young than in the adult, as shown in the tables of measurements; its decrease in relative size with age being more pronounced than usual.

The position of the anus is highly variable in this species. The distance from the ventral to the anal is especially great in the specimen from Izu. The naked area does not extend forward to the ventrals, and no fossa is apparent.

¹ Alcock, Ann. Mag. Nat. Hist. (6), vol. 4, 1889, p. 393; Journal of the Asiatic Society of Bengal, vol. 63, pt. 2, 1894, p. 127; Illustrations of the Zoology of the *Investigator*, Fishes, 1894, pl. 13, fig. 3; A Descriptive Cat. of the Indian Deep-Sea Fishes in the Ind. Mus., 1899, p. 108 and 111; Brauer, die Tiefsee-Fische, p. 263; Sewell, Rec. Ind. Mus., vol. 7, 1912, p. 9.

The spinules of the scales are in quincunx order, increasing in number with age, becoming densely crowded in the adult. The individual spines vary in shape in different specimens, being either conic or hastate.

Inner edge of shoulder girdle almost completely naked.

Pyloric caeca long and slender, nearly as long as postorbital length of head, 24 and 29 in number in two Japanese specimens counted.

Color dark brown; the entire abdominal region blackish; peritoneum silvery, with brown spots.

Table of measurements in hundredths of length to anus.

	Japan.					Philippine Islands.		
						Type.	Paratypes.	
<i>Albatross station</i>	¹ Izu	4977	4915	4968	4918	5202	5201	5527
Total length, mm.....	312+	² 216	226	124+	133	² 283	249	210
Length to anus, mm.....	69	66.2	49.7	32.5	25	77	55	55
Length, head.....	79	71	73	76	80	74	76	81
Length, orbit.....	26	21	26	28.5	28	21	22	23
Width, interorbital.....	16	17	15	18.5	18	14	17.5	19
Width, suborbital.....	11	11	10	10	10	10	11	11
Orbit to preopercle.....	29	26.5	26	24	28	29	27.5	31
Length, snout.....	23	21	22	23.5	26	22	22.5	25
Length, maxillary.....	25	23	21	.....	26	25	24	26
Length, barbel.....	17.5	16	11	12	.....	15	13	14
Depth, body.....	52	56	51	44	59	60	56	.....
Width, body.....	38	35	29	23.5	30	29	.....	.....
Anus to anal.....	26	23	17	20	13	17	17	17
Anus to ventral.....	24	15	16	18	13	15	13	14
Ventral to isthmus.....	30	27	30	.....	27	30.5	26	28
Height, second dorsal spine.....	62	66.5	66	71	71	69	62	74
Height, third dorsal ray.....	56	61	.....	.....	.....	62	.....	67.5
Length, first dorsal base.....	19.5	20.5	21	19.5	22	23	21	22.5
Interdorsal space.....	31	26	31	.....	.....	27.5	32	34
Length, pectoral.....	41	37	38	.....	40	41.5	38	40
Length, first pectoral ray.....	5.5	4	6	.....	.....	.....	.....	.....
Length, second pectoral ray.....	34	29	30	.....	.....	.....	.....	.....
Length, third pectoral ray.....	40.5	34	37	.....	.....	.....	.....	.....
Length, outer ventral ray.....	.....	.....	34	.....	50	39	45	42
Length, second ventral ray.....	28	.....	25	.....	31	27	28	29
Scales, above lateral line.....	7	8	8	.....	8	8	8	8
Soft rays, first dorsal.....	9	10	9	9	10	9	11	10
Ventral rays.....	10-8	9	9	9-10	8	9	9	9
Pectoral rays.....	20	20	20	.....	19	18	18	19
Serrations, dorsal spino.....	13	18	12	9	6	.....	18	17

28. LIONURUS CETONUOPSIS, new species.

Plate 11, fig. 1.

This interesting species is very close to a Philippine species, *L. parvipes* (Smith and Radcliffe).³ These two species are apparently related to *Cetonurus*, as their common characters indicate. Among these may be mentioned the following: Body rather robust; snout very high and broad, intermediate in form between typical *Lionurus* and *Cetonurus*; suborbital ridge comparatively well marked; scales small, hispid with suberect spinules, much as in *Cetonurus*; external groove

¹ Izu, Japan; a specimen sent to Stanford University from the Imperial University; No. 8302, Fish Collections, Stanford University (see synonymy).

² A pseudocaudal developed.

³ Proc. U. S. Nat. Mus., vol. 43, 1912, p. 124, pl. 28, fig. 1.

along lateral line somewhat interrupted; bones of head rather soft, intermediate in condition between *Lionurus* and *Cetonurus*. These species have 5 or 6 ventral rays, while all other species of *Lionurus* and of *Cetonurus* have 7 to 17.

Type-specimen.—A mature female, 58 mm. long to anus; *Albatross* station 5084; 918 fathoms; off east coast of Hondo; Cat. No. 76869, U.S.N.M.

Dorsal, II, 9; ventral, 6; pectoral, 18; 11 scales between lateral line and origin of second dorsal.

Body more robust than in *L. parvipes*, the depth below origin of dorsal 1.25 in head; trunk more compressed than usual, the width across pectoral bases 2.4 in head; tail slender, and less strongly compressed than usual, rather sharply constricted behind anus; depth 2.7 in head at a point twice length of head from tip of snout; width of tail about half its depth anteriorly, two-fifths its depth posteriorly; first dorsal base oblique; sides of head vertical and nearly parallel behind anterior margin of orbit; anterolateral angles of snout prominent, on a vertical passing slightly in front of tip of premaxillary, and on a vertical passing through upper part of pupil; distance between lateral angles slightly greater than the interorbital width, and nearly equal to length of snout; snout 2.59 in head, broadly triangular before the lateral prominences, the terminal angle, viewed from above, being 110 degrees; tip of snout high, on a horizontal passing between the pupil and the upper orbital margin; preoral length of snout 3.9 in head, equal to vertical depth of snout above tip of premaxillaries; suborbital ridge distinct, curved, and oblique, its length 2.25 in head, both its ends free, not extending to preopercle nor lateral prominence of snout; free margin of preopercle not adnate, extending downward and backward to the evenly curved angle; in no place entirely overlapping the subopercle or interopercle, leaving a narrow margin of interopercle visible; preopercular ridge strongly produced backward in a semicircular form, its upper vertical portion, above the curve, short, 1.6 in orbit; orbit nearly round, its longitudinal diameter 4 in head; interorbital convex, 3.1 in head; suborbital angulated at ridge, its least width 1.8 in orbit; mouth oblique, the maxillary extending to below anterior third of pupil; teeth in bands on jaws, the outer premaxillary series slightly enlarged; barbel slender and short, 4.5 in orbit; nostrils in an oval naked fossa, one-third as long as orbit; the posterior margin of the small circular anterior nostril elevated; scaleless groove parallel to anterolateral margin of snout, scarcely developed; head soft, the sensory canals comparatively greatly developed. Branchiostegals 7; 9 tubercular gill-rakers on lower limb of second arch; slit before first arch constricted, 2 in orbit, slit behind fourth arch, 3.

Scales small; those along base of vertical fins not enlarged; spinules curved, suberect, in quincunx order, 10 to 15 on each scale on sides of trunk; scales of head irregular, their boundaries rather difficult to determine, their spinules erect, becoming stronger on snout, but there are no spinous tubercles; under side of head completely scaled; gular and branchiostegal membranes, and anterior part of mandibles, naked; inner edge of shoulder girdle completely naked. Lateral line with a very short anterior arch, one-fourth as high as long, its length 2.25 in head.

Distance from occiput to origin of dorsal 2.15 in head. First dorsal spine broadly triangular, compressed, sharp, with an indistinct longitudinal groove; the second spine 1.6 in head, its anterior edge trenchant, armed with strong, widely spaced serrations, 6 on proximal two-thirds of spine, about 10 in all; last four dorsal rays unbranched; length of first dorsal base half the interdorsal space, and equal to distance between lateral and terminal angles of snout; second dorsal low. Origin of anal slightly behind vertical from end of first dorsal. Pectoral pointed, 1.95 in head, the rays slender; base of pectoral in front of origin of dorsal. Ventral small, with six weak rays, the outer one with a short slender filament which reaches to anus; ventral inserted anterior to pectoral and anterior to end of opercle.

Distance from center of anus to origin of anal less than usual in *Lionurus*, being only half the distance from the anus to base of outer ventral ray. Anus surrounded by a black naked area, two-thirds as long as orbit; no other naked areas on breast.

Color in alcohol light brown on back and sides, shading into bluish black on belly; head gray, with a large blackish opercular patch; branchiostegal membranes black, without a light inner margin; gular membrane and lips blackish; lining of buccal, branchial, and abdominal cavities black.

L. cetonuropsis differs from *L. parvipes* in the shorter dorsal spine (length 0.51 of length to anus, instead of 0.58 to 0.64), with fewer stronger serrations; the much lighter color, especially of the head and fins, which are pale instead of dusky; the weaker spinules on the scales; the somewhat stronger dentition; the shorter, blunter head; the narrower suborbital (0.115, instead of 0.13 to 0.16 of length to anus). These differences have been verified in each of the six Philippine specimens of *L. parvipes*.

One young specimen, in poor condition, 20 mm. long to anus, was dredged with the type.

Table of measurements in hundredths of length to anus.

	Type.	<i>L. parvipes.</i>					
		Type.	Paratypes.				
			5636	5609	3608	5609	5636	5670
<i>Albatross station</i>	5084	5636	5609	3608	5609	5636	5670
<i>Total length, mm</i>	268	¹ 218	¹ 284	¹ 274	283	308	210
<i>Length to anus, mm</i>	58	65	72	48	.....	.....	.....
<i>Length, head</i>	77.5	81	79	86	.....	.....	.....
<i>Length, orbit</i>	21	20	20	22	.....	.....	.....
<i>Width, interorbital</i>	27	25	24	29	.....	.....	.....
<i>Width, suborbital</i>	11.5	14	13	16	.....	.....	.....
<i>Orbit to preopercle</i>	30	30	29	31	.....	.....	.....
<i>Length, snout</i>	27.5	28	25	31	.....	.....	.....
<i>Length, maxillary</i>	22.5	22	20	26	.....	.....	.....
<i>Length, barbel</i>	5	3	5.5	8	.....	.....	.....
<i>Depth, body</i>	61	57	.....	64	.....	.....	.....
<i>Width, body</i>	31	30	.....	.....	.....	.....	.....
<i>Anus to anal</i>	11	8	12	7	.....	.....	.....
<i>Anus to ventral</i>	21.5	20	23	18	.....	.....	.....
<i>Ventral to isthmus</i>	20	18	20.5	18	.....	.....	.....
<i>Height, second dorsal spine</i>	51	60	.....	64	.....	.....	.....
<i>Length, first dorsal base</i>	16.5	16	13	18	.....	.....	.....
<i>Interdorsal space</i>	31	36	31	41	.....	.....	.....
<i>Length, pectoral</i>	42	.....	.....	.....	.....	.....	.....
<i>Length, outer ventral ray</i>	22	24	.....	.....	.....	.....	.....
<i>Length, second ventral ray</i>	22	.....	.....	.....	.....	.....	.....
<i>Scales, above lateral line</i>	11	11	11	12	.....	10	.....
<i>Soft rays, first dorsal</i>	9	8	7	8	8	8	11
<i>Ventral rays</i>	6	6	6-5	6	.....	.....	6
<i>Pectoral rays</i>	18	17	17	18	.....	19	.....
<i>Serrations, dorsal spine</i>	10	27	.....	13	19	18+	.....

¹ A pseudocaudal developed.

29. TRACHONURUS VILLOSUS (Günther).

Coryphaenoides villosus GÜNTHER, Ann. Mag. Nat. Hist., ser. 4, vol. 20, 1877, p. 441.

Macrurus villosus GÜNTHER, Challenger Reports, vol. 22, Deep-Sea Fishes, 1887, p. 142, pl. 36, fig. B.—BRAUER, die Tiefsee-Fische, 1906, p. 268.

This species was frequently dredged in Japan, but only four specimens are preserved, the loss of specimens being largely due to the soft character of the flesh.

Description of a fine specimen 455 mm. long (a small pseudocaudal developed), dredged in 505 fathoms, off the east coast of Hondo, at *Albatross station* 5080.

Body sharply compressed, tapering to a longer and slenderer tail than usual, which is narrowly oblong in cross-section, its width near middle 3.6 in its depth; width of body over the pectoral bases 1.8 in the greatest depth, which is contained 1.2 times in the head. Ventral contour gently curved; base of first dorsal not greatly elevated anteriorly; interorbital flat, wide, and widening rather rapidly posteriorly, its least width 3 in head; snout subconic, bluntly pointed, as long as orbit, its blunt lateral angles near vertical from front of premaxillaries; mouth large, the maxillaries extending to below posterior border of pupil, equal to width of interorbital, larger in the

young (see tables); teeth in moderate villiform bands in jaws, the outer premaxillary series not enlarged; orbit one-fourth length of head, with an irregular outline; least suborbital width 2.2 in orbit; distance from orbit to margin of preopercle equal to interorbital width; no prominent ridges nor tubercles; interopercle widely exposed, in no part covered by preopercle; posterior margin of anterior nostril elevated and forming a well-marked flap; barbel shorter than pupil; branchiostegals, 7; gill-rakers tubercular; gill slit before first arch half length of orbit, about as wide as the slit behind the fourth arch.

Fourteen pyloric caeca about as long as the snout.

Five scales between middle of first dorsal and lateral line, 6 below origin of second dorsal (not including the lateral line scale); 25 from lateral line to origin of anal. Those along anterior portion of dorsal and anal bases enlarged. Scales diamond-shaped and nonimbricate, each with 10 to 16 large, suberect spinules, strongest on a series of scales along the bases of the vertical fins. Lateral line forming a low, convex curve anteriorly. A naked area behind pectoral, extending upwards and forwards. Rami of mandibles, the gular membrane, and the anterior part of branchiostegal membranes scaled; a single scale located on the branchiostegal membrane on each side, opposite the upper angle of interopercle (also present in the smaller specimen, 225 mm. long); a few extending on base of second dorsal spine, surrounding the first spine; inner edge of shoulder girdle completely naked.

First dorsal spine almost concealed; the second entirely smooth, slender, rounded on its anterior edge, its length 1.6 in head; last three dorsal rays unbranched; base of first dorsal 1.3 in orbit, 1.6 in interdorsal space; height of second dorsal rays about half the orbit. Longest anal rays 3.5 in head. Length of pectoral 2.25. Filament of outer ventral ray reaching to fifth anal ray, the second ray nearly reaching anal; ventral inserted below first dorsal base, further back than usual.

Distance from anus to base of outer ventral ray equal to orbit, twice that from anus to anal; distance from ventral to isthmus 1.7 in head. Area between ventrals and anal naked.

Body dark brown; fins, belly, and lining of buccal cavity dusky; lining of branchial cavity black, without a light margin on opercular membrane; peritoneum black.

A smaller specimen, 225 mm. long, 51 mm. to anus, from *Albatross* station 4971, in 649 fathoms, off the east coast of central Hondo, differs from the larger specimen, just described, as follows: snout 1.2 in orbit; maxillary reaching to below middle of pupil; teeth coarser;

orbit 3.3 in head; nostril flap shorter; 4 to 6 spinules on scales of body; an additional naked area, as in *T. sentipellis*,¹ the Hawaiian species, located at the upper angle of the preopercle; second dorsal spine half as long as head; base of first dorsal 1.3 in interdorsal space. A still smaller specimen, 131 mm. long, 26 mm. to anus, also from station 4971, has only 1 to 4 spinules on the scales; the teeth coarser; and the opercle with a sharp but weak spine at the end of each limb.

Günther's short description evidently errs in stating that the second dorsal begins immediately behind the first, and the mouth is probably described and figured too small.

T. villosus differs from *T. sentipellis*, the Hawaiian species, in having the gular membrane scaled, and in certain proportions, as indicated in the following table:

Table of measurements in hundredths of length to anus. *

	<i>T. villosus.</i>			<i>T. sentipellis.</i>			
	5080	4971	4971	(?)	(?)	(?)	3474
Albatross station.....	5080	4971	4971	(?)	(?)	(?)	3474
Total length, mm.....	4455	225+	131	250	255	255	
Length to anus, mm.....	103	51	26	66	56	33	
Length, head.....	69	73	22	74	76	74	
Length, orbit.....	17.5	22	25	22	23	26	
Width, interorbital.....	23	25	21	25.5	23	21	
Width, suborbital.....	8	9	.....	9	8	9	
Orbit to preopercle.....	23	23	.....	25	25	23	
Length, snout.....	17.5	19	.....	18	18	17	
Width, snout, at base.....	24	24	.....	26	24	.....
Length, maxillary.....	24.5	.....	26	21	24	27	
Length, barbel.....	6	.....	.....	9	8	.....
Depth, body.....	.....	56	44	60	60	49	
Width, body.....	36	28	.....	43	36	.....
Anus to anal.....	7.5	10	.....	6	7	6	
Anus to ventral.....	15.5	16	.....	11.5	13	20	
Ventral to isthmus.....	41	43	.....	39	36	37	
Height, second dorsal spine.....	43	39	36	46	43	37	
Height, third dorsal ray.....	37	.....	.....	.....	.....	.....
Length, first dorsal base.....	13	16	.....	12	17	16	
Interdorsal space.....	24	22	.....	17	12	.....	Longer.
Length, pectoral.....	31	.....	.....	32	33	.....
Length, outer ventral ray.....	27.5	.....	.....	.....	.....	.....
Length, second ventral ray.....	21	.....	.....	22	21	.....
Scales, above lateral line.....	6	6	.....	6	6	6	6
Soft rays, first dorsal.....	8	9	8	7	7	8	7
Ventral rays.....	7	7	.....	7	7	7	7
Pectoral rays.....	15	16	.....	16	15	.....

30. CETONURUS ROBUSTUS, new species.

Plate 11, fig. 2.

The genus *Cetonurus* is fully defined in the key to the subfamilies and genera.

C. robustus is apparently closely related to *C. crassiceps* (Günther),⁵ known from a single specimen taken by the *Challenger* north

¹ Gilbert and Cramer, Proc. U. S. Nat. Mus., vol. 19, 1897, p. 429, pl. 45, fig. 1; Gilbert, Bull. U. S. Fish Comm., 1903 (1905), pt. 2, p. 679.

² Hawaiian Islands; *Albatross*, 1902.

³ Paratype.

⁴ A pseudocaudal developed.

⁵ *Corphaenoides crassiceps* Günther, Ann. Mag. Nat. Hist., ser. 5, vol. 2, 1878, p. 25.

Macrurus crassiceps Günther, *Challenger* Reports, vol. 22, Deep-Sea Fishes, 1887, p. 143, pl. 37.

of the Kermadec Islands, at a depth of 520 fathoms. It differs from Günther's description in the larger eye, 4 to 4.5, instead of less than 5, in head, more than half the postorbital length of head; in the less sudden constriction of the tail from the trunk; in the smaller mouth, the maxillaries not extending beyond eye; and in the distinct serrations of the dorsal spine. Günther's figure shows the ventrals nearly twice as long as the orbit, while they are less than half the orbit in *C. robustus*. The Japanese species is also very close to the Atlantic species, *C. globiceps* Vaillant,¹ but differs from a specimen referred to that species from the east coast of South America in the absence of enlarged scales along the anterior base of anal; in the squamation of the gular membrane, which is naked in the Atlantic specimen; in the more numerous and much stronger spinules on the scales, especially on the enlarged scales along the dorsal base; in the absence of an area with enlarged scales near origin of anal; and in the more widely spaced scales on the head. Its relationships with the Atlantic species, *C. microps* Vaillant,² are unknown.

Type-specimen—more than 285 mm. long (tip of tail broken), 765 mm. to anus; dredged at a depth of 649 fathoms off the east coast of central Hondo, at *Albatross* station 4971. Cat. No. 76870. U.S.N.M.

Dorsal, II, 9; ventral, 10; pectoral, 17.

Body robust, very deep, and strongly compressed, especially compressed toward the belly. Depth of body over base of ventrals, 1.22 in head; under origin of dorsal, 1.3; over fifteenth anal ray, 2.5; at a vertical twice length of head behind tip of snout, 3.9. Width of body over base of pectorals, 3 in head; just behind pectorals, 4.65; width one-third the depth of the slender tail, measured behind the robust anterior portion. Dorsal contour rising in an even curve to origin of first dorsal, the base of which is oblique, the anterior end being higher than the posterior end by a vertical distance half as long as the base of fin.

Sides of head vertical, without projecting ridges; anterolateral angles of snout prominent, slightly anterior to a vertical from front of premaxillaries, and on a horizontal passing through eye between pupil and upper orbital margin; distance between lateral angles and eye 1.8 in orbit; distance between lateral angles greater than the interorbital width or the length of the snout, equal to postorbital length of head; snout broadly triangular in front of lateral angles, its preoral length equal to its preocular length, 3 in head; the tip of snout on a horizontal passing through upper margin of orbit; orbit nearly round, 4 in head, 1.6 in postorbital length; inter-

¹ *Macrurus globiceps* Vaillant. in Filhol, *La Nature*, No. 560, Feb. 23, 1884, p. 199.

Hymenocephalus crassiceps Vaillant, *Expéd. Sci. du Travailleur et du Talisman*, Poissons, 1888, p. 214, pl. 20.

Hymenocephalus globiceps Vaillant, *idem.*, p. 386.

² *Bull. Mus. Monaco*, No. 41, 1905, p. 3; name only.

orbital wide, 2.5 in head, its sides parallel; least suborbital width 1.25 in orbit, its ridge bluntly angulated transversely, horizontal below posterior half of orbit, rising abruptly anteriorly toward anterolateral rostral angle; margin of preopercle evenly curved, almost completely adnate to subopercle and interopercle, which it fails to cover at any point; preopercular ridge produced backward as a semicircular arch, the chord of which is contained 1.25 in orbit. Mouth oblique, the maxillary extending to below middle of eye, 3.75 in head. Teeth small, confined to anterior half of jaws; the premaxillary band narrow, the outer series scarcely enlarged; the mandibular band very narrow, not more than two or three scales deep at any point; barbel short and slender, 0.15 of the orbit; nostrils in a round naked fossa, about one-third as long as orbit; scaleless groove parallel to anterolateral margin of snout very narrow, but distinct. Branchiostegals 7; gill-rakers tubercular; gill slit before first arch, and that behind fourth arch, each about one-third as long as orbit.

Pyloric caeca very short, only half as long as orbit, 9 in number in a paratype.

Scales small, 14 in a series from origin of second dorsal to lateral line, 38 from anal origin to lateral line; scales in rather irregular series on body, nonimbricate on the head. Those on the body bear long, curved, and suberect spinules arranged in quincunx order, 5 to 12 on each scale on trunk, about 5 on each scale on head, similar to those on body. Terminal tubercle of snout comparatively weak, rounded, armed with conic spinules; lateral tubercles indistinct. A series of enlarged scales along base of second dorsal, armed with very strong spinules. Lateral line with the external groove obsolescent or concealed, opening through a series of widely spaced black papillae extending along middle of tail, slightly rising anteriorly, but not forming an arch, a line of similar papillae extending from origin of lateral line backward near dorsal base; scattered papillae near anal base; one constantly present, located vertically below origin of dorsal a distance contained 2.5 times in orbit; a series of papillae extending forward from first dorsal on each side, near dorsal contour. Median line of gular membrane scaled; branchiostegal membrane naked; inner edge of shoulder girdle completely naked.

First dorsal spine small but sharp, without a longitudinal groove, the anterior edge rounded; second spine rather strong at base, filamentous at tip, about half length of head, its anterior edge trenchant, and armed with 21 small, procumbent serrations (stronger in some of the paratypes); base of first dorsal 1.9 in interdorsal space, 1.3 in orbit; second dorsal low, the longest rays 3 in orbit. Origin of

anal scarcely behind end of first dorsal. Pectoral 2.6 in head (in a paratype), inserted below first dorsal. Outer ventral ray scarcely filamentous, just reaching anus, 1.33 in orbit; ventral inserted anterior to end of opercle.

Anus less removed from anal than usual in the group of genera to which *Cetonurus* belongs; distance from center of anus to origin of anal one-third its distance from base of outer ventral ray; distance from ventral to isthmus equal to length of orbit. A naked area, two-fifths as long as orbit, surrounding anus, and extending to anal fin; no other naked areas on breast.

Color of body light brown, shading into blackish on belly; head grayish; opercles, lips, and mandibles dusky; gular and branchiostegal membranes black; lining of buccal and branchial cavities black, without light margins; peritoneum black.

Four paratypes from *Albatross* station 4971, at which the type was dredged, and one small paratype from station 4973, near the type locality at a depth of 600 fathoms.

Table of measurements in hundredths of length to anus.

	Type.	Paratypes.				
		4971	4971	4971	4971	4973
<i>Albatross</i> station.....	4971	4971	4971	4971	4971	4973
Total length, mm.....	285+	279+	288+	265+	252+	116+
Length to anus, mm.....	76.5	77.7	76	62	57.2	ca38
Length, head.....	78	80.2	81	79	85.5	.....
Length, orbit.....	22.5	20.7	23	22	23.5	.....
Width, interorbital.....	30	31	32	31	33.5	.....
Width, suborbital.....	20	21.6	22.5	22.5	24.5	.....
Orbit to preopercle.....	33	34.2	34.3	33	36	.....
Length, snout.....	27	29	27	30	31	.....
Length, maxillary.....	21.7	23	24.5	25	25.5	.....
Length, barbel.....	3	3.5	2.3	3.5	.....	.....
Depth, body.....	64	60	62	60.5	61	.....
Width, body.....	25	26	29	27.5	28	.....
Anus to anal.....	5	6.5	.....	6.5	6	.....
Anus to ventral.....	17	16	18	17	19	.....
Ventral to isthmus.....	20	23	23	22	21.5	.....
Height, second dorsal spine.....	38	40	.....	42	46	.....
Height, third dorsal ray.....	40	.....	.....	.....	.....	.....
Length, first dorsal base.....	14	13	15.5	15.5	17	.....
Interdorsal space.....	26.5	30	27.2	24	21.5	.....
Length, pectoral.....	.....	31	.....	.....	.....	.....
Length, outer ventral ray.....	17	.....	19	.....	.....	.....
Length, second ventral ray.....	17	.....	18	19	.....	.....
Scales, above lateral line.....	14	14	15	14	13	.....
Soft rays, first dorsal.....	9	10	9	10	10	10
Ventral rays.....	10	10	10	10-9	9	9
Pectoral rays.....	17	17	18	.....	18	.....
Serrations, dorsal spine.....	21	22	16+	18	22	.....

DETAILED LIST OF STATIONS.

ABBREVIATIONS AND SYMBOLS.

* Signifies depth as shown by chart, when no sounding was made.

** Signifies character and depth of bottom, as obtained by sounding at previous station.

The character of the bottom is expressed by the following abbreviations:

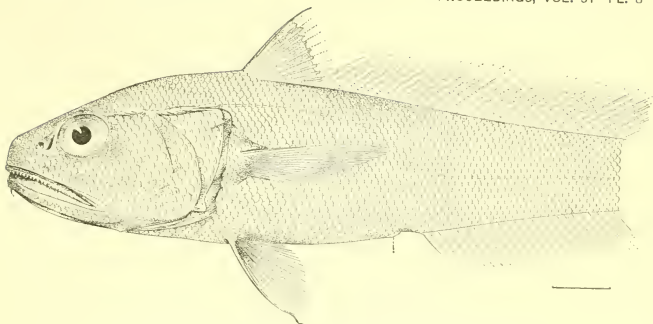
bk_____	black.	gn-gy_____	greenish-gray.
bl_____	blue.	gy_____	gray.
br_____	brown.	hrd_____	hard.
br-gn_____	brownish-green.	lav_____	lava.
brk_____	broken.	M_____	mud.
C_____	clay.	Oz_____	ooze.
Co_____	coral.	P_____	pebbles.
crs_____	coarse.	R_____	rock.
dk_____	dark.	rky_____	rocky.
fne_____	fine.	S_____	sand.
For_____	foraminifera.	Sh_____	shells.
G_____	gravel.	sml_____	small.
Glob_____	globigerina.	Sp_____	specks.
gn_____	green.	St_____	stones.
gn-br_____	greenish-brown.	vol_____	volcanic.

Station (Dredge No.)	Latitude N.	Longitude E.	Date.	Depth in fathoms.	Character of bottom.	Bottom tem- perature.	Number of speci- mens.	Species of Coryphaenoididae.
	° ' "	° ' "				° F.		
4897	32 33 00	128 19 00	1906. Aug. 10	207	fine gy. S., brk. Sh., For.	49.7	1	<i>Coclorhynchus jordani</i> .
4898	32 33 30	128 20 00	...do....	**207	...do.**		1	<i>Hymenoccephalus striatissimus</i> .
4906	31 39 00	129 20 30	Aug. 11	**369-406			1	<i>Coclorhynchus jordani</i> .
4907	31 39 30	129 24 00	...do....	406	gy. Glob. Oz.	42.6	1	<i>Coclorhynchus parvifatus</i> .
4908	31 40 00	129 29 40	...do....	434	...do....	42.9	1	<i>Coclorhynchus parvifatus</i> .
4909	31 38 30	129 27 30	...do....	**434	...do.**		2	<i>Coclorhynchus parvifatus</i> .
4911	31 38 30	129 19 00	Aug. 12	391	gy. Glob. Oz.	41.9	1	<i>Coclorhynchus tokimensis</i> .
4912	31 39 40	129 20 00	...do....	**391	...do.**		1	<i>Coclorhynchus tokimensis</i> .
4915	31 31 00	129 25 30	...do....	**427	gy. Glob. Oz., brk. Sh.**		2	<i>Coclorhynchus tokimensis</i> .
4916	30 25 00	129 06 40	Aug. 13	361	gy. S., Glob., brk. Sh.	42.7	1	<i>Lionurus spinosus</i> Type.
4917	30 24 00	129 06 00	...do....	**361	...do.**		1	<i>Lionurus spinosus</i> Type.
4918	30 22 00	129 08 30	...do....	361	...do. (?)		1	<i>Lionurus spinosus</i> Type.
4919	30 34 00	129 19 30	...do....	440	Glob. Oz.	41.8	1	<i>Coclorhynchus tokimensis</i> .
4940	31 22 10	130 40 10	Aug. 17	115	br. M., bk. Sp.	59.8	7	<i>Hymenoccephalus marginatus</i> .
4941	31 22 00	130 39 20	...do....	*117	...do....		1	<i>Hymenoccephalus marginatus</i> .
4942	31 23 10	130 39 10	...do....	*118	...do....		2	<i>Coclorhynchus jordani</i> .
4943	31 24 35	130 38 40	...do....	*119	...do....		8	<i>Coclorhynchus jordani</i> .
4956	32 32 00	132 25 00	Aug. 23	720	gn-br. M., fine. gy. S., For.	37.5	1	<i>Coclorhynchus jordani</i> .
4957	32 36 00	132 23 00	...do....	437	...do....		1	<i>Squalogadus modificatus</i> Type.
4958	32 36 20	132 24 30	...do....	405	...do....	40.1	2	<i>Squalogadus modificatus</i> Paratype.
4966	33 25 20	135 36 20	Aug. 29	290-244	br. M., S., For.	44.1	1	<i>Nematonurus longifilus</i> .
4967	33 25 10	135 37 20	...do....	244-253	...do....	45.9	1	<i>Coclorhynchus marginatus</i> .
							1	<i>Coclorhynchus marginatus</i> .
							8	<i>Coclorhynchus japonicus</i> .
							1	<i>Hymenoccephalus striatissimus</i> .
							4	<i>Malacocephalus nipponensis</i> Type.
							1	<i>Lionurus garmani</i> .
							2	<i>Lionurus garmani</i> .
							1	<i>Coclorhynchus sp. indesseri?</i> (Young specimens; in poor condition).
							1	<i>Hymenoccephalus striatissimus</i> .
							1	<i>Coclorhynchus japonicus</i> .
							1	<i>Hymenoccephalus striatissimus</i> .
							1	<i>Malacocephalus nipponensis</i> Type.
							1	<i>Lionurus garmani</i> .

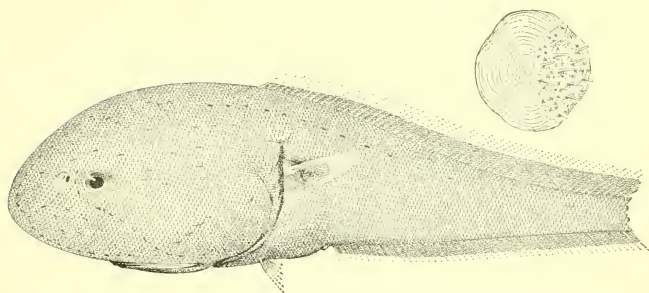
4968	33 24 50	135 38 40	253	dk. gy. S., br. M., brk. Sh.	45.7	1	<i>Coelrhynchus japonicus</i> .
		...do....				4	<i>Hymnocephalus strictissimus</i> .
4969	33 23 40	135 33 00	587	br. M., S., St.	38.9	6	<i>Lionurus garmani</i> .
		...do....				1	<i>Lionurus proximus</i> .
4971	33 23 30	135 34 00	649	br-gn. M., For.	38.1	6	<i>Bathygadus antrodes</i> .
		...do....				2	<i>Coryphacnoides nasutus</i> .
4972	33 25 45	135 33 00	440	.....do.....	39.8	11	<i>Rathygadus antrodes</i> .
		...do....				1	<i>Coryphacnoides nasutus</i> .
4973	33 24 15	135 30 30	600	br. M., St.	38.2	1	<i>Lionurus condyrtura</i> .
4975	33 21 30	135 38 50	712-545	br. M., P., For.	37.5	5	<i>Godonius</i> , sp.
4977	33 23 00	135 37 40	544	br. M., fine. S.	38.9	1	<i>Coryphacnoides nasutus</i> .
		...do....				2	<i>Bathygadus antrodes</i> .
4980	34 09 00	137 55 00	507	br. M., fine. S., For.	39.0	2	<i>Cetonus robustus</i> Type.
		Sept. 1				1	<i>Cetonus robustus</i> Paratype.
5015	46 44 00	144 02 00	510	gn. M.	35.9	1	<i>Bathygadus antrodes</i> .
5029	48 22 30	145 43 30	440	bk. S., G.	35.3	1	<i>Coryphacnoides nasutus</i> .
5044	42 10 40	142 14 00	309-359	gy. S., Co., S.	132.1	2	<i>Lionurus proximus</i> .
5045	42 11 10	142 12 00	359	br. M., fine. bk. S., Co., S.	38	1	<i>Nematonurus longifilis</i> .
		...do....				4	<i>Coryphacnoides nasutus</i> .
5048	38 09 24	141 52 30	129	dk. gy. S., brk. Sh.	40.7	6	<i>Lionurus proximus</i> .
5049	38 12 00	142 02 00	182	dk. gy. S., brk. Sh., For.	37.8	1	<i>Nematonurus pectoralis</i> .
5053	34 49 20	138 40 15	503	gn. M.	34.9	2	<i>Coryphacnoides nasutus</i> .
5054	34 52 45	138 42 20	282	gn. M., brk. Sh., For.	45.3	1	<i>Lionurus garmani</i> .
5056	34 57 35	138 43 35	258	.....do.....	46.0	1	<i>Coryphacnoides marginatus</i> .
		...do....				1	<i>Bathygadus garretti</i> Type.
		Oct. 10				1	<i>Bathygadus garretti</i> Paratype.
		...do....				6	<i>Coryphacnoides marginatus</i> .
		Oct. 12				1	<i>Coelrhynchus productus</i> Type.
		...do....				5	<i>Coelrhynchus productus</i> Paratype.
		Oct. 13				1	<i>Coelrhynchus japonicus</i> .
5059	35 05 30	138 39 50	297-197	gy. S.	45.0	2	<i>Coelrhynchus productus</i> .
		Oct. 13				1	<i>Coelrhynchus japonicus</i> .
		...do....				1	<i>Hymnocephalus strictissimus</i> .
		Oct. 13				3	<i>Lionurus garmani</i> .
		...do....				3	<i>Lionurus condyrtura</i> .

1 Reading of thermometer verified.

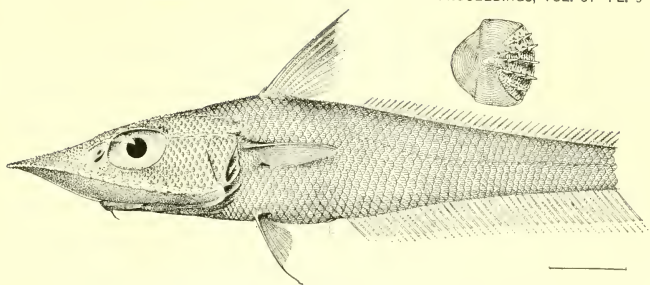
Station (Dredge No.)	Latitude N.	Longitude E.	Date.	Depth in fathoms.	Character of bottom.	Bottom tem- perature.	Number of spec- imens.	Species of Coryphaenoididae.
	° / "	° / "				° F.		
5060	35 06 00	138 40 10	1906. ...do....	197	crs. bk. S.	50.6	7 1 2 4	<i>Coryphaenoides marginatus</i> . <i>Coelorhynchus kishinouyei</i> . <i>Hymenoccephalus lethoenemus</i> <i>Lionurus garmani</i> . <i>Lionurus condylura</i> . <i>Lionurus darus</i> Type. <i>Coryphaenoides nasutus</i> . <i>Gadomus colletti</i> .
5061	35 04 50	138 38 00	...do....	332-250	br. M., fine-gy. S.	43.7	1 2 1	<i>Coelorhynchus kishinouyei</i> . <i>Coelorhynchus japonicus</i> . <i>Lionurus garmani</i> . <i>Lionurus condylura</i> . <i>Gadomus colletti</i> .
5062	35 05 20	138 37 10	...do....	250	gn. M.	47.7	1 2 2	<i>Coelorhynchus kishinouyei</i> . <i>Coelorhynchus japonicus</i> . <i>Lionurus garmani</i> . <i>Lionurus condylura</i> . <i>Gadomus colletti</i> .
5065	35 05 40	138 39 30	Oct. 15	235-211	bk. S., brk. Sh.	48.5	1 6 5	<i>Coryphaenoides marginatus</i> . <i>Coelorhynchus kishinouyei</i> . <i>Lionurus garmani</i> . <i>Lionurus condylura</i> . <i>Coelorhynchus productus</i> Paratype. <i>Coelorhynchus productus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus garmani</i> . <i>Lionurus condylura</i> . <i>Gadomus colletti</i> .
5066	35 06 05	138 40 20	...do....	211-293	fine, bk. S.	50.8	1 1 1 4	<i>Coryphaenoides marginatus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus garmani</i> . <i>Lionurus condylura</i> . <i>Gadomus colletti</i> .
5067	35 05 50	138 41 15	...do....	293	bk. S., brk. Sh.	45	3 2	<i>Coryphaenoides marginatus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus condylura</i> . <i>Lionurus garmani</i> . <i>Gadomus colletti</i> .
5069	35 03 10	138 47 00	...do....	131-108	M., S., brk. Sh.	55.8	1 1	<i>Coryphaenoides marginatus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus condylura</i> . <i>Lionurus garmani</i> . <i>Gadomus colletti</i> .
5072	34 44 55	138 22 20	Oct. 16	284-148	gy. M.	44.1	1 1 1	<i>Coryphaenoides marginatus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus condylura</i> . <i>Lionurus garmani</i> . <i>Gadomus colletti</i> .
5080	34 10 30	138 40 00	Oct. 19	505	fine-gy. S., Glob.	38.7	2 1 1	<i>Coryphaenoides marginatus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus garmani</i> . <i>Gadomus colletti</i> .
5082	34 05 00	137 59 00	Oct. 20	662	gn. M., fine. S., Glob.	37.7	1	<i>Coryphaenoides marginatus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus garmani</i> . <i>Gadomus colletti</i> .
5083	34 04 20	137 57 30	...do....	624	fine-gy. S., Glob.	38.1	1	<i>Coryphaenoides marginatus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus garmani</i> . <i>Gadomus colletti</i> .
5084	34 00 00	137 49 40	...do....	918	gn. M., fine. S., Glob.	36.8	1	<i>Coryphaenoides marginatus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus garmani</i> . <i>Gadomus colletti</i> .
5085	35 06 45	139 19 45	Oct. 23	622	gn. M., fine, bk. S.	37.8	1 3	<i>Coryphaenoides marginatus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus garmani</i> . <i>Gadomus colletti</i> .
5086	35 08 15	139 20 00	...do....	292	gn. M., crs. bk. S.	43.7	2 1	<i>Coryphaenoides marginatus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus garmani</i> . <i>Gadomus colletti</i> .
5087	35 09 40	139 19 05	...do....	614	gn. M.	37.5	1	<i>Coryphaenoides marginatus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus garmani</i> . <i>Gadomus colletti</i> .
5088	35 11 25	139 28 20	Oct. 25	369-405	gn. M.	41.8	1	<i>Coryphaenoides marginatus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus garmani</i> . <i>Gadomus colletti</i> .
5093	35 03 15	139 37 42	Oct. 26	302	crs. bk. S.	43.9	2	<i>Coryphaenoides marginatus</i> . <i>Hymenoccephalus lethoenemus</i> . <i>Lionurus garmani</i> . <i>Gadomus colletti</i> .



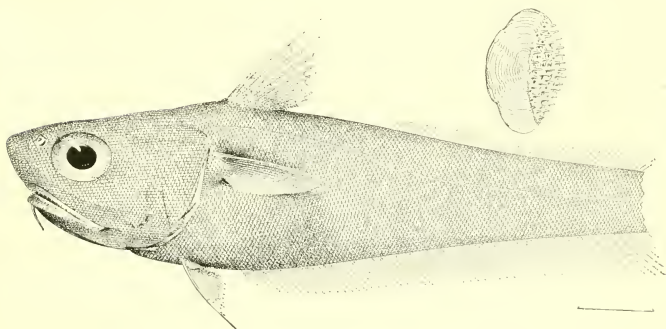
1. BATHYGADUS GARRETTI. (PAGE 151.) FROM THE TYPE.



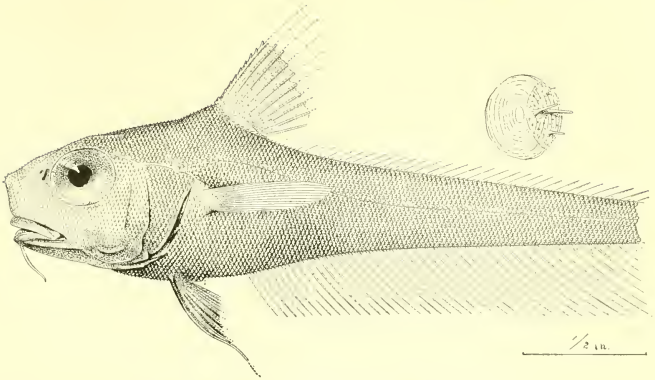
2. SQUALOGADUS MODIFICATUS. (PAGE 156.) FROM THE TYPE.



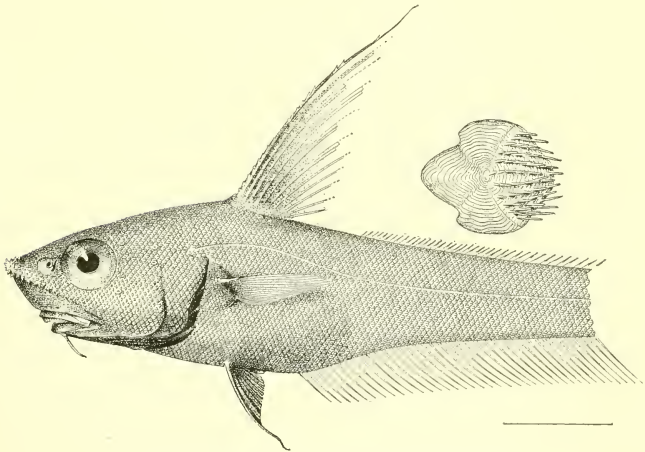
1. COELORHYNCHUS PRODUCTUS. (PAGE 175.) FROM THE TYPE.



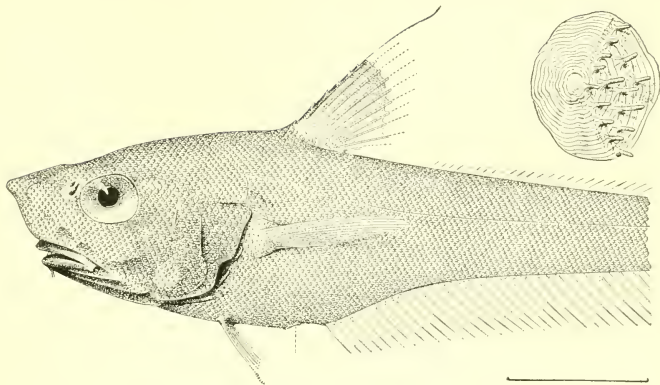
2. MALACOCEPHALUS NIPPONENSIS. (PAGE 189.) FROM THE TYPE.



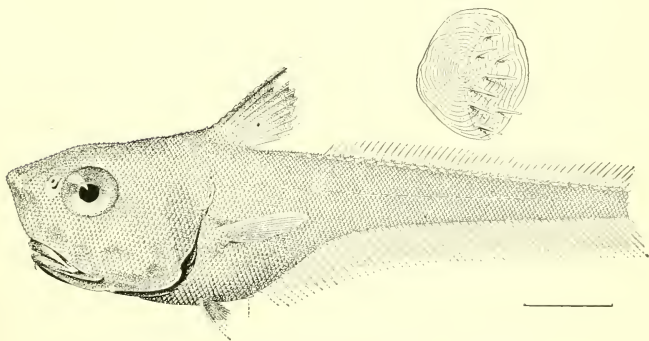
1. *LIONURUS DURUS*. (PAGE 197.) FROM THE TYPE.



2. *LIONURUS SPINOSUS*. (PAGE 199.) FROM THE TYPE.



1. *LIONURUS CETONUOPSIS*. (PAGE 202.) FROM THE TYPE.



2. *CETONURUS ROBUSTUS*. (PAGE 207.) FROM THE TYPE.