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THE MARINE FISHES OF WEST AFRICA BASED ON THE
COLLECTION OF THE AMERICAN MUSEUM CONGO
EXPEDITION,¹ 1909-1915

PART I

BY HENRY W. FOWLER²

PLATE I (FRONTISPIECE) AND 1 TO 275 TEXT FIGURES

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INTRODUCTION

In this work I have attempted a comprehensive, descriptive account of the fishlike vertebrates known from the coast of western tropical Africa. The great homogeneity of this vast faunal region makes it evident that its influence extends somewhat beyond the confines of Africa proper. I have felt it necessary to consider all the coasts between Morocco and Angola, embracing the Spanish Sahara, Senegal, Gambia, Portuguese Guinea, Sierra Leone, Liberia, Old Guinea, the Cameroons, French Congo, and the Congo estuary. As no collections appear to have been reported from along the coast of Namaqualand to 1930, it is not included. For completeness the outlying islands, as the Madeiras, Canaries, and Cape Verde group, and even the distant Azores, Ascension Island, and St. Helena, are also included. In a general way, all these regions are more or less related in their marine ichthyofauna. Even from the scant information now at hand, they seem to have much in common.

¹Scientific Results of The American Museum of Natural History Congo Expedition. Ichthyology, No. 8.

²Of The Academy of Natural Sciences of Philadelphia.

As will appear from a glance at the appended bibliography, the marine fishes of West Africa have been little noticed by ichthyologists. In a measure, this is explained by the late development of this part of the continent. It is only of recent years that any attempt has been made to work out the vast fresh-water fauna. Most of this was accomplished through the excellent papers of Dr. G. A. Boulenger, then of the British Museum. The American Museum Congo Expedition obtained the best collection ever brought to America. It forms about the last important contribution and was reported by Messrs. John T. Nichols and Ludlow Griscom.

Collections of African fishes have always been rare in America. The marine fishes obtained by the American Museum Congo Expedition number about 250 specimens. The new forms have already been described under the caption 'New Fishes obtained by the American Museum Congo Expedition, 1909-1915.' All of these specimens were obtained at the mouth of the Congo and, in the main, represent chiefly large forms locally used as food. Mr. Herbert Lang secured them during a limited stop-over while waiting to take his steamer back to New York.

To Professor Samuel Henshaw, at that time Director of the Museum of Comparative Zoölogy at Cambridge, thanks are due for the opportunity to examine forty-four species of West African fishes. These were chiefly from the Azores, Madeiras, Canaries, Cape Verde Islands, Gambia, and Guinea. This institution has also received a few from the late Dr. Franz Steindachner of Vienna.

In the United States National Museum, Mr. Barton A. Bean kindly placed at my disposal about forty-three species from West Africa. Most of these were from the Azores, Madeira, the Canaries, and Liberia. Notes from the United States 'Eclipse' Expedition and a few scattered examples in the Wilkes' Exploring Expedition were also examined in this connection. The latter were from the Canaries and the Cape Verde Islands.

In the Academy at Philadelphia I have had an opportunity to report on the West African collections from Madeira, Liberia, and the French Congo. In addition to these, several smaller collections were loaned from the last-named region and from the Cameroons. Wherever possible, direct comparisons were made with European and Mediterranean specimens.

The major part of this work is devoted to the species, genera, families, orders, etc. For the descriptions of the species more detailed explanation may be serviceable. The generally accepted technical name is

given first, followed by that of the original describer. All vernacular names are taken from the references in synonymy, with their localities or regions following. The synonymy consists always of the original reference of description and only such others as are embraced in the region under discussion. No other synonyms are included. The detailed description of the species is always taken, if possible, from an entire series of specimens. If the series is large it follows that the description will more completely express the range of variation. Finally, the range and remarks on the materials are given. Where no materials are available, the descriptions are freely quoted from other authors and standardized to fit in with the sequence of characters as adopted in the present work. Sometimes characters have been gleaned from figures and used in similar fashion. All such cases are duly credited to the respective authors.

The classification used is taken from the definitions of Günther and subsequently elaborated by the late Dr. D. S. Jordan. Especially have the latter's recently published 'Genera of Fishes' and a 'Classification of Fishes,' been consulted. The descriptions of the higher groups, as genera, families, orders, and classes, are modified from papers in which various of Dr. Jordan's colleagues associated, or the works of Garman, Günther, Regan, Boulenger, and many others. In addition, I have consulted and drawn from many general works. The original reference with the designated type is always given in the case of genera. If not originally indicated, I append the reference believed to be that of the first author to formally designate the type. The synonyms are treated in similar fashion. When subgenera are used they are defined in the keys to the genera, and so on in the progression of most higher groups, as series, subfamilies etc.

All illustrations are from my own pen or brush. A number are finished details, though the great majority are outlines in pen and ink. These are given in the hope that they may secure a wider scope of interest for the work, especially through visualizing rare or little-known forms. Although some are original, most are copied from any source desirable, these indicated in the caption of each figure.

My thanks are due to Mr. Herbert Lang for placing this interesting collection in my hands for study and to be used as the basis of this report. He also very kindly assisted in securing the loan of certain rare books or papers. A few figures of the rare, and all of the new species, are the work of my own pen. A duplicate set of specimens, from those obtained by the Congo Expedition, was presented to The Academy of Natural Sciences of Philadelphia.

In generalities, I have but little to add to the knowledge of distribution of marine equatorial West African fishes. Many excellent suggestions have been given by the later writers; especially those to be found in the various works of Pellegrin. The influx of various faunal elements, such as the great preponderance of Mediterranean species, is very evident. This is true of the Sahara coast line, though no doubt closer collecting will reveal many more species than hitherto supposed within the Gulf of Guinea, the shores of the Congo region, and Angola. Evidently many Mediterranean species extend to the Cape of Good Hope. A number of species representative of the tropical American coast lines have likewise been found there, but few of those which actually range across the Atlantic. Some few genera typical of the Indian Ocean or Indo-Pacific have drifted past the Cape of Good Hope, of which *Lethrinus*, *Periophthalmus*, and *Thysanophrys* are noteworthy.

At best, our knowledge of the West African ichthyofauna is far too incomplete to premise much in zoögeographical distribution. It is hoped that the present effort will mark a beginning, as at the most it is but a pioneer effort. Possibly sufficient interest may eventually be aroused to secure satisfactory collections and data on which a perfected work may be built. Vast areas of both the seas and shore lines still remain unknown, save from fragmentary collections, and many of these have not even been carefully studied.

EXPLANATION OF EXTERNAL CHARACTERS

By way of explanation of the descriptions that follow in the main body of this work, a few items and the accompanying diagram will indicate the various definitions (Fig. 1).

The shape of the body is very variable, from the long slender form of an eel to the typical fusiform pattern of a perch, where it tapers at both ends. Further extremes may be found in the slender pipefishes, needlefishes and eels, to the flatfishes, where the body may be as deep as long. *Monodactylus* has the deepest body among fishes, being much deeper than it is long. In the descriptions the depth of the body is usually given, and then with reference to the number of times it is contained in the length of the fish to the hypural bone, or exclusive of the caudal fin.

The body falls into three divisions, as the head, trunk, and tail. Often these distinctions are not clearly marked or may be greatly variable. Unless otherwise stated, the head is always expressed with reference to its total length, as contained in the length of the body to the

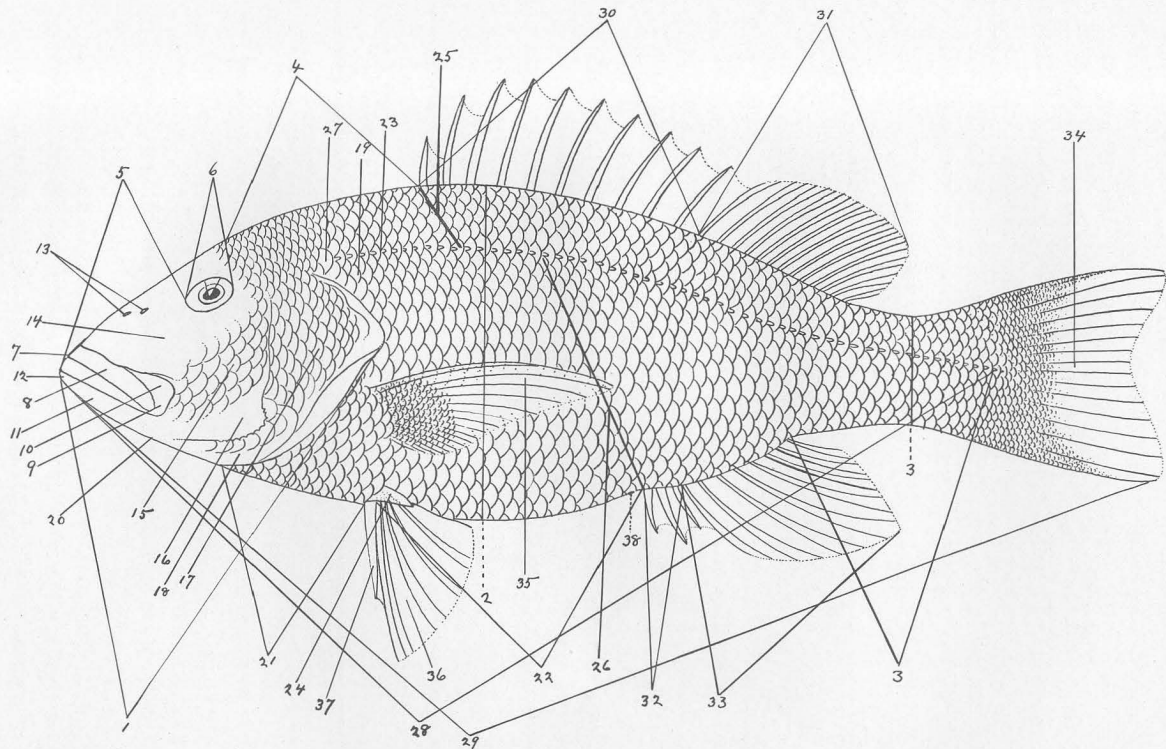


Fig. 1. Diagram showing external characters of the red snapper (*Lutjanus aya*).

1, head; 2, depth; 3, caudal peduncle; 4, predorsal; 5, snout; 6, eye; 7, mouth; 8, upper lip; 9, maxillary; 10, supplemental maxillary; 11, mandible; 12, chin; 13, nostrils; 14, preorbital; 15, cheek; 16, preopercle; 17, opercle; 18, interopercle; 19, shoulder; 20, isthmus; 21, breast; 22, belly; 23, lateral line; 24, ventral axillary; 25, scales above lateral line; 26, scales below lateral line; 27, suprascapula; 28, body length; 29, total length; 30, spinous dorsal; 31, soft dorsal; 32, spinous anal; 33, soft anal; 34, caudal; 35, pectoral; 36, ventral; 37, ventral spine; 38, vent.

hypural bone, or exclusive of the caudal fin. It is the first item of description and is followed by that noted above as the depth of the body.

The fins are very characteristic organs of the trunk and tail. In most fishes they appear as median fins, sometimes called vertical fins, and paired fins. The former are the more primitive, and on the back may be broken or separated into two or three dorsal fins, or a row of separated finlets, as in the sauries and mackerels. On the under surface of the body the median fin may be broken into one or two anal fins. The portion remaining at the end of the tail is known as the caudal fin.

The fins are supported by interspinal (concealed) and external rays. The latter or fin rays are usually covered with membranes and may be horny or bony. When stiff, rigid, unbranched, pointed at their free ends, and without articulations or segments, such fin rays are known as spines. They are always indicated by roman capitals. Usually, among the higher bony fishes, at least one spine supports the front portions of the dorsals, anals, pectorals, and ventrals. When the fin rays are transversely jointed and split lengthwise they are called soft rays. If not branched they are rudimentary rays, in which case, in many of the more primitive bony fishes, they are often found at the front of the dorsal and anal, and frequently of the caudal. The soft rays are indicated by Arabic characters and the simple or rudimentary rays by small roman. In cases of rays specifically modified as finlets following the vertical or median fins, the plus sign followed by Arabic characters is used. Should any of the median fins be separated, a dash is used.

The paired fins, forming from a continuous lateral fold that originally extended along each side of the trunk from the head to the vent, constitute two groups. The remaining front and hind portions are known as the pectoral fins and ventral fins, respectively. In most fishes the pectoral is seldom wanting and is usually placed just behind the gill opening. The very variable ventrals are usually present. They are usually situated near the junction of the trunk and tail and usually close before the vent, when they are styled abdominal. When placed below the pectorals they are thoracic, and when on the throat or before the pectoral they are jugular. The count of rays in the paired fins is rarely of such importance as that for the median fins and is therefore seldom noticed. Sometimes degeneration of the median fins occurs in the hind division of the dorsal, which shrinks, loses its fin rays and, becoming fatty, forms an adipose fin.

The lateral line is complex, branching in the head, though along the side of the body it is usually found as a single median series of pores. Sometimes an accessory lateral line may occur along the back or belly.

The scales are developed in pockets and in pouches of the skin. When smooth and with entire or unbroken edges they are cycloid, and when the free edge has one or more series of toothlike spines they are ctenoid. Sometimes the scales are modified as dermal denticles, or the body may be variously enclosed in bony plates, or even cuirassed. Scales may be absent or even microscopic. The scale counts are primarily made between the head and tail or along the trunk and tail to the base of the caudal fin. If the count is extended out on the caudal fin, it is so stated. Transversely, the scales are counted above the lateral line to the spinous dorsal origin. Below, they are counted opposite and down to the spinous anal. A count is also made before the dorsal as far as the squamous area extends. The scales used for structural examination are lifted from above the lateral line and from below it, opposite the front of the soft dorsal, or below the spinous dorsal, when this is present. Counts are made of the basal or other striae and of the denticles, when these are present.

Most of the remaining numerals pertain to the head and are expressions of variation. The space above the mouth and directly before the eye is known as the snout. The term "muzzle" is sometimes used, meaning the jaws and snout, and even including the preorbital also. The extremely variable eye is typically lateral and of large size. It may be rudimentary, greatly modified, telescopic, or even on long stalks as in certain young stomiatids. The size, position, color, and shape of the eye are frequently of great importance in specific distinctions.

The greatly variable mouth is usually terminal; when the upper jaws or snout are protruded it becomes ventral, or may be styled inferior or included. Lips may be present or absent, usually smooth and entire, though sometimes fringed. Tactile filaments, as barbels, are often present on the head, frequently near the chin. In many fishes, the maxillary slopes along the edge of the upper jaw and expands behind. As this bone is more frequently better defined posteriorly than is the mouth cleft or rictus, it is generally used in computations of the size of the mouth.

The nostrils are situated on the upper sides of the snout in front. Usually each olfactory sac has a pair of openings, which may be variously closed or distant. The space between the eyes is known as the interorbital and that below the eyes as the infraorbital, or, when the sub-

orbital bones are evident, as the suborbital. Thus, the suborbital chain may be variously modified, the first or anterior known as the preorbital and the last or posterior as the postorbital. With respect to the length of the snout, the eye, the maxillary, and interorbital—all these have been expressed proportionally in the descriptions. For example, the length of the eye is set down according to the number of times it may be contained in the head. In all such cases, should the lower jaw, or mandible, project in front, the length of the head is taken from the tip of the upper jaw.

The gill opening falls behind or below the hind part of the head, curving down or forward toward the chin. It has a movable flaplike fold along the border, though the hind edge is usually free. Water is taken in through the mouth and, after bathing the gills, is forced out through the gill opening. On the under surface of the head, the space between the two halves of the lower jaw and between both gill openings is known as the isthmus. Inside the gill opening on the first gill arch, we usually find a lot of slender points, sometimes setiform, again spinelike, or even tubercular. These are known as the gill rakers. They are important in many fishes. As the arch is bent well up, the count on the upper section is given with the plus sign, and is followed by the count in the lower section. Sometimes the uppermost or lowermost rakers are rudiments, in which case they are expressed in small roman numerals.

The vent or cloacal aperture is usually placed near the junction of the trunk and tail. In most bony fishes, the vent is in front of the separate or combined openings of the genitourinary apertures. In such cases it may even be far advanced on the isthmus.

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DESCRIPTIVE ACCOUNT OF CLASSES, ORDERS, FAMILIES, GENERA,
AND SPECIES

The fishlike animals known in a general or popular way as fishes belong to that great group, branch, or phylum of the animal kingdom known as the Chordata. During some stage of their lives, at least, the Chordata are furnished with a notochord. This is formed as a primitive dorsal cartilage and is so placed as to cause the interior of the body to fall into two divisions. In the upper division is the large nervous system or spinal chord. The lower division contains the heart and alimentary canal. In this way the Chordata differ from all other animals having a body cavity, as in these others there is no division by a notochord, and when the nervous system is present it occurs either in the lower region of the body or as a ring around the mouth.

The Chordata form two well-defined divisions: the Protochordata and the Vertebrata. The Protochordata include a number of marine animals, entirely unlike fishes, with the appearance of mollusks or worms, and known as sea squirts, sea pears, and salpas. No fossils have been found. The Vertebrata include the remaining chordate animals and differ in retaining the notochord permanently or having it develop into the segmented structures of the vertebral column. Further, no vertebrates resemble worms or mollusks very closely. The fishlike vertebrates may be said to differ from the others (Amphibia, Reptilia, Aves, and Mammalia) in not developing jointed limbs, in having their locomotive members evolved as fins, in breathing throughout life the air contained in the water, and in being permanent y aquatic.

SYNOPSIS OF THE CLASSES

- a.*—ACRANIATA. Front end of central nervous axis not dilated into a brain and skull absent; notochord perfect, persists through life, extends throughout length of body, enclosed in membranous sheath; heart lengthwise, tubular, gives off branchial tubes uniting in aorta.....LEPTOCARDII.
- aa.*—CRANIOTA. Front end of central nervous axis dilated into a brain and contained in a skull; notochord not extending forward beyond pituitary body of brain; heart more perfected, divided into two parts.
- b.*—Skull imperfect, without jaws; a single median nostril; gills purse-shaped.....MARSIPOBRANCHII.
- bb.*—Skull perfected, with jaws; nostrils paired, not median; gills not purse-shaped.....PISCES.

CLASS LEPTOCARDII

Lancelets

Gill slits enclosed externally by fold in integument enclosing a chamber (atrium) opening below. Equivalent to the single order following.

ORDER AMPHIOXI

Lancelets

One family.

Branchiostomidae

Lancelets

Small scaleless marine creatures, with long compressed translucent body, rudimentary eyes and fins, and mouth a lengthwise slit encircled usually by fringe of cirri.

KEY TO THE GENERA

- a.*—No oral cirri. AMPHIOXIDES.
aa.—Oral cirri present. BRANCHIOSTOMA.

AMPHIOXIDES Gill

Amphioxides GILL, 1895, Amer. Nat., XXIX, p. 457. Type: *Branchiostoma pelagicum* Günther. Monotypic.

Mouth as sinistral slit without cirri. No closed atrial chamber. Gill slits in unpaired medioventral series. Pharynx with upper nutritive and lower respiratory division.

A provisional group for several larval lancelets, possibly the young of *Asymmetron*.

Amphioxides pelagicus (Günther)

Branchiostoma pelagicum GÜNTHER, 1888, 'Rept. Voy. "Challenger,"' XXI (part 2), p. 43, Pl. vi, fig. b. N. lat. 23° 3', W. long. 156° 6'.

Amphioxides pelagicus GILL, 1895, Amer. Nat., XXIX, p. 458.—GOLDSCHMIDT, 1905, 'Wiss. Ergebn. "Valdivia,"' XII, p. 9, Pl. I, figs. 3-4 (N. lat. 0° 20' 2", W. long. 6° 45', in 3500 m.).

Gill arches 17 to 30. Myotomes 52 or 53+14 or 15. Caudal longer, leaflike. Length 5 to 21 mm. (Goldschmidt.)

Atlantic and Pacific Oceans.

Amphioxides valdiviae Goldschmidt

Amphioxides valdiviae GOLDSCHMIDT, 1905, 'Wiss. Ergebn. "Valdivia,"' XII, p. 9, Pl. I, fig. 1. N. lat. 24° 43' 4", W. long. 17° 1' 3", in 2000 m. (S. lat. 0° to 40°, E. long. 58° to 99°, in 1100-2000 m.)

Gill arches 27 to 35. Myotomes 56 to 58+11 to 14. Caudal shorter, paddle-like. Length 7 to 9.25 mm. (Goldschmidt.)

Atlantic and Indian Oceans.

BRANCHIOSTOMA Costa

Lancelets

Branchiostoma COSTA, 1834, 'Cenni. Zoologici' (Naples), p. 49. Type: *Branchiostoma lubricum* Costa. Monotypic.

Amphioxus YARRELL, 1836, 'Hist. Brit. Fish.,' II, p. 468. Type: *Limax lanceolatus* Pallas. Monotypic.

Amphioxys auct.

Dolichorhynchus WILLEY, 1901, Quart. Jour. Micros. Sci., London, (2) XLIV, p. 269. Type: *Dolichorhynchus indicus* Willey. Monotypic.

Mouth nearly median, with cirri. Atrial chamber closed. Gill slits paired, lateral. Pharynx undivided. Reproductive bodies present on each side of median axis of body.

Although fourteen species are admitted by Hubbs in his recent survey of this genus, most are closely related and separated only by slight differences in the myotomes and ray chambers.¹

Branchiostoma lanceolatum (Pallas)

Limax lanceolatus PALLAS, 1774, 'Spicil. Zool.,' X, p. 19, Pl. 1, fig. 2, a-b. Cornwall, England.

Branchiostoma lanceolatum STEINDACHNER, 1882, Denkskr. Akad. Wiss. Wien, XLIV (1), p. 51 (Bay of Rufisque).—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 157.—PELLEGRIN, 1905, Bull. Soc. Zool. France, XXX, p. 138 (Nouakchott); 1914, Ann. Inst. Océanogr., Monaco, VI (4), p. 6 (Baie du Lévrier, Mauritania coast).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 228 (Rio de Oro).

Muscular bands 32 to 35+10 to 13+11 (?) to 16 (=57 to 61). Length to 51 mm.

Though reported from several localities in West Africa, the above counts are from Italian and Mediterranean material. It ranges northward to England and Scandinavia.

Many works have been written about the lancelet, especially its structure and relationships. Zoölogists are especially interested, as it exhibits the lowest development in vertebrate life. Its distribution is local, though often extremely abundant where found.

The lancelet lives in sand banks, where it secures shelter and ample food among microscopic animal and vegetable forms of life, as protozoans, desmids, diatoms, etc. The firm, elastic notochord, extending to each end of the body, enables it to move either way with extraordinary agility. It darts into the sand with the rapidity of an arrow. Frequently it buries itself in the sand with only the mouth cavity exposed. The ring of cilia in rapid motion causes a stream of food to flow into its respiratory cavity, which also acts as the esophagus. Sometimes the lancelet emerges from the sand, swims about or sinks to the bottom.

¹ 1922 (January 2), Occasional Papers Mus. Zool. Univ. Michigan, No. 105, pp. 1-16.

Branchiostoma africae Monod

Branchiostoma africae (Hubbs) Monod, 1927, 'Faune Colon. françaises,' p. 644. Souelaba, Cameroons.

Muscular bands 42 to 44 + 14 or 15 + 11 to 14 (= 67 to 73).

Differs from *Branchiostoma lanceolatum* chiefly in the increased muscular bands.

CLASS MARSIPOBRANCHII

Lampreys

Body eel-shaped, mouth partly inferior, suctorial, usually circular. No true jaws. Nostril single, median. Gills formed as fixed sacs, six or more on each side, without gill arches. Heart without arterial bulb. Alimentary canal straight, simple, without caecal appendages, pancreas, or spleen. Generative outlet peritoneal. Skeleton cartilaginous. Skull imperfectly developed, not separate from vertebral column. No limbs, no shoulder girdle, no pelvis, no ribs. Body naked. Vertical fins with feeble rays, usually continuous around tail.

Naked eel-shaped animals found in cool waters, both fresh and salt, which undergo a metamorphosis, the young often quite unlike the adult. Chiefly distinguished by the absence of jaws, limbs, and ribs, also without coat of mail, and by the presence of a brain.

ORDER HYPEROARTII

Lampreys

Eyes well developed in adult, absent in young. Nasal duct a blind sac, not penetrating palate. Gill openings close behind head, communicating with a common branchial passage which opens directly into pharynx.

One family.

Petromyzonidae

Lampreys

Body elongate, slender, partly cylindrical in front, compressed behind. Eyes well developed in adult, rudimentary in young. Mouth partly inferior, nearly circular, suctorial, disklike, formed for sucking. Lips present, usually fringed. Adult with horny teeth resting on papillae in mouth, young toothless. Teeth simple or with more than one cusp, those immediately above and below esophagus most specialized. Nostril on top of head, close before eyes. Gill openings seven, placed in row along side of pharynx, communicating inside partly with esophageal canal

opening in front of pharynx. An extra branchial skeleton forming a basket work. Intestine with spiral valve. Eggs small, numerous, segmentation holoblastic. Dorsal fin somewhat notched, hind part usually continuous with anal around tail.

Lampreys are usually found fastened on other fishes by means of the sucker-like mouth. They feed on their hosts by scraping off the flesh with their horny teeth and sucking the blood. Most lampreys ascend rivers and brooks in the spawning season, after which very many individuals die. They undergo a transformation; the young are toothless and with rudimentary or partly cutaneous eyes, and with small transverse lower lip, upper lip hooklike, and edge of mouth fringed. Their gill pouches communicate directly with the pharynx, the small gill openings are in a groove, and the vertical fins continuous. Before these young were found to be the normal young of lampreys, various names, as *Ammocoetes*, *Scolecospma*, *Chilopterus*, etc., were given to them. About eleven genera are known. Pellegrin has reported "la Lamproie de Planer" from the mouth of the Congo.

PETROMYZON Linné

Lampreys

Petromyzon LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 230. Type: *Petromyzon marinus* Linné. (Designated by Jordan and Gilbert, 1882, Bull. U. S. Nat. Mus., No. 16, p. 10.)

Petromison auct.

Bathymyzon GILL, 1883, Proc. U. S. Nat. Mus., p. 250. Type: *Petromyzon* (*Bathymyzon*) *bairdii* Gill. Monotypic.

Caspiomyzon BERG, 1906, Bull. Acad. Sci. St. Pétersbourg, (5) XXIV, p. 177. Type: *Petromyzon wagneri* Kessler. Monotypic.

Oceanomyzon FOWLER, 1907, Proc. Acad. Nat. Sci. Philadelphia, p. 46. Type: *Oceanomyzon wilsoni* Fowler. Monotypic.

Eudontomyzon REGAN, 1911, Ann. Mag. Nat. Hist., London, (8) VII, p. 200. Type: *Eudontomyzon danfordi* Regan. Monotypic.

Front lingual plate with 2 curved denticulated ridges, separated by median longitudinal groove. Lower mouth plate usually distinctly toothed, variably crescentic and spoutlike or with obsolete teeth. Teeth of buccal funnel in radiating series, converging backward toward edge of disk. Dorsals as 2 more or less distinct, well-separated fins, separated from caudal by notch.

Probably a single species, the largest of the lampreys, in the North Atlantic and tributary streams.

Petromyzon marinus Linné

Petromyzon marinus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 230. European Seas.—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 501 (West Africa)—REGAN, 1911, Ann. Mag. Nat. Hist., London, (8) VII, p. 198 (West Africa).

Head $7\frac{1}{4}$ to $10\frac{1}{3}$ (measured to first gill openings); depth 11 to 17; head width $1\frac{2}{3}$ to 2 in its length; snout $1\frac{2}{5}$ to $1\frac{4}{5}$; disk width $1\frac{4}{5}$ to $2\frac{1}{4}$; interorbital $1\frac{7}{8}$ to $3\frac{1}{2}$; eye 2 to 4 in interorbital space, 6 to 10 in head; tail measured from vent to caudal tip $2\frac{3}{5}$ to $3\frac{7}{8}$ in rest of body.

Body elongate, trunk compressed. Median ridge down back to dorsal fin. Tail beyond vent slender, tapering, well compressed. Head large in adult, smaller in young, partly cylindrical. Snout convex, little longer than broad. Eye little longer than deep, without lids, near last fourth in head in adult, absent in young. Mouth forming large rounded disk in adult, small in young. In adult disk edges with numerous fleshy flaps, ends of each fringed. Teeth strong, rather short, conic, in rather oblique radiating series. Innermost teeth largest, upper bicuspid. Teeth of tongue lunate, biserial, pectinate, and serrations of front and first pair confluent. Single nostril midway in interorbital just before eyes. Top of head and interorbital convex. Gills, seven on each side. Skin smooth, rather tough. Fins as two dorsals and a caudal. First dorsal inserted slightly behind middle in body length, separated from second dorsal in adult, though slightly continuous in young. Caudal small, rounded.

Color livid brownish, usually clouded with blackish and whitish. Some examples quite yellowish, others greenish or olivaceous when adult. Half-grown examples often quite pale or dull bluish. Young pale brown. Reaches 915 mm. in length.

Widely distributed in the North Atlantic, northward to the British Isles and Scandinavia. The above description from American (Massachusetts, Maine, New Jersey, Maryland), and Italian examples.

CLASS PISCES

Fishes

Skull formed with sutures and with membrane bones, as opercle, preopercle, etc., present. Skeleton usually bony, though sometimes of cartilage. Air vessel at first a lung formed on lower side of esophagus, but in later forms it becomes superior, degraded into a swim vessel or entirely lost with age. Gill openings a single aperture on each side. Gills filamentous, outer edges free, bases joined to bony arches, of which latter usually in four pairs and fifth pair typically formed as tooth-bearing lower pharyngeals. Heart with auricle, ventricle, and arterial bulb. Eggs small. Fins median and paired, latter with distinct rays.

This great group comprises the vast majority of fishlike vertebrates of recent time. A number are also known only as fossils, many of which are not sufficiently preserved to show the important characters of their anatomy.

KEY TO THE SUBCLASSES

- a.*—Skull without system of membrane bones, as opercles, etc.; ventral fins with claspers.

- b.*—Jaws distinct from skull; teeth distinct; gills 5 to 7, joined by outer edge of skin, each as separate external slit along side of pharynx. SELACHII.
- bb.*—Jaws joined with skull; teeth united as bony plates; gill opening single on each side of pharynx, contains 4 gills within branchial chamber. HOLOCEPHALI.
- aa.*—Skull with well-developed system of membrane bones, as opercles, suborbital chain, etc.; gill opening single on each side; no claspers to ventral fins. TELEOSTEI.

SUBCLASS SELACHII

Sharklike Fishes

Teeth numerous. Upper jaws not fused with skull. Membrane bones of head undeveloped, except sometimes rudimentary opercle. Skeleton cartilaginous. Skull without sutures. No air vessel. Intestine with spiral valve. Arterial bulb with 3 series of valves. Optic nerves united by chiasma. Cerebral hemispheres united. Gills not free, attached to skin by outer margin. Male without frontal and prepelvic tentacula. Ova few, large, impregnated, and sometimes developed internally. Embryo with deciduous external gills. Notochord more or less segmented. Skin naked or covered with minute rough scales, sometimes with spines. Dorsal fins rigid, non-erectile. Tail heterocercal. Ventral fins abdominal. Male with pair of large intromittent organs or claspers, each attached to ventral fin.

The true sharks and skates form an almost perfect gradation, though the notidanoid sharks are somewhat removed from the former.

KEY TO THE ORDERS

- a.*—Gill openings 6 or 7. NOTIDANI.
- aa.*—Gill openings 5.
- b.*—Anal fin present. ASTEROSPONDYLI.
- bb.*—No anal fin.
- c.*—Gill openings lateral.
- d.*—Pectoral fins normal. CYCLOSPONDYLI.
- dd.*—Pectoral fins modified, large, expanded horizontally and extended forward at base in front, which is separated from neck by deep notch containing gill openings. RHINAE.
- cc.*—Gill openings ventral. BATOIDEI.

ORDER NOTIDANI

Notidanoid Sharks

Vertebral column imperfectly segmented, each segment equivalent to two vertebrae and bearing two neural arches. Gill openings 6 or 7. One dorsal fin. Anal present.

This order represents the most primitive of existing sharks. Two families, recent and extinct.

KEY TO THE FAMILIES

a.—Gill openings 6, anterior covers crossing throat.

CHLAMYDOSELACHIDÆ.

aa.—Gill openings 6 or 7, covers not crossing throat. . . HEPTRANCHIIDÆ.

Chlamydoselachidæ

Frimled Sharks

Body long, slender. Head wide. Eyes lateral. No nictitating membrane. Mouth anterior. No labial folds. Teeth with slender cusps, bases wide, extended backward. Nostrils lateral, separated from mouth. Gill openings 6, front one covers branchial slit, crossing throat. Spiracles small. Pterygoquadrate not articulated to postorbital process of skull and hyomandibular elongate. Intestine with spiral valve. Lateral line an open groove. One dorsal fin, spineless. Anal present. No pits at caudal base. Caudal long, axis low.

One genus in deep seas of Japan, Madeira, and Norway.

CHLAMYDOSELACHUS Garman

Frimled Sharks

Chlamydoselachus GARMAN, 1884 (January 17), Bull. Essex Inst., XVII, p. 47.

Type: *Chlamydoselachus anguineus* Garman. Monotypic.

Chlamydoselache auct.

Mouth very wide, longer than skull. Teeth raptorial, alike in both jaws, each with wide base and 3 slender, curved, partly conic cusps, with or without rudimentary basal cusps; no median teeth in upper series; median series on symphysis below. Edge of first gill opening free across isthmus. Fins broad, caudal without notch.

Chlamydoselachus anguineus Garman

Figure 2

Chlamydoselachus anguineus GARMAN, 1884 (January 17), Bull. Essex Inst., XVII, p. 47, Fig. 5. Japanese Seas.—COLLETT, 1890, Bull. Soc. Zool. France, XV, p. 219 (Funchal, Madeira).

Body long, slender, tail greatly compressed, depth about $12 \frac{2}{3}$. Head oblong, greatly depressed, about $7 \frac{1}{2}$. Snout depressed, broadly rounded, projects little beyond mandible. Eye small, hind edge about first $\frac{2}{5}$ in head. Mouth large, more than half of head. Teeth tricuspid, spaces between each cusp with small basal denticle; 13 rows each side above, no median row; 11 rows each side below and median row of symphyseal teeth. Nostrils lateral, large, little low. Gill openings very large, first largest, others gradually smaller. Dorsal small, origin over anal origin. Anal twice size of dorsal. Caudal with broad lower lobe, tapers to slender sharp point. Pectoral small, broad, with very blunt angle. Ventral large, broad, rounded. Uniform brown. Length 996 mm.

Japan, Madeira, and Norway, in depths to 360 fathoms. The above description from a Japanese example. Reaches 1525 mm.

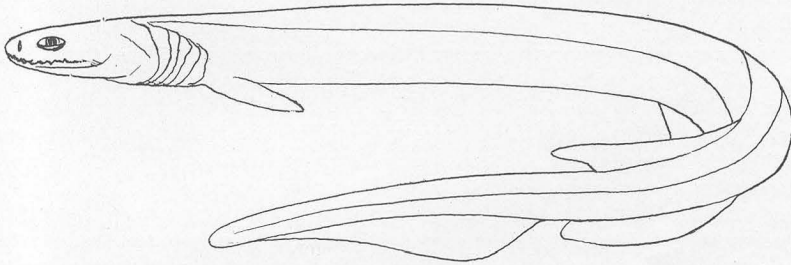


Fig. 2. *Chlamydoselachus anguineus*, after Garman.

Heptranchiidae

Body elongate. Head depressed. Eyes lateral, without nictitating membrane. Mouth large, inferior, with labial fold on lower jaw at angle. Teeth more or less comblike, compressed, with slender cusps and varying number of pointed cusps. Nostrils near end of snout, not connected with mouth. Gill openings 6 or 7, before pectorals, edges of covers not free across isthmus. Spiracles present, small. Spiral valve in intestine. One dorsal, without spine, behind ventrals. Anal present.

About three genera. Many species have been described from the Cretaceous and Tertiary.

KEY TO THE GENERA

- a.*—Gill openings 6.....HEXANCHUS.
aa.—Gill openings 7.....HEPTRANCHIAS.

HEXANCHUS Rafinesque

Hexanchus RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.', p. 14. Type: *Squalus griseus* Bonnaterre. Monotypic.

Notidanus CUVIER, 1817, 'Règne Animal,' II, p. 128. Type: *Squalus griseus* Linné. (Designated by Jordan and Evermann, 1917, Stanford Publications, 'Genera of Fishes,' part 1, p. 97.)

Monopterhinus BLAINVILLE, 1828, 'Faune Française,' I, p. 77. Type: *Squalus griseus* Gmelin. (Designated by Jordan and Evermann, *op. cit.*, p. 95.)

Eyes lateral. Mouth wide, shorter than skull, with rudimentary labial fold on lower jaw at angles. Teeth dissimilar, anterior upper raptorial, lower sectorial, compressed in cusps and bases. Gill openings 6, edge of first gill cover not free across isthmus. Spiracles minute. Fins moderate, notch near caudal tip.

Hexanchus griseus (Bonnaterre)

Albufasa, Albufara (Madeira)

Squalus griseus BONNATERRE, 1788, 'Tabl. Ichth.,' p. 9. Mediterranean.

Notidanus griseus LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 194 (Madeira).

Body moderately elongate, cavity little over half its length. Head large, wide, depressed, about 5 in length. Snout short, blunt. Eye as long as snout. Mouth large, groove behind angle halfway to gill opening, labial fold mainly on lower jaw at angle. No median upper tooth; anterior upper teeth slender, sharp, with or without basal cusps; anterior 2 or 3 lateral teeth larger, with single cusp at outer side of primary, posterior lateral with 2 or more outer cusps, hindmost teeth small, cusps much reduced. Lower jaws with median tooth, with or without median cusps; first lateral teeth with 7 cusps, primary cusp little longer, without serrations on its inner edge, other cusps and teeth decreasing regularly, cusps increasing in number, one or more, backward. Six wide gill openings before pectoral. Spiracle small, far behind eye. Dorsal moderate, its origin above ends of ventrals. Anal smaller, origin below middle of dorsal base, middle of base below end of dorsal about one length distant from subcaudal. Caudal long, third or more of total, modified scales along its upper edge. Pectorals large, broad as long, subtruncate. Ventrals rather longer than dorsal, three times as long as wide. Uniform dark brownish. Length 840 mm. (Garman).

Atlantic, Mediterranean, and Pacific Oceans. Barnard reports it as *Hexanchus griseus* (1925, Ann. South African Mus., XXI, p. 22) from Agulhas Bank to Natal.

HEPTRANCHIAS Rafinesque

Heptbranchias RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 13. Type: *Squalus cinereus* Gmelin. Monotypic.

Heptanchus, *Heptancus* auct.

Aellopos AGASSIZ, 1843, 'Poiss. Foss.,' III, p. 376. Type: *Aellopos wagneri* Agassiz. (Designated by Fowler, 1911, Bull. 4, Geol. Survey, New Jersey, p. 24.)

Notorynchus AYRES, 1856, Proc. California Acad. Sci., I, p. 72. Type: *Notorynchus maculatus* Ayres. Monotypic.

Notorhynchus auct.

Body elongate, partly fusiform, compressed. Head tapering forward, or broad. Snout broad or narrow and produced. Eye lateral, large. Mouth large, cleft long and wide, angle with labial fold and deep groove toward gill opening. Teeth dis-

similar, compressed, laterals each with large primary cusp, denticulate on its inner edge and with 4 or more smaller cusps, increasing in number posteriorly. Small symphyseal tooth on lower jaw. Gill openings 7. Spiracle small, far behind and above eye. Dorsal small, behind ventrals. Caudal long.

Several species in most warm seas. Many fossils, mostly known from detached teeth.

***Heptranchias perlo* (Bonnaterre)**

Bica doce (Madeira)

Figure 3

Squalus perlo BONNATERRE, 1788, 'Tabl. Ichth.,' p. 10. Mediterranean.

Notidanus cinereus LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 194 (Madeira).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 398 (Madeira).—ROCHEBRUNE, 1882, 'Faune Sénégalaise,' Poiss., p. 462 (Senegambia).

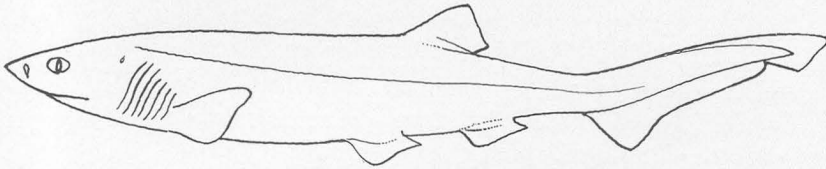


Fig. 3. *Heptranchias perlo*.

Body elongate, slender, compressed behind, depth 10 to 10 $\frac{3}{4}$ to last caudal vertebra. Head rather long, tapering, 6 $\frac{2}{5}$ to 6 $\frac{1}{2}$ in body. Snout broadly convex, well-pointed, long as wide at front of eyes, 3 in head. Eye large, longer than deep, near first $\frac{2}{5}$ in head, 4 to 4 $\frac{1}{2}$ in head. Mouth large, rather evenly triangular, width about 2 $\frac{1}{3}$ in head; mandible tip slightly before front eye edge. Deep rictal groove well back from each mouth corner, half exposes dental edge of mandible. Lips moderate. Upper teeth sharp, long, pointed, hooked backward, have anterior and posterolateral simple, each with 1 or 2 minute cusps behind; symphyseal mandibular tooth tricuspid, median cusp enlarged; mandibular teeth 5 on each ramus, cutting edges serrated, of 6 or more cusps with very small notch in front. Interorbital moderately broad, slightly depressed, 3 $\frac{1}{6}$ to 3 $\frac{3}{4}$ in head. Gill openings progressively smaller from first. Scales minute, tricarinate, median ends in strong sharp point. Dorsal origin nearer snout tip than caudal tip. Anal origin close after hind basal dorsal edge. Caudal, from origin of lower lobe, 2 $\frac{2}{5}$ in rest of body. Pectoral width 1 $\frac{1}{5}$ its length, which 1 $\frac{2}{5}$ in head. Ventral inserted nearer anal origin than pectoral, fin low, front lobe 3 $\frac{3}{5}$ in head. Dull grayish brown above, paler to whitish below. Length 827 to 902 mm.

Atlantic, Mediterranean, and Japan. Described above from Italian material.

ORDER ASTEROSPONDYLI

Typical Sharks

Vertebral column well segmented, each segment forming a neural arch and one centrum. Vertebrae each with internal calcareous lamellae

radiating from central wing. Gill openings 5. Dorsal fins 2.

This order includes the greater number of living sharks. It is divided into 2 suborders: the *Proarthri* and the *Galei*. The former is largely composed of extinct forms, while the few living species inhabit the Indo-Pacific.

SUBORDER GALEI

True Sharks

Gill openings always lateral, 5 in number. Palatoquadrate apparatus not articulated with skull. Dorsal fins 2, well developed, each without spine.

About thirteen families. A large number of fossil species also included.

KEY TO THE FAMILIES

- a.*—Eye without nictitating membrane.
 - b.*—Tail moderate, not half length of rest of body.
 - c.*—First dorsal higher than second.
 - d.*—First dorsal inserted before ventrals.
 - e.*—Upper caudal lobe moderate, much longer than lower; no caudal keels. CARCHARIDAE.
 - ee.*—Caudal lunate, lower lobe little less than upper; side of tail keeled. ISURIDAE.
 - dd.*—First dorsal over or behind ventrals.
 - f.*—Tail long, axis little raised; nasal grooves and nasal cirri present. ORECTOLOBIDAE.
 - ff.*—Tail short, axis not raised; nasal cirri present or absent; nasal grooves absent or rudimentary. SCYLIORHINIDAE.
 - cc.*—First dorsal long, low, much lower than second; upper caudal lobe short; no caudal keels. PSEUDOTRIAKIDAE.
 - bb.*—Tail very long, as long as rest of body. ALOPIIDAE.
- aa.*—Eye with nictitating membrane.
 - g.*—Head normal.
 - h.*—Teeth compressed, triangular, one series functional. EULAMIIDAE.
 - hh.*—Teeth pavement-like, more than one row functional. MUSTELIDAE.
 - gg.*—Head kidney- or hammer-shaped, much wider than long. SPHYRNIDAE.

Carchariidae

Sand Sharks

Body elongate. Axis of tail nearly horizontal. Snout sharp, short. Mouth wide. Lower labial folds present. Teeth slender, edges entire. Dorsals 2. Caudal long, followed by shallow notch. Pectorals rather short.

Sharks of large or moderate size, very voracious, represented by a single genus in most warm seas.

CARCHARIAS Rafinesque

Sand Sharks

Carcharias RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 10. Type: *Carcharias taurus* Rafinesque. Monotypic.

Odontaspis, AGASSIZ, 1836, 'Poiss. Foss.,' III pp. 87, 306. Type: *Squalus ferax* Risso. Monotypic.

Triglochis MÜLLER AND HENLE, 1837, Sitzs. Akad. Wiss. Berlin, p. 113; 1837, Archiv Naturg., p. 395. Type: *Carcharias taurus* Rafinesque. Monotypic.

?*Oxytes* GIEBEL, 1847, 'Faun. Vorwelt.,' I, part 3, 'Die Fische,' p. 364. Type: *Oxytes obliqua* Giebel. Monotypic.

Eugomphodus GILL, 1861, Proc. Acad. Nat. Sci. Philadelphia, p. 60. Type: *Squalus littoralis* Mitchill. Monotypic.

Body fusiform. Head tapering, depressed. No nictitating membranes. Mouth large, arched forward, somewhat protractile. Teeth large, with lanceolate awl-shaped cusp, base two-rooted and with or without denticles on each side of cusp. Gill openings wide, in front of pectorals. Spiracles small, behind the eyes. Dorsals, ventrals, and anal partly equal. Dorsal behind middle in trunk, above space between pectorals and ventrals. Second dorsal and anal rather large. Tail compressed, with pit above. Caudal elongate, lower lobe moderately produced.

Large voracious sharks, living in most warm seas. About four species are known. Many fossils have also been described.

Carcharias taurus Rafinesque

Sarda (Cape Blanco), Semass (Senegambia)

Figure 4

Carcharias taurus RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 10, Pl. VI, fig. 1. Sicily.—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 116 (Santa Luzia Island examples).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 228 (Rio de Oro).—URIARTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2)LIII, p. 10 (Gran Canaria).

Odontaspis taurus ROCHEBRUNE, 1881, 'Faune Sénégalie,' Poiss., p. 23 (Guet N'Dar, Gorée, Dakar, Portendick).—ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 9 (southwest of Santa Luzia Island, Cape Verde, in 16 m.).

Odontaspis americanus METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 189 (Gorrei; Rio de Oro).

Body robust. Head broad, blunt, depressed. Snout small, tapering, tip blunt, length about $\frac{3}{4}$ its width. Eye small, placed at first third in head. Mouth large, nearly long as wide, arched in front. Lower labial fold $\frac{1}{3}$ jaw length, upper rudimentary and hidden. Teeth 40 to 46 rows above, 36 to 40 below, decrease toward corners of mouth, slender middle enlarged cusp long and edge sharp. Some of larger teeth with three or four basal cusps, two on each side. Nostril about midway in space before eye, front valve with somewhat produced lobe near inner edge. Interorbital slightly convex. Third gill opening longest. Skin finely roughened, denticles with

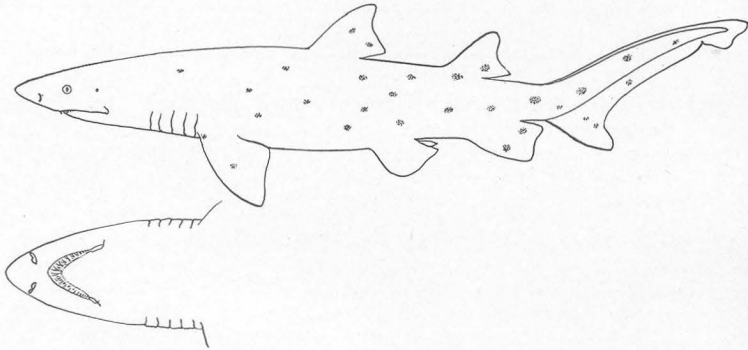


Fig. 4. *Carcharias taurus*.

three keels. Dorsal inserted nearer snout than last caudal vertebra, fin low. Second dorsal slightly smaller than first. Anal about equals second dorsal, inserted just before latter. Caudal rather small. Pectoral and ventral broad, latter rounded and inserted slightly nearer first dorsal than second. Color gray-brown above, whitish below. Some examples mottled or spotted with rusty or darker obscurely, also fin edges dark.

The above description is from American specimens (New Jersey), the largest 2745 mm. The species is distributed on both shores of the warmer parts of the Atlantic and in the Mediterranean. Barnard reports it as *Carcharias taurus* (1925, Ann. South African Mus., XXI, p. 36) from the Cape Seas.

Isuridae

Porbeagles

Body elongate, fusiform, stout. Caudal peduncle depressed, with strong keel on each side. Head partly conic. No nictitating membrane. Mouth large, crescentic, with labial folds. Teeth various. Nostrils oblique, near mouth but not confluent. Gill openings wide, before

pectorals. Spiracles small or obsolete. First dorsal large, second dorsal and anal very small. Caudal lunate, with pits. Pectorals large, falciform.

Large sharks, some of immense size and pelagic.

KEY TO THE GENERA

- a.*—Teeth broadly triangular, edges serrate. **CARCHARODON.**
aa.—Teeth awl-like or moderately compressed, edges entire. **ISURUS.**

CARCHARODON Müller and Henle

Great White Sharks

Carcharodon (A. Smith) MÜLLER AND HENLE, 1838, *Ann. Mag. Nat. Hist.*, London, (2) II, p. 37. Type: *Carcharias verus* Blainville. Monotypic.

Body fusiform, massive in front. Caudal peduncle strong, depressed. Head conic. Snout produced. Eye moderate, pupil erect. Mouth large, crescentic. Teeth large, upper wider. Spiracles small, behind eye, sometimes absent. First dorsal above space before ventrals. Caudal with pits.

These, the celebrated "man-eater sharks," are found in almost all seas of the temperate and torrid zones.

Carcharodon carcharias (Linné)

Sarda (Canaries), Khadjh (Senegambia)

Squalus carcharias LINNÉ, 1758, 'Syst. Nat.', 10th Ed., p. 235. Europe.—BOWDICH, 1825, 'Excurs. Madeira,' p. 233 (Gambia).—LICHTENSTEIN, 1844, 'Descript. Animal. Forster,' p. 2 (Madeira).

Carcharodon carcharias URIATE AND MATEU, 1931 (October 15), *Not. Resúm. Inst. Españ. Océanogr.*, Madrid, (2)LIII, p. 11 (Canaries, San Cristobal, Las Palmas).

Carcharodon rondeletii ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 23 (Guet N'Dar).

Body cavity more than half of length. Snout partly conic, little broader than deep at nostrils, blunted. Eye above front of mouth. Mouth wide. Teeth in 24 to 26 rows, lower with more concave edges. Nostrils small, far apart, nearer mouth and eye than snout tip, with very small projection of front valve. Spiracle little nearer eye than gill opening. Scales small, with 3 keels. First dorsal moderate, entirely before middle of length, behind pectoral bases. Second dorsal very small, like anal, base entirely before anal. Lower caudal pit less developed. Back, slaty brown, sides and below white. Length 2440 mm.

Found throughout the seas of the temperate and torrid zones. Reported as *Carcharodon carcharias* (1925, *Ann. South African Mus.*, XXI, p. 33) by Barnard, from Cape Seas. One of the largest and certainly the most savage of all sharks. Though this fish is reported from Madeira and Senegambia, I have examined but few examples, and these are American. The above description is from notes on a New Jersey specimen. The species is said to reach a length of 9150 mm. or more.

ISURUS Rafinesque

Porbeagles

Isurus RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 11. Type: *Isurus oxyrinchus* Rafinesque. Monotypic.

Lamna CUVIER, 1817, 'Règne Animal,' II, p. 126. Type: *Squalus cornubicus* Gmelin. (Designated by Gill, 1861, Ann. Lyc. Nat. Hist. New York, VIII, p. 32.)

Lamna (not Faber, 1775) RISSO, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 123. Type: *Squalus cornubicus* Gmelin. Monotypic.

Selanonius FLEMING, 1823, 'Hist. Brit. Animal.,' p. 169. Type: *Squalus selanoneus* Walker. Monotypic.

Oxyrhina AGASSIZ, 1836, 'Poiss. Foss.,' III, pp. 87, 276. Type: *Lamna oxyrhina* Valenciennes. Monotypic.

Oxyrhina auct.

Exoles GISTEL, 1848, 'Naturg. Thierr.,' p. ix. Type: *Squalus cornubicus* Gmelin. (*Exoles* Gistel proposed to replace *Lamna* Cuvier.)

Plectrostoma GISTEL, *op. cit.*, p. x. Type: *Lamna oxyrhina* Valenciennes. (*Plectrostoma* Gistel proposed to replace *Oxyrhina* Agassiz.)

Iuropsis GILL, 1862, Ann. Lyc. Nat. Hist. New York, VII, pp. 398, 408. Type: *Oxyrhina glauca* Müller and Henle. Orthotypic.

Anatodus LE HON, 1871, 'Prélim. Mém. Poiss. Tert. Belgique,' p. 8. Type: *Anatodus agassizii* Le Hon. Monotypic.

Body short, stout, back somewhat elevated, resembling mackerel and tunny. Caudal peduncle slender. Snout long, pointed. Teeth long, lanceolate or triangular, entire; bases two-rooted. Gill openings wide, before pectorals. First dorsal large, entirely or close behind pectorals, or nearly midway between latter and ventrals. Second dorsal and anal very small, former smaller. Caudal lunate, with large lower lobe. Pectorals large, partly falciform.

Large fierce sharks mostly of cool seas, with about seven species. A number of fossils, represented by seventy or more species, have been described from fragments, teeth, etc. The common name porbeagle is derived from porpoise and beagle, the hunting dog.

KEY TO THE SPECIES

- a.—LAMNA. Each tooth with a small point or denticle each side of base in adult.
nasus.
- aa.—ISURUS. Teeth without basal denticles at all ages.
- b.—First dorsal origin opposite end of base of pectoral fin.....*oxyrinchus*.
- bb.—First dorsal origin opposite tip of depressed pectoral fin.....*cepedii*.

Isurus nasus (Bonnaterre)

Requim, Nequim (Madeira)

Figure 5

Squalus nasus BONNATERRE, 1788, 'Tabl. Ichth.,' p. 10, Pl. LXXXV, fig. 350 (on Porbeagle Pennant, 1776, 'Brit. Zool.,' III, p. 117, Cornwall; Broussonet, 1780, Act. Paris, p. 667. Atlantic).

Lamna cornubica LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 194 (Madeira).

Body compressed, scarcely depressed forward, deepest at dorsal origin, depth about $6\frac{1}{3}$. Head depressed, width 3 in its length, which 5 in body. Snout broad as long, length $2\frac{2}{5}$ in head. Eye laterally superior, little before middle in head, diameter $7\frac{3}{4}$. Mouth large, front edge of upper jaw about midway between snout tip and mouth corner or little before eye; no folds or grooves at mouth corners. Teeth rows 28 above, 26 below, directed inward, entire, most with single outer minute basal cusp and many with another similar one inside. Internasal twice space between each nostril and front edge of mouth. Interorbital broadly depressed, $3\frac{3}{4}$ in head. First gill opening longest. First dorsal origin midway between snout tip and depressed second dorsal tip, fin $2\frac{2}{5}$ in head. Second dorsal origin little nearer that of first than caudal tip. Anal little longer than second dorsal, opposite. Caudal lobes broad. Pectoral larger than first dorsal, $1\frac{1}{4}$ in head, $1\frac{3}{5}$ to ventral origin or not quite to hind basal edge of first dorsal. Ventral origin midway between hind basal edge of first dorsal and second dorsal origin, 3 in head, $1\frac{5}{8}$ to second dorsal origin. Above gray-brown, pale or whitish below, line of demarcation along side of caudal peduncle sharply defined. Length 700 mm.

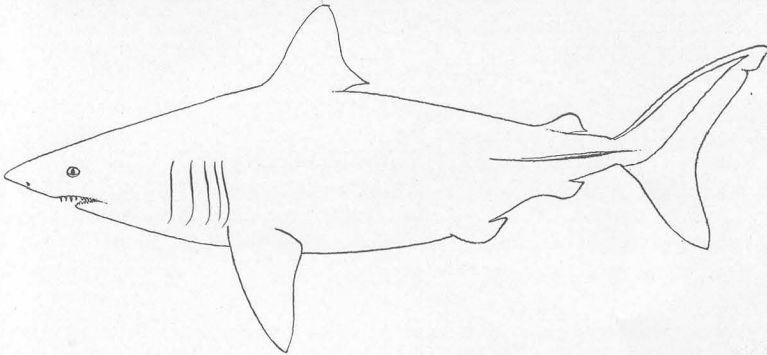


Fig. 5. *Isurus nasus*.

Atlantic and Pacific Oceans. Described above from an Italian example. A fierce pelagic shark of the open sea. It devours great quantities of squid, herring, other small sharks, etc.

Isurus oxyrinchus Rafinesque

Janiquin (Canaries), Endojh (Senegambia)

Isurus oxyrinchus RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.', p. 12, Pl. XIII, fig. 1. Sicily.

Isurus oxyrhynchus URIARTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2)LIII, p. 12 (Gran Canaria).

Oxyrhina gomphodon ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 22 (Leybar, Margingouins, Saloum, Thionk, Bango, Gorée, Dakar, Rufisque).

Lamna spallanzanii GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 390 (Madeira).—HILGENDORF, 1888, Archiv Naturg., p. 213 (Azores).—STEINDACHNER, 1891, Sitzs. Akad. Wiss. Wien, C (1), p. 363 (Latiñosa, Canaries).

Crown of head depressed. Snout long, pointed, subconic. Eye small, little advanced to middle of mouth. Mouth large, equals preoral, angles midway from end of snout to pectorals. Teeth large, without basal denticles, 26 rows above, 24 to 26 rows below; cusp lanceolate, strong, curved, with sharp edges; base two-rooted, rather swollen; third tooth of upper jaws much smaller than second or fourth. Nostrils much nearer mouth than snout tip. Width of gill openings nearly equals preoral length. Spiracles minute, above and somewhat behind mouth angle. Dorsal origin nearly above end of pectoral base; dorsal base nearly $1/3$ interdorsal base, about equals its distance from ventral origins. Second dorsal origin before anal origin. Caudal large, lunate, subcaudal lobe greatly developed, blunted. Pectorals large, falciform, base and inner edge together equal about half outer edge, outer angle sharp, hind margin deeply concave. Bluish gray to brown, white beneath. (Garman.)

Found in the Mediterranean and Atlantic. According to Duméril, it reaches a length of 3 m. 21 cm. I have examined the jaws of a large specimen now in the Academy. Though data is lacking, it might possibly have been obtained in Italy.

***Isurus cepedii* (Lesson)**

Squalus (Lamna) cepedii LESSON, 1830, 'Voy. "Coquille,"' II (1), p. 93. Lat. S. 6° , long. W. 27° , in South Atlantic.

Lamna glauca GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 391 (St. Helena).—MELLISS, 1875, 'St. Helena,' p. 113.—GÜNTHER, 1910, Jour. Mus. Godefroy, XVII, p. 484 (St. Helena).—CLARK, 1913, Proc. Roy. Phys. Soc. Edinburgh, XIX, p. 384 (Ascension Island).

Head about 4 in total length, crown depressed. Snout subconic, larger than mouth. Mouth long as wide; sides straight to broadly arched anterior portion; labial folds nearly half length of jaw, at inner edge of lips. Teeth long, slender, unequal, 24 rows above and 22 below, sharp-edged, outlines sinuate, without basal denticles. Nostrils small, width $2/5$ of orbit, nearer eye than snout end. Width of gill openings equals snout, last before pectoral. Spiracles minute, last above mouth angle. First dorsal origin near vertical from ends of pectoral, front edge strongly curved; base about half its length, farther back than that of pectoral, length little greater than height of fin, more than $1/3$ its distance from second dorsal; hind angle rather short but sharp; greater part of hind margin vertical. Second dorsal very small, base almost entirely before front of anal. Outer pectoral edge about 4 times long as inner, angles rounded, hind edge slightly concave. Ventrals below middle of space between dorsals. Back dark bluish or blackish brown, dark color distinctly limited on level of caudal carinae from white of lower surfaces. (Garman.)

Japan, California, Cape Seas, and tropical Atlantic. Reported by Barnard as *Isurus glauca* (1925, Ann. South African Mus., XXI, p. 33) from Cape Seas. Reaches 1 m. 50 cm. I have seen a California example. *Squalus (Lamna) cepedii* Lesson appears to be the oldest name for this shark. Though Lesson's description is detailed, it is not sufficiently so in some respects. His account, freely translated, is as follows:

Body fusiform. Snout elongate, pointed, conic, very depressed below. Eyes large, superior. Mouth inferior, with 2 rows of strong teeth, which are triangular, smooth, and cutting. Nostrils sigmoid, small, inferior. Gill openings before and little above pectoral. First dorsal little backward, hind edge deeply emarginate and ending in long point. Second dorsal very close to tail; conic and posterior basal end slender, pointed lobe. Anal placed opposite second dorsal origin, emarginate behind. Tail deeply forked, lower lobe pointed. Pectoral falcate. Ventral emarginate behind. Bluish sea-green to gray above. White below. Eye clear blue. Length 1830 m.

Orectolobidae

Nurse Sharks

Body short, subcylindrical to moderate and depressed. Head narrow. Snout medium to broad and short. Eyes small, without nictitating membrane. Mouth transverse, with labial folds around angle of both jaws. Teeth compressed, with or without lateral cusps at each side of median. Nostrils with nasoral groove and with cirrus on front nasal valve. Gill openings small to medium, last 2 or 3 above pectorals. Spiracle minute and behind eye to large and more or less inferior. Fins short and broad. Tail long and slender with short caudals, to rather short with long caudals. No fin spines and no caudal pits.

About ten genera.

GINGLYMOSTOMA Müller and Henle

Nurse Sharks

Ginglymostoma MÜLLER AND HENLE, 1837, Sitzs. Akad. Wiss. Berlin, p. 113; 1837, Archiv Naturg., p. 396. Type: *Squalus cirratus* Gmelin. (Designated by Hay, 1902, Bull. U. S. Geol. Survey, 179, p. 310.)

Plicodus WINKLER, 1874, Arch. Mus. Teyler, Haarlem, III, p. 301. Type: *Plicodus thielensis* Winkler. Monotypic.

Acrodobatis LEIDY, 1877, Jour. Acad. Nat. Sci. Philadelphia, (2) VIII, p. 250. Type: *Acrodobatis serra* Leidy. (Designated by Hay, *op. cit.*, p. 310.)

Acrodontobatis LEIDY, *loc. cit.* (nom. orig.).

Body medium, depressed and broadened forward, compressed behind. Head wide. Snout short and blunt. Eyes small, without fold. Mouth broad, inferior, little curved. Teeth small, 28 rows above, 27 rows below, compressed, 3-5 cusped, with strong, sharp cusp, at each side of which is a pair of denticles, median cusp strongest, several series in function. Nostrils near end of snout; front nasal valves reach mouth, broadly separated by attachment across symphysis, each with cylindrical cirrus at outer edge; hind valve fold on outer side of groove. Gill openings moderate, fourth and fifth widest, close together above pectoral. Spiracle minute, well behind the eye. Dorsals rather close; first larger, above ventrals; second dorsal origin forward of anal. Caudal large, subcaudal not lobed.

Tropical Atlantic, Pacific, and Indian Oceans.

Three species.

Ginglymostoma cirratum (Bonnaterre)

Frontispiece

Squalus cirratus BONNATERRE, 1788, 'Tabl. Ichth.,' p. 7. Seas of America. (On "Le Barbillon" Broussonet, 1780, Mém. Acad. Sci. Paris, p. 656.)

Ginglymostoma cirrhatum DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 261 (Gorée).

Ginglymostoma cirrhatum ROCHEBRUNE, 1883, 'Faune Sénégalaise,' Poiss., p. 24 (Gorée, Rufisque, Joalles).

Ginglymostoma cirratum OSORIO, 1898, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 200 (Cape de Verde).—ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 5 (south of Santa Luzia Island, Cape Verde, in 17 m.); 1919, Rés. Camp. Sci. Monaco, LII, p. 113 (same example).

Ginglymostoma caboverdianus CAPELLO, 1866–1868, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, I, No. 2, p. 167. S. Thiago de Cabo-Verde; 1872, *op. cit.*, p. 88 (S. Thiago).

Body rather cylindrical, sides more compressed behind, deepest at preventral region, depth $7 \frac{2}{5}$ to 8. Head depressed, $5 \frac{1}{2}$ to $5 \frac{4}{5}$ in body, about broad as long. Snout broadly depressed, length $\frac{7}{8}$ its width, $1 \frac{5}{6}$ to 2 in head. Eye lateral, much longer than deep, front edge about midway in head, diameter 8 in head. Mouth advanced, preoral $2 \frac{2}{3}$ its width, latter $2 \frac{1}{5}$ to $3 \frac{1}{2}$ in head; broad well-marked lower fold at each corner forward about $\frac{1}{3}$ its entire width; upper fold more narrow, extends more forward or toward nasal. Teeth rather small, little larger in lower jaw, where there are about 30 rows. Nostrils large, internasal nearly equals mouth width. Interorbital broad, slightly convex, $1 \frac{2}{5}$ to $1 \frac{3}{5}$ in head. Scales smooth or with low keel. First dorsal a little nearer pectoral origin than origin of lower caudal lobe; second dorsal close behind first, or midway between first dorsal origin and origin of upper caudal lobe. Caudal long, upper lobe scarcely developed, tip notched to form a long broad lower lobe. Pectoral a little longer than second dorsal, wide, hind edge straight, length $1 \frac{1}{8}$ to $1 \frac{1}{5}$ in head. Ventral reaches $\frac{3}{5}$ to anal, $1 \frac{3}{5}$ to 2 in head. Uniform brown, with pale yellowish to grayish tints. Young with scattered dark brown to dusky spots. Length 318 to 585 mm.

Found in the tropical Atlantic. The above description from American examples (Florida and West Indies).

Scyliorhinidae

Cat Sharks

Body short, subcylindrical. Snout depressed. Nictitating membrane of eye rudimentary, lower eyelid functioning in its place and closing within upper lid. Mouth large, below head, upper lip generally hiding lower at angles. Teeth small, numerous, acute, several rows functional. Nasal cirri absent or present. Nasoral grooves absent or rudimentary. Gill openings five, last above pectoral base. Spiracles present. Scales small, with one to several cusps, median and its keel usually sharper. Dorsal fins 2 (1 in *Pentanchus*), spineless, placed behind body cavity. Anal fin present. Tail without keels or pits; caudal fin long,



Nurse Sharks (*Ginglymostoma cirratum*).

axis little raised and lower lobe not produced. Eggs enclosed in horny cases.

Eleven genera.

KEY TO THE GENERA

- a.*—Lower labial folds present, none on upper jaw. *SCYLIORHINUS*.
aa.—Labial folds around mouth angles. *GALEUS*.

SCYLIORHINUS Blainville

Cat Sharks

Scyliorhinus BLAINVILLE, 1816, Bull. Soc. Philom., Paris, p. 121. Type: *Squalus canicula* Linné. (Designated by Hay, 1902, Bull. U. S. Geol. Survey, No. 179, p. 310.)

Scyliorhinus auct.

Catulus (not Kniphof, 1759) VALMONT, 1768, 'Dict. Hist. Nat.,' IV, p. 51; 1769, XII, p. 421. Type: *Catulus vulgaris* Valmont = *Squalus canicula* Linné. (Inadmissible.)

Scyllium CUVIER, 1817, 'Règne Animal,' II, p. 124. Type: *Squalus canicula* Linné. (Designated by Jordan and Evermann, 1917, Stanford Publications, 'Genera of Fishes,' part 1, p. 97.)

Scylliodus AGASSIZ, 1843, 'Poiss. Foss.,' III, p. 377. Type: *Scylliodus antiquus* Agassiz. Monotypic.

Thyellina AGASSIZ, *op. cit.*, p. 378. Type: *Thyellina angusta* Agassiz. Monotypic.

Body shorter than tail. Head short. Snout blunt and short. Mouth large; labial fold on lower jaw. Teeth in many rows, each tooth with median larger cusp, and from one to several small lateral cusps. Nostrils distinct from mouth, or, in species in which hind nasal valve cirroid, with rudimentary nasoral groove. Front nasal valves not confluent across internarial space, cirri absent or rudimentary. Gill openings small, last above pectoral. Spiracles small, close to corner of eye. Dorsals and anal small, anal largest. First dorsal above or behind ventral bases. Caudal short. Ventrals of male more or less conerescent above claspers.

About eight species.

Scyllium marmoratum Bennett is recorded from the Atlantic coast of north Africa by Bennett,¹ who says, "among the previously described species contained in the collection was a specimen of *Scyllium marmoratum* Benn. (Memoirs of Sir T. Stamford Raffles, Appendix) hitherto only known as an inhabitant of the Indian seas." No subsequent record has ever been given, and Bennett's north African example does not appear to have been noticed by writers who examined the British Museum collections.

KEY TO THE SPECIES

- a.*—Each hind nasal valve with cirrus; first dorsal between ends of ventral bases; second dorsal slightly above anal base. *canicula*.
aa.—Each hind nasal valve not cirroid; first dorsal at ends of ventrals; second dorsal base with half its length behind anal base. *stellaris*.

¹ 1831, Proc. Zool. Soc. London, p. 148.

Scyliorhinus caniluca (Linné)

Tollo, Cazon, Gata (Canaries)

Figure 6

Squalus canicula LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 234. European Ocean.
Scyllium canicula OSORIO, 1895 (March), Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 253 (Dahomey); 1898, *op. cit.*, (2) V, p. 200 (Dahomey, Anno Bom).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 391 (off Morocco, in 141 m.; off Cape Bojador, in 214 m.).

Scyliorhinus canicula PIETSCHMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 98 (Atlantic coast of Morocco).

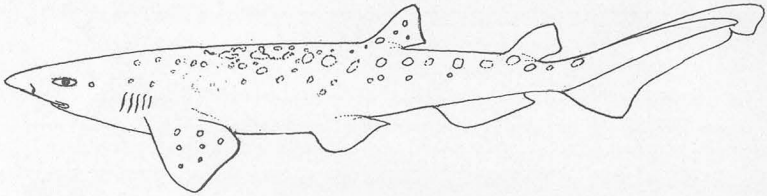
Catulus caniculus URIARTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2)LIII, p. 13 (Canaries).

Squalus catulus LICHTENSTEIN, 1844, 'Descript. Animal. Forster,' p. 2 (Madeira).

Scyllium? *spinacipellitum* VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 60, Pl. I, figs. 3-3a (scales). Off Canary Islands, in 975 m.

Scyllium? *acutidens* VAILLANT, *op. cit.*, Pl. I, figs. 4 (scale). Off Canary Islands, in 946 m.

Scyliorhinus canicula var. *albomaculata* PIETSCHMANN, *op. cit.*, p. 98. Atlantic coast of Morocco.

Fig. 6. *Scyliorhinus canicula*.

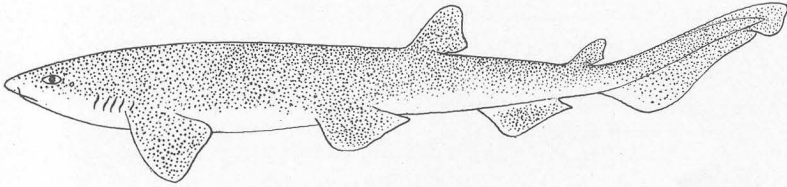
Snout short, broadly rounded. Eyes moderate. Mouth wide, much curved; lower labial fold extends halfway to symphysis of mandible. Nostrils nearer mouth than end of snout; front nasal valves reach mouth in broad flap, in which narrowly separated at point of attachment in front of symphysis of jaws; very rudimentary cirrus on each valve; hind nasal valve narrow, short cirroid; nasoral groove shallow. First dorsal origin short distance farther back than ends of ventral bases; second dorsal smaller, origin above last fourth of anal base. Anal base $1\frac{2}{3}$ longer than first dorsal base; tip of fin ends below middle of second dorsal base, or farther back. Ventrals very oblique, those of male joined above claspers and more produced. Light rusty or reddish brown, thickly sprinkled with small brown spots, smaller than eye, grading to mere dots, on back and flanks; larger and more scattered on fins and on lower flanks. Length to 610 mm. (Garman.)

Found in the Mediterranean and Atlantic northward to the British Isles and Scandinavia. The nominal *Scyllium?* *spinacipellitum* Vaillant and *Scyllium?* *acutidens* Vaillant, described from their scales only, appear to be likely variants of the present species.

Scyliorhinus stellaris (Linné)

Pintarroja, Lija o lixa, Zapa, Remudo (Canaries)

Figure 7

Squalus stellaris LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 235. European Seas.*Scyllium stellare* VINCIGUERRA, 1890, Lo Spallanzani, Roma, (2) XIX, p. 468 (Spanish Sahara).—PELLEGRIN, 1912, Bull. Soc. Zool. France, XXXVIII, p. 258 (Morocco).*Catulus stellaris* CHABANAUD AND MONOD, 1926, Bull. Com. Étud.-Hist. Sci. Af.-Occ. française, 228 (Cape Blanco; Rio de Oro).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 185 (Cape Blanco).—URIARTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2) LIII, p. 13 (Canaries, Gran Canaria).*Scyliorhinus stellaris* PIETSCHMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 98 (Atlantic coast of Morocco).Fig. 7. *Scyliorhinus stellaris*.

Body long, slender, depressed only anteriorly, otherwise well compressed, depth 9 to last caudal vertebra. Head moderately small, well depressed. Snout width at front of eyes $1\frac{2}{5}$ its length, latter $2\frac{1}{5}$ in head. Eye elongate, trifle behind middle in head length, $4\frac{1}{3}$ in head, lids deep. Mouth moderate, broadly rounded at symphysis which is a trifle before front of eye. Snout protrudes beyond mouth a distance equal to length of gape; width of mouth $2\frac{1}{8}$ in head; rictal groove rather deep, not extended back far; inside corner of mouth short groove forward half length of mandibular ramus; lips firm. Teeth rather small, numerous, mostly alike in jaws, and most tricuspid, or median cusp greatly enlarged and other 2 small; lateral teeth all small, no distinct cutting edge formed. Nostrils large, confluent with mouth in front, each with large broad, fleshy flap only separated from its fellow by very narrow interspace, and behind cavity with rather short firm cirrus; situated at last fourth in snout as measured to eye. Interorbital broad, little elevated convexly, $2\frac{1}{4}$ in head.

First gill opening longest, about half of eye. Scales small, tridentate, with median cusp largest. First dorsal origin nearer snout tip than caudal tip by snout length. Second dorsal origin little behind last third between first dorsal origin and caudal tip. Anal inserted well behind first dorsal base. Caudal, from origin of lower lobe, $3\frac{2}{5}$ in rest of body. Pectoral short, broad, hind edge straight, greatest width about half length and reaches little over half way to ventral. Latter inserted about midway between snout tip and hind edge of second dorsal, broad, rounded. Claspers short,

rather well developed, covered with large external sheath, only notched above medianly at tip.

Dull brown, back entirely variably spotted with deeper brown; on predorsal slightly mottled, and posteriorly other spots larger and better defined. A few spots also on dorsal, caudal, and pectoral above. Iris dull slaty. Lower surface pale to whitish, immaculate. Length 459 mm.

Eastern Atlantic and Mediterranean. Described above from an Italian example.

GALEUS Rafinesque

Rough Cat Sharks

Galeus RAFINESQUE, 1810, 'Caratteri Nuov. An Sicil.,' p. 13. Type: *Galeus melastomus* Rafinesque. (Designated by Fowler, 1908, Proc. Acad. Nat. Sci. Philadelphia, p. 53.)

Pristiurus BONAPARTE, 1834, 'Fauna Ital.,' Pesci, (3) VII. Type: *Galeus melastomus* Rafinesque. Monotypic.

Pristidurus BONAPARTE, 1839, Mém. Soc. Sci. Neuchâtel, II, p. 11. Type: *Galeus melastomus* Rafinesque.

Body cavity less than half total length. Snout elongate. Eye large, lower lid with fold. Mouth large, labial folds on both jaws around angles. Teeth small, numerous, 3 to 7 cusps, median cusp strongest. Front nasal valves without cirri, widely separated from one another and from mouth; hind nasal valves short, not extended backward. Spiracle small, near eye. Gill openings small, last above pectoral base. Dorsals small; anal and subcaudal rather large; vertebral axis of caudal not raised. Upper caudal edge usually has modified scales above a sensory area. Muscular portions of pectoral bases closely enveloped by body muscles.

Mediterranean and Atlantic, Pacific to Formosa and Japan.

Galeus melastomus Rafinesque

Leitão do Mar (Madeira), Black mouth Dogfish

Figure 8

Galeus melastomus RAFINESQUE, 1810, 'Caratteri Nuov. An Sicil.,' p. 13. Sicily.

Pristiurus melanostomus LOWE, 1846-1860, 'Fishes of Madeira,' I, p. 93, Pl. XIV (Madeira).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 406 (Madeira).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 391 (off Morocco in 535 m.).

Scyllium artedi LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 194 (Madeira).

Pristiurus atlanticus VAILLANT, 1888, 'Expéd. "Travailleur" et du "Talisman,"' Poiss., p. 58, Pl. I, fig. 1a-d. Cape Spartel, Morocco, in 540 m.—BRAUER, 1906, 'Wiss. Ergeb. "Valdivia,"' XII, p. 366 (copied).

Body long, slender, depressed only anteriorly, depth 10 to 14 7/8 to last caudal vertebra. Head greatly depressed, as long as wide. Snout width at front of eyes equals its length, latter 2 to 2 1/8 in head. Eye elongate, large, near last 3/8 in head, 3 3/4 to 4 2/3 in head, lids deep. Mouth moderately large, broad or obtusely triangular, width 2 to 2 4/5 in head; mandible tip opposite front eye edge; short outer and inner groove at mouth corner; lips rather thin. Teeth very sharp, numerous, rather small, alike in jaws, tricuspid, median cusp largest. Nostrils large, placed

about last third between snout tip and mouth, interspace little greater than length of either. Interorbital wide, slightly convex, 2 to $2\frac{2}{3}$ in head.

Second gill opening largest, $1\frac{1}{3}$ in eye. Scales tridentate; upper caudal edge, from origin to $\frac{3}{5}$ its extent, with series of backwardly directed denticles on each side, large at first and diminishing behind, though inconspicuous, sharp and rough to touch. First dorsal origin nearer snout tip than caudal. Second dorsal origin near first third in space between first dorsal origin and caudal tip. Anal inserted slightly behind first dorsal base. Caudal from origin of lower lobe, $2\frac{1}{2}$ to $3\frac{3}{5}$ in rest of body. Pectoral short, broad, rounded, lower hind edge nearly straight, reaches about $\frac{2}{3}$ to ventral, the latter inserted midway between front part of nostril and lower caudal lobe origin, broad, edges rounded.

Dull brown, paler below. Length 177 to 480 mm.

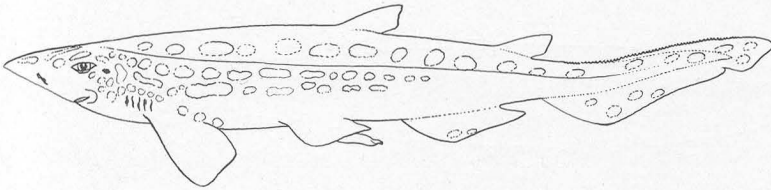


Fig. 8. *Galeus melastomus*.

Found in the Mediterranean and northward on the Atlantic coast of Europe to Norway. The above description from Mediterranean examples.

Pseudotriakidae

Body long. Snout depressed. Eyes lateral, oblong, without nictitating folds. Mouth wide. Jaws with many rows of small tricuspoid teeth. Nostrils separate from one another and from mouth, inferior. Gill openings moderate, before pectoral. Spiracles moderate in size. First dorsal above body cavity, before ventrals. Second dorsal present. Caudal very low and long, without basal pits. Pectorals and ventrals well developed.

PSEUDOTRIAKIS Capello

Pseudotriakis CAPELLO, 1866-1867 (1868), *Jorn. Sci. Math. Phys. Nat., Acad., Lisboa*, I, No. 4, p. 315. Type: *Pseudotriakis microdon* Capello. Monotypic.

Pseudotriakis auct.

Snout short, tapering, end blunted. Mouth very large, with short labial folds around angles on both jaws. Teeth numerous, small, with strong median cusp and small lateral cusps. Nostrils near mouth. First dorsal longer than second, highest behind, inserted between pectoral and ventral. Second dorsal larger than anal. Subcaudal not produced in lobe.

Probably a single species widely distributed in deep water.

***Pseudotriakis microdon* Capello**

Figure 9

Pseudotriakis microdon CAPELLO, 1867, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, I, No. 4, p. 315, Pl. v, fig. 1. Portugal.—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 114 (seven miles southwest Sal Island, Cape Verde, in 1477 m.).

Pseudotriakis microdon MONACO, 1904 (February 20), Bull. Inst. Océanogr. Monaco, No. 6, p. 10 (Azores, in 1500 m.).—JAQUET, 1915 (May 15), Bull. Inst. Océanogr. Monaco, No. 36, p. 1 (Cape Verde example).—RICHARD, 1910 (February), Bull. Inst. Océanogr. Monaco, No. 162, p. 152, Fig. 109 (near Cape Verde in 1477 m.).—ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 6 (Sal Island example).

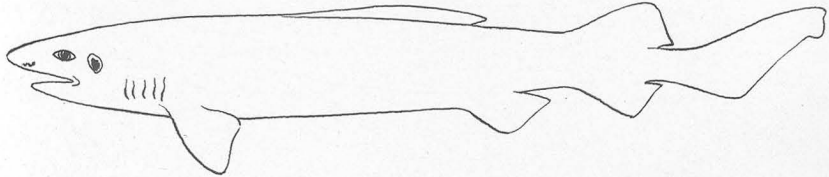


Fig. 9. *Pseudotriakis microdon*, after Goode and Bean.

Body moderately stout, caudal region shorter. Head 5 in total length, depressed. Snout short, tapering, blunt. Mouth large, reaches forward nearly halfway from eye to snout end, width nearly 3 times preoral length. Last gill opening above pectoral. Spiracle moderate, its length half width of fourth gill opening. First dorsal long, low, origin backward from end of pectorals, distant from snout little more than twice pectoral length. Second dorsal higher and shorter than first, base longer than interdorsal space, hind angle slightly produced. Anal entirely below second dorsal, base $\frac{2}{3}$ length of latter. Subcaudal without produced lobe, separated from terminal by notch, origin below end of anal fin. Ventral origins little before hind end of first dorsal base. Brown, hind edges of ventrals, second dorsal, anal, and caudal darker. (Garman).

Atlantic Ocean. Reaches 3050 mm. in length.

Alopiidae

Thresher Sharks

Body fusiform, moderately elongate. Axis of tail elevated. Head short, rounded. Snout rather short. Mouth arched, with labial folds. Teeth entire, equal in jaws. Gill openings moderate, last above pectoral origin. Spiracles minute or absent, if present close behind eye. First dorsal large, midway between pectorals and ventrals. Second dorsal and anal very small. Caudal exceedingly long, about equal to rest of

body, or a little longer, upper lobe notched near tip and lower lobe moderate. Caudal pit present. No caudal keel. Pectorals very large.

Sharks remarkable for their extremely long tails, by means of which they may be distinguished from all other sharks. The common name thresher or thrasher is applied from the resemblance to one who thrashes, as they beat the water with their long tails.

ALOPIAS Rafinesque

Thresher Sharks

Alopias RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 12. Type: *Alopias macrourus* Rafinesque. Monotypic.

Alopecias MÜLLER AND HENLE, 1838, 'Besch. Plagiostomen,' p. 74. Type: *Alopias macrourus* Rafinesque.

Vulpecula VALMONT, 1769, 'Dict. Hist. Nat.,' Paris, IX, p. 530; 1769, XII, p. 624. Type: *Vulpecula marina* Valmont. Monotypic. (Inadmissible.)

Carcharhinus BLAINVILLE, 1816, Bull. Soc. Philom., Paris, p. 121. Type: *Squalus vulpes* Gmelin. (Designated by Fowler, 1907 (1908), Proc. Acad. Nat. Sci. Philadelphia, p. 63.)

Carcharinus, *Carcharhinus* auct.

Body slightly compressed. Snout partly conic, blunt. Eyes large, pupil vertical. Teeth compressed, triangular, bases two-rooted, moderate in size. Nostrils transverse. Caudal peduncle compressed. Probably a single species, widely distributed.

***Alopias vulpinus* (Bonnaterre)**

Peixe Cavallo (Madeira)

Squalus vulpinus BONNATERRE, 1788, 'Tabl. Ichth.,' p. 9, Pl. LXXXV, fig. 389. Mediterranean.

Carcharias vulpes LOWE, 1837, Trans. Zool. Soc. London., II, part 3, p. 194 (Madeira).

Alopias vulpes LOWE, 1852, Ann. Mag. Nat. Hist., London, (2) X, p. 55 (Madeira).

Alopecias superciliosus LOWE, 1839, Trans. Zool. Soc. London, III, part 1, p. 18 (Madeira); 1840, Proc. Zool. Soc. London, VIII, p. 39 (Madeira).

Body robust, compressed, back elevated and with more convex profile than abdomen. Caudal peduncle short, without pits. Tail longer than body. Head rather large, deep, little compressed. Snout broad, length about half its width. Eye large, anterior. Mouth moderate, outer labial fold half its length, inner fold half the length of outer. Teeth small, 28 to 42 rows, each simple. Forehead steep, wide. Nostrils small, nearer mouth than snout tip, nearly midway from eyes. Front nasal valve with short lobe near inner edge. Spiracle minute or imperfect. Scales with 5 keels. First dorsal inserted nearly midway between hind eye edge and origin of second dorsal, high as long. Second dorsal and anal small, about equal, former advanced. Pectoral long, falcate, not reaching ventral. Latter broad, inserted little nearer first dorsal than second. Color dark slaty brown or gray-brown above to level of spiracle, below which contrasted with white of lower surface. Lower sides of pectoral and space below gill opening dark. Length 3050 to 4725 mm.

Almost all warm seas. Described from American (New Jersey and Rhode Island) and Italian examples. Reported as *Alopias vulpes* (1925, Ann. South African Mus., XXI, p. 34) from the Cape and Natal seas by Barnard.

Eulamiidae

Requiem Sharks

Body elongate. Head normal, depressed. Snout depressed, lengthwise, and normally produced. Eyes lateral, with nictitating membranes. Mouth inferior, crescentic. Teeth small, many rows, cuspidate. Nostrils below snout. Gill openings moderate, last above pectoral base. Spiracle small or absent. Oviparous. Dorsals two, first high, above space between pectorals and ventrals. Second dorsal smaller, opposite anal. Tail compressed, without keels, mostly bent up.

The largest group of recent sharks, with many closely related species, difficult to determine, and found in almost all seas. About twenty or more genera, several extinct. The teeth of both living and fossils appear to be the most useful characters in classification.

KEY TO THE GENERA

- a.—Spiracle absent.
 - b.—Teeth entire.
 - c.—Bases of teeth not swollen, cusps oblique in both jaws. SCOLIODON.
 - cc.—Cusps rather slender, upper nearly erect, lower erect. APRIONODON.
 - bb.—Teeth partly or entirely serrated.
 - d.—First dorsal near pectorals. EULAMIA.
 - dd.—First dorsal near ventrals. GLYPHIS.
- aa.—Spiracle small; teeth serrated, notched, oblique; labial folds present.
 - e.—Spiracle minute; subcaudal long. GALEOCERDO.
 - ee.—Spiracle small; subcaudal short. GALEORHINUS.

SCOLIODON Müller and Henle

Sharp-nosed Sharks

Scoliodon MÜLLER AND HENLE, 1837, Sitzs. Akad. Wiss. Berlin, p. 114; 1837, Archiv Naturg., p. 197. Atypic. Type: *Carcharias (Scoliodon) laticaudus* Müller and Henle, here affixed to both references.

Body compressed. Head depressed. Snout blunt, elongate. Mouth greatly arched, with short labial folds at angles. Teeth alike in jaws, entire or nearly so, oblique, flat, bases wide, pointed toward mouth corners so inner edges become mostly horizontal, front ones more erect. Teeth not swollen at bases but each with deep notch on outer edge below sharp point. Median upper tooth and two teeth at symphysis of lower jaw, smaller in some species. Scales minute, with 3 to 5 keels. Caudal pits distinct and lower caudal lobe prominent.

This genus scarcely distinct from *Eulamia*. It includes small sharks of about seven species, in most warm seas.

KEY TO THE SPECIES

- a.—Labial folds on both jaws, upper little longer.....*terrae-novae*.
 aa.—Labial folds short, only on lower jaw.....*acutus*.

Scoliodon terraenovae (Richardson)

Squalus (*Carcharias*) *terraenovae* RICHARDSON, 1836, 'Faun. Bor.-Amer.,' III, p. 298. Newfoundland.

Carcharias (*Scoliodon*) *terraenovae* METZELAAR, 1910, 'Rapp. Kolonie Curaçao,' II, p. 186 (West Africa).

Carcharias (*Scoliodon*) *terraenovae* LAMPE, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 213 (Mindello, São Vicente, Cape Verde).

Scoliodon terraenovae CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 229 (Cape Blanco).—MONOD, 1927, 'Faune Colon. françaises,' p. 646 (on Pietschmann).

Carcharias eumeces PIETSCHMANN, 1913, Jahrb. Nassau. Ver. Naturk. Wiesbaden, LXVI, p. 172, Pl. I (Bibundi, Cameroon).

Scoliodon eumeces FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 294 (Elmina, Ashantee).

Body compressed, depth $8 \frac{2}{3}$ to $9 \frac{1}{5}$. Head depressed, $4 \frac{1}{2}$ to $5 \frac{1}{8}$; width $1 \frac{2}{3}$ to $1 \frac{3}{4}$ its length. Snout greatly depressed, long, end blunt, 2 to $2 \frac{1}{10}$ in head. Eye about an eye diameter nearer gill opening than snout tip, $3 \frac{3}{4}$ to $4 \frac{1}{2}$ in snout. Nictitating membrane below eye forward. Mouth greatly arched, wider than cleft. Upper labial fold little longer, about fourth of upper jaw. Teeth alike, 23 or 24 below, 25 above, edges entire, bases wide; at front of upper jaw 1 or 2 erect teeth, 2 or 3 in front of lower. Interorbital broadly convex, $2 \frac{1}{6}$ to $2 \frac{1}{4}$ in head. Gill openings about as wide as eye. Scales with 3 ribs ending in as many points, and median longest. First dorsal origin opposite end of inner pectoral angle, extended end behind, reaching opposite ventral origin. Second dorsal base about $1 \frac{1}{2}$ of anal base and $\frac{1}{3}$ above end of anal base. Second dorsal end behind $1 \frac{1}{2}$ to $1 \frac{3}{4}$ lengths from its base behind to caudal pit above, which larger. Tail $3 \frac{1}{2}$ in entire length. Pectoral $1 \frac{2}{5}$ to $1 \frac{3}{5}$ in head; ventral 3. Color in alcohol ash-gray generally, whitish below. Iris pale. Fins all ash-gray, hind edges of lower, including lower caudal lobe, whitish, or at least paler. Border of long caudal lobe narrowly brownish. Length 310 to 314 mm.

Atlantic Ocean. Described from two examples in the United States National Museum obtained at Elmina, Ashantee, 310 to 314 mm. The species reaches 2135 mm.

Carcharias (*Scoliodon*) *walbeehmi* Osorio¹ is reported from Cape de Verde and St. Thomé. This may be a wrong identification of present species. The Indo-Pacific *Scoliodon walbeehmi* (Bleeker) does not seem

¹ 1898, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 200.

to occur in the Atlantic, though it is reported from Natal and Portuguese East Africa.

Scoliodon acutus (Rüppell)

Carcharias acutus RÜPPELL, 1835, 'Neue Wirbelth.,' Fische, p. 65, Pl. xviii, fig. 4. Djedda, Red Sea.

Carcharias (Scoliodon) acutus STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LXI (1), p. 575 (St. Louis, Senegal, Guet N'Dar, Niger); 1882, Denkschr. Akad. Wiss. Wien, XLIV, p. 51 (Senegambia).

Head depressed. Snout long, narrowed forward, rounded at end. Preoral length nearly equals space from eye to first gill opening. Mouth arched, wider than long; labial folds short, on lower jaws, not on upper. Teeth in 25 rows above, 26 below; median upper tooth erect, not small; 2 lower symphyseal teeth hardly smaller than others. Nostrils nearer end of snout than mouth corners. First dorsal base nearer ventrals than pectoral bases. Second dorsal origin above end of anal base, length 1/3 its space from caudal. Anal base about twice that of second dorsal, equals half space from subcaudal or hardly half its distance from ventral bases. Pectoral longer than broad, rather sharp-angled, reaches dorsal, hind edge concave. Ventral smaller than anal. Back brownish; lower surfaces and edges of pectorals whitish. (Garman.)

East Indies, Indian Ocean, and eastern Atlantic. Reaches 738 mm. in length. Barnard reports it as *Carcharinus acutus* (1925, Ann. South African Mus., XXI, p. 24) from the Cape Seas.

Carcharias palasorrah cannot date from Cuvier¹ as it is not proposed in strictly binomial form.

APRIONODON Gill

Aprionodon GILL, 1861, Ann. Lyc. Nat. Hist. New York, VII, pp. 400, 401, 411. Type: *Carcharias (Aprion) isodon* Müller and Henle. Orthotypic.

Aprion (not Cuvier, 1830) MÜLLER AND HENLE, 1838, 'Beschr. Plagiostomen,' p. 31. Type: *Carcharias (Aprion) isodon* Müller and Henle. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 2, p. 192.)

Differs from *Eulamia* chiefly in the dentition, the teeth entire, cusps nearly erect and bases wide.

Three species in the tropical Atlantic and Indo-Pacific.

Aprionodon isodon (Müller and Henle)

N'j'korou (Senegambia)

Carcharias (Aprion) isodon (Valenciennes) MÜLLER AND HENLE, 1838, 'Beschr. Plagiostomen,' p. 32. No locality.

Carcharias (Aprionodon) isodon DUMÉRIL, 1865, 'Hist. Nat. Elasmobr.,' p. 349 (types: from New York).—ROCHEBRUNE, 1883-1884, 'Faune Sénégalie,' Poiss., p. 18 (Guet N'Dar, Barbarie, Dakar, Leybar).

¹ 1829, 'Règne Animal,' 2d Ed., II, p. 388.

Snout short, broad, blunt, space from mouth angle to nostril twice that from nostril to snout end, preoral equal to internasal. Teeth erect, entire, in 31 rows; upper small, with broad bases; lower similar, but smaller; median teeth small. Width of nostrils hardly less than length of orbits. Origin of first dorsal nearly above inner pectoral angle. Second dorsal much smaller than first, above anal or origin at end of anal base. Pectoral subfalciform, reaches hind end of first dorsal base, somewhat large. (Garman.)

Tropical Atlantic. Reaches 610 mm.

EULAMIA Gill

Requiem Sharks

Eulamia GILL, 1862, Ann. Lyc. Nat. Hist. New York, VIII, p. 401. Type: *Carcharias lamia* Risso. Monotypic.

Platypodon GILL, *loc. cit.* Type: *Carcharias (Prionodon) menisorrah* Müller and Henle. Monotypic.

Isogomphodon GILL, *loc. cit.* Type: *Carcharias (Prionodon) oxyrhynchus* Müller and Henle. Monotypic.

Lamiopsis GILL, *loc. cit.* Type: *Carcharias (Prionodon) temminckii* Müller and Henle. Monotypic.

Isoplagiodon GILL, *loc. cit.* Type: *Carcharias (Prionodon) sorrah* (Valenciennes) Müller and Henle. Monotypic.

Body rather robust. Head broad, depressed. Snout produced in front. Eyes with well-developed nictitating membrane. Mouth curved forward, labial folds short or rudimentary. Teeth compressed, partly triangular, with single large cusp, strongly serrated in adult, less so in young. Nostrils inferior, separated from mouth and from one another. First dorsal usually larger, opposite space between pectorals and ventrals. Second dorsal small. Caudal moderately long, axis elevated and lower lobe produced. Caudal pits well developed. Pectorals falcate.

A large group, comprising upward of sixty species, many of large size, voracious, and savage. The species are difficult to distinguish and live in all warm seas. The genus is usually known under the name *Carcharias*, now used for the sand sharks.

Carcharias fissidens Bennett,¹ is scarcely identifiable. It has been placed as a doubtful synonym of *Carcharias porosus* Ranzani.

Carch. dentibus triangularibus, singulis versus angulum oris profunde emarginatus; incisura acuta; pinna dorsalis 2 da supra analis medium incipiente.

Figura dentium apud La Cépède, Hist. Nat. des Poiss., tom. I, Pl. VIII, f. 2.

The single notch on each tooth on the edge directed towards the angle of the mouth is so deep and acute as to give the teeth, when viewed from the side, a close resemblance to so many arrow-heads.

KEY TO THE SPECIES

a.—Second dorsal smaller than anal, origins opposed.

b.—Snout elongate; teeth nearly erect, cusps narrow, serrated above, less below; pectorals subfalciform, reach below mid-dorsal... *limbatus*.

¹ 1830, Proc. Comm. Zool. Soc. London, p. 148. Atlantic coast of North Africa.

- bb.*—Snout blunt; teeth serrated above, mostly smooth below; pectorals falciform. *falciformis*.
- aa.*—Second dorsal smaller than anal, origin farther backward; snout broad, broadly rounded; teeth serrated, upper broad, lower lanceolate; pectoral nearly twice as long as wide. *obscurus*.
- aaa.*—Second dorsal and anal about equal, origin advanced.
- c.*—Snout short, blunt, broad; teeth serrated, broad above, oblique, narrow below; pectoral subfalciform. *plumbeus*.
- cc.*—Snout short, broadly rounded; teeth serrated, broad based, upper cusps wider, lower nearly smooth; pectoral falciform, outer angle sharp. *melanopterus*.
- aaaa.*—Second dorsal and anal about equal, origins opposed; snout obtusely pointed; teeth serrated, more closely toward base, upper wider; pectoral $\frac{2}{3}$ wide as long. *menisorrah*.
- aaaaa.*—Second dorsal larger than anal, origin advanced; snout moderate; upper teeth wide, triangular, serrated; pectoral long, moderately broad. *commersonii*.

***Eulamia limbatus* (Müller and Henle)**

Tubarao (Madeira)

Figure 10

Carcharias (Prionodon) limbatus (Valenciennes) MÜLLER AND HENLE, 1838, 'Besch. Plagiostomen,' p. 49, Pl. XIX, fig. 9 (teeth). No locality.—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 19 (Cape Verde).

Carcharias limbatus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 373 (Cape Verde Islands).

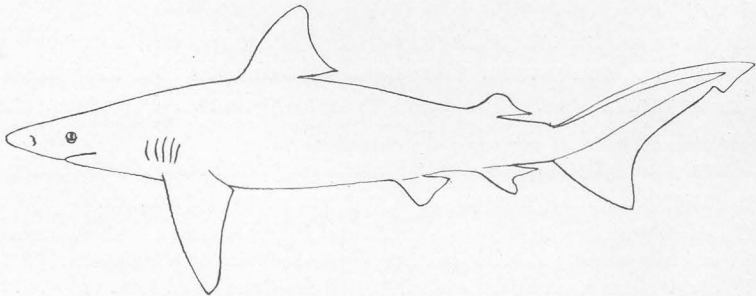


Fig. 10. *Eulamia limbatus*, after Garman.

Carcharhinus limbatus MONOD, 1927, 'Faune Colon. françaises,' p. 646 (Kribi).

Carcharias microps LOWE, 1840, Proc. Zool. Soc. London, VIII, p. 38. Madeira; 1839, Trans. Zool. Soc. London, III, part 1, p. 18 (Madeira); 1843, Proc. Zool. Soc. London, II, part 3, p. 93 (Madeira).

Body compressed. Head broader than high, tapers from gills. Snout elongate, rather narrowly rounded at end, length nearly twice mouth length. Eye small,

nearly $\frac{1}{3}$ mouth length, front orbital edge on level with that of latter, nictitating membrane below. Mouth large, much arched; short labial fold at angle, slightly forward on each jaw and with short groove behind. Teeth almost erect, 34 rows above, 31 rows below; bases broad; cusps narrow; upper teeth serrate on bases and somewhat serrate on sides of cusps; lower teeth not serrate on cusps and with or without coarse serrations on bases; median upper teeth small; median lower teeth small and tooth each side little larger. Nostrils smaller than eye, more than halfway from snout end to orbit. Gill openings large, width equals mouth length, last above pectoral base. Dorsal origin above inner pectoral angle, fin not reaching ventral origin by a space equal to mouth length. Second dorsal small, basal length equals half space from caudal pit, or about length of produced hinder angle. Anal little larger than second dorsal, directly below, hind edge deeply notched, with 2 sharp angles. Caudal about $\frac{2}{7}$ of total; lower lobe produced, pointed. Pectorals sub-falciform, outer angle rather sharp, inner blunt rounded, width about $\frac{2}{3}$ greatest length; reaches below middle of dorsal. Ventral small, about midway between dorsal bases. Back brown; black spot on tips of dorsals, pectorals, anal, and subcaudal; white below. (Garman.)

Tropical and temperate seas. Length 1830 mm. or more.

***Eulamia falciformis* (Müller and Henle)**

Carcharias (Prionodon) falciformis (Bibron) MÜLLER AND HENLE, 1838, 'Besch. Plagiostomen,' p. 47. Cuba.—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLV (1), p. 14 (Gorée).

Body moderate, cavity nearly half total length. Snout obtusely pointed, rounded at sides from eyes. Orbits oblong. Teeth in 30 rows; upper oblique, with notch and strongly denticulate basal process; lower without or with fine serrations, cusp narrower, on broader base; median paired. Nostrils hardly half diameter of eyes. First dorsal nearer pectorals than ventrals, outer angle rounded, hinder pointed, hind edge deeply indented. Second dorsal small, directly above anal. Anal little larger than second dorsal, hind edge deeply notched, acuminate extremity reaches little more than halfway from base to caudal. Caudal more than $\frac{1}{4}$ of total, lower lobe prominent. Pectorals moderate, falciform, hind edge deeply concave. Grayish brown, paler below. (Garman.)

Found in the tropical Atlantic. Said to reach 3050 mm.

***Eulamia obscurus* (Le Sueur)**

Faqueteira (Madeira), Tiburon (Canaries)

Figure 11

Squalus obscurus LE SUEUR, 1818, Jour. Acad. Nat. Sci. Philadelphia, I, p. 223, Pl. IX. No locality.

Carcharias obscurus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 366 (Madeira, St. Helena).—MELLISS, 1875, 'St. Helena,' p. 112.—GÜNTHER, 1880, 'Rept. Voy. "Challenger,"' I, p. 5 (Ascension Island); 1889, *op. cit.*, XXII, p. 5 (Sierra Leone).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 300 (Canaries).

Carcharhinus (Platypodon) obscurus PIETSCHMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 99 (Agadir, Morocco).

Carcharias falcipinnis (not Bibron) LOWE, 1839, Proc. Zool. Soc. London, p. 90 (Madeira); 1839, Trans. Zool. Soc. London, III, part 1, p. 18 (Madeira); 1843, Proc. Zool. Soc. London, XI, p. 93 (Madeira).

Prionodon obvelatus VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' Zool., XI, p. 103, Pl. xxvi. Canary Islands.—DUMÉRIL, 1865, 'Hist. Nat. Elasmobr.,' p. 376 (type).

Body moderately long and stout, abdominal cavity extending slightly beyond middle. Head large, much wider than deep, crown convex. Snout broadly rounded before nostrils, length half of width. Eye small, barely 3 in mouth, placed near first third in head. Mouth wide, crescentic, width greater than space to snout tip. Labial folds very short, in angles of both jaws. Teeth all finely serrated, 29 or 30 rows,

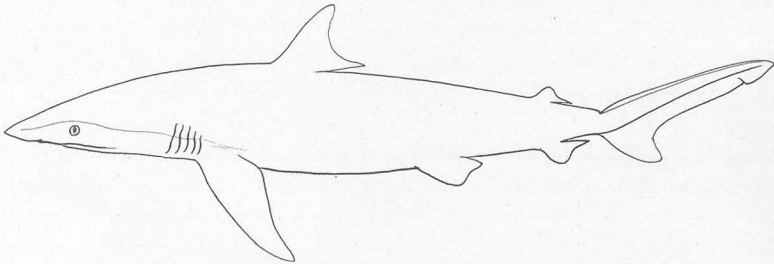


Fig. 11. *Eulamia obscurus*.

upper oblique and with other edges notched, lower narrow, more erect, on broad bases. Outer angle of nostril nearer eye than snout tip. Interorbital very wide. Last 2 gill openings above pectoral base. Scales with 5 keels and points, broad. First dorsal moderate, inserted much nearer snout tip than second dorsal or a little before inner pectoral angles, hind edge concave. Anal inserted a little behind second dorsal origin, hind edge deeply notched. Caudal moderate, lower lobe large and falcate. Pectoral falcate, pointed, reaches back as far as first dorsal end. Ventral small. Color dusky gray or brown above, whitish below. Length 2745 to 3050 mm., or more.

Northern and middle Atlantic. The above description from field notes of American (New Jersey) examples.

Barnard reports one as *Carcharhinus obscurus* (1925, Ann. South African Mus., XXI, p. 25) from Table Bay.

***Eulamia plumbeus* (Nardo)**

Figure 12

Squalus plumbeus NARDO, 1827, 'Prodr. Ichth. Venet.,' p. 9. Venice.

Prionace milberti ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 7 (southwest of Santa Luzia, Cape Verde, 16 m.).

Carcharinus milberti ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 115.—
 URIARTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr.,
 Madrid, (2) LIII, p. 15 (Gran Canaria).

Body moderately long, stout, abdominal cavity extending slightly beyond middle. Head large, much wider than deep, crown convex. Snout depressed, rather wide, rounded as seen from above. Eye rather small, nearly midway in head. Mouth wide, crescentic. Short labial fold at each corner of mouth. Teeth in 25 to 29 rows, upper directed obliquely outward, more oblique toward angles of mouth, and outer edges notched; lower ones erect and narrower, with wide bases. Nostrils about midway in space in front of mouth. Interorbital moderately wide. Last 2 gill openings above pectoral base. Scales narrow, with 3 points. First dorsal large, high, inserted much nearer snout tip than second dorsal, or slightly behind ends of

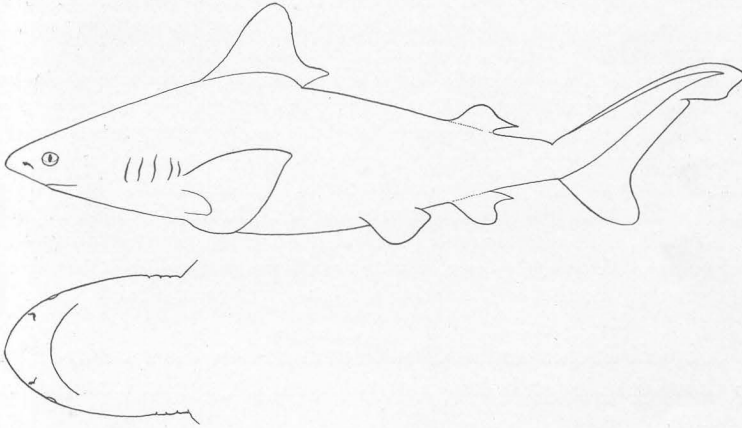


Fig. 12. *Eulamia plumbeus*.

pectoral bases, hind edge concave. Anal inserted a little behind second dorsal origin, hind edge deeply notched. Caudal moderate, lower lobe large. Pectoral short, tip not reaching opposite hind edge of first dorsal, and width of fin, a little over half its length. Ventral moderate. Grayish to brownish above, whitish below. Young often quite bluish above. Reaches 8145 mm.

Warmer Atlantic and eastern Pacific, occasionally entering fresh waters. Described above from American (Middle States) examples.

Squalus plumbeus Nardo has priority over the American *Carcharias* (*Prionodon*) *milberti* Müller and Henle, 1838, which has gained usage. Under *Squalus glaucus* and *Squalus plumbeus*, the latter as "Caecchia" he says¹:

¹ 1827, Isis, Band XX, Heft 6, pp. 477, 483.

Hos pisces confunderunt, et male descriperunt Ichthyologi; ambo foveam triangularem in extremo dorso habent, sed inter se maxime differunt..... Speciei secundae convenit perfecte *Squ. glaucus* Bloch si colorem exciperetur et formam rostri quae in exemplari nostro rotunda est.

***Eulamia melanopterus* (Quoy and Gaimard)**

Nilow (Senegambia)

Carcharias melanopterus QUOY AND GAIMARD, 1824, 'Voy. "Uranie,"' Zool., V-VI, p. 194, Pl. XLIII, figs. 1-2. Waigiou, East Indies.

Carcharias (Prionodon) melanopterus ROCHEBRUNE, 1883-1884, 'Faune Sénégal-gambie,' Poiss., p. 19 (Leybar, Maringouins, Thionk).

Body rather robust, trunk and tail compressed, depth less than 8. Head broader than deep, less than 6. Snout short, broadly rounded. Eyes small, just before middle in head, front edges above front mouth edge. Mouth broad, length $\frac{2}{3}$ its width, which is 2 in head; labial folds at angle very short, short groove flares toward eye. Teeth serrated, 25 to 30 rows; upper cusps broader, outer edge deeply notched, inner edge straight and oblique; lower cusps narrow, nearly smooth in young. Nostrils slightly nearer snout end than mouth. One or 2 gill openings above pectoral base. Dorsal origin above inner pectoral angle or about midway between snout tip and second dorsal origin, hind edge deeply emarginate. Second dorsal and anal similar, about opposite, or origin nearer first dorsal origin than caudal tip. Caudal less than $\frac{1}{3}$ total; subcaudal rather slender or angular. Pectoral large, width less than half its length, hind edge concave. Ventral small, origin nearly midway between dorsal origins. Brownish, paler to olive above, lower parts white. Fins all rather paler than general dorsal body color, tipped broadly black, and caudal edges black. Reaches 1345 mm.

Tropical Pacific and Indian Oceans and in the eastern Atlantic. The above description is from Hawaiian and Polynesian examples in the Academy.

Barnard reports it as *Carcharinus melanopterus* (1925, Ann. South African Mus., XXI, p. 24) from the Cape and Natal Seas.

***Eulamia menisorrhah* (Müller and Henle)**

Carcharias (Prionodon) menisorrhah (Valenciennes) MÜLLER AND HENLE, 1838, 'Besch. Plagiostomen,' p. 46. Java, Australia, Red Sea.

Carcharias menisorrhah BOULENGER, 1903, 1905, Mem. Soc. Españ. Hist. Nat., Madrid, I, p. 553 (Cape San Juan, Spanish Guinea).

Body moderate, cavity nearly half total length, depth $8\frac{7}{8}$. Head depressed, $6\frac{1}{6}$. Snout elongate, obtusely pointed, snout $2\frac{1}{4}$ in head. Eye small, median. Mouth width $2\frac{2}{3}$ in head, gape not quite an eye diameter behind the eye; each angle with a small, inconspicuous fold. Teeth in about 25 rows in each jaw, compressed, sharp, with or without serrations or each with several small points, variable with age. Nostrils rather large, inferior, each with small flap, placed near snout edge and midway between mouth front and snout tip. Interorbital broad, convex, 2 in head. Last 2 gill openings above pectoral base. Dorsal origin above inner pectoral angle, fin high, inserted nearer pectoral than ventral origin. Second dorsal small,

opposite and similar to anal, hind edges concave, outer angles blunted and ends slender points. Caudal pointed, 1/4 of total; subcaudal more than half of fin. Pectoral large, width 2/3 length, reaches below middle of dorsal base, hind edge slightly concave. Ventral well behind first dorsal base, though nearer its origin than anal origin. Back brown, fin edges whitish; edges of first dorsal, second dorsal, and caudal very narrowly margined with black in young; second dorsal of adult usually with black spot; lower surfaces white. Reaches 930 mm.

Indian Seas, Mauritius, eastern Atlantic, and Panama. The above description from Sumatran examples.

***Eulamia commersonii* (Blainville)**

Dekojh (Senegambia)

Squalus commersonii BLAINVILLE, 1816, Bull. Soc. Philom., Paris, p. 121 (name only). (Blainville, 1828, 'Faune Française,' Poiss., p. 90. Based on *Squale requin* Lacépède, 1798, 'Hist. Nat. Poiss.,' I, p. 169, Pl. VIII, fig. 1. No locality.)

Carcharias (Prionodon) lamia STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LXI (1), p. 576 (Dagana); 1882, Denkschr. Akad. Wiss. Wien, XLIV, p. 51 (Senegambia).

Prionodon lamia RICHARD, 1904 (October 15), Bull. Inst. Océanogr. Monaco, No. 19, p. 11 (near Sabages in N. lat. 30°, W. long. 15°).

Carcharias (Prionodon) leucos ROCHEBRUNE, 1883, 'Faune Sénégalaise,' Poiss., p. 19 (Dakar).

Body elongate, deepest at pectoral, depth about 6 1/2 in length. Head robust, depressed, 6 in length. Snout short, very broad, length half its width or 2 1/2 in head. Eye small, near first third in head. Mouth broadly and evenly convex, length half its width, which is 2 in head; short labial groove at each angle. Teeth subtriangular, in 30 rows in each jaw, all serrated; upper teeth broad, erect; lower teeth about half the width of upper; bases two-rooted; median teeth small, erect. Nostrils rather small, midway in snout, internasal half of interorbital. Last 2 gill openings, over pectoral base. Dorsal origin much nearer snout tip than origin of second dorsal, higher than length of base. Second dorsal small, little longer and more advanced than anal. Anal small. Caudal large, less than 1/3 total body length, and subcaudal lobe nearly half caudal length. Pectoral long, width twice or more in its length, which is about 3/5 to ventral. Ventral small, inserted little nearer hind basal edge of first dorsal than anal origin. Light or gray-brown to darker, pale to whitish below. Young with fin tips darker. Sometimes adults spotted with dark. Reaches a length of 3050 mm.

Atlantic, Mediterranean, and Pacific, mostly in tropical seas. The above description from a Florida example.

Blainville says:

Je n'ose citer pour cette espèce la synonymie de Gmelin et des autres ichthyologistes, crainte d'erreur; je me borne à celle de Broussonnet, Acad. des Sc., 1780, p. 670, no. 19, le Requin, vulgairement le Requiem. M. de Lacépède figure sous ce nom, t. I, pag. 169, pl. 5,¹ fig. 1, une espèce distincte, à laquelle j'ai donné le nom de Commerson.

¹ But it is really plate 8, figure 1 and shows the dorsal, pectoral, and both caudal tips blackish.

GLYPHIS Agassiz

Blue Sharks

Glyphis AGASSIZ, 1843, 'Poiss. Foss.,' III, p. 243. Type: *Glyphis hastalis* Agassiz. Monotypic.

Galeus VALMONT, 1768, 'Dict. Hist. Nat.,' I, p. 464. Type: *Galeus glaucus* Valmont = *Squalus glaucus* Linné. (Designated by Garman, 1913, Mem. Mus. Comp. Zoöl., XXXVI, p. 4.) (Inadmissible.)

Cynocephalus, KLEIN, 1777, 'Gesellsch. Schauplatz,' IV, p. 161. Type: *Squalus glaucus* Linné. (Designated by Gill, 1862, Ann. Lyc. Nat. Hist. New York, VII, p. 401.) (Inadmissible.)

Prionodon (not Horsfield, 1823) MÜLLER AND HENLE, 1838, 'Besch. Plagios-tomen,' p. 35. Type: *Squalus glaucus* Linné. (Designated by Fowler, 1911, Bull. IV, Geol. Survey, New Jersey, p. 74.)

Prionace CANTOR, 1849, Jour. Asiat. Soc. Bengal, XVIII, p. 399. Type: *Squalus glaucus* Linné. (*Prionace* Cantor proposed to replace *Prionodon* Müller and Henle.)

Body comparatively slender, fusiform. Head depressed. Snout long. Eyes lateral, nictitating membranes well developed. Mouth inferior, greatly arched; labial folds rudimentary. Teeth curvilinear triangles, edges serrated, bases broad. Nostrils oblique. Scales minute, with broad tricarinate crowns. Dorsals, ventrals, and anal small. First dorsal nearer ventrals than pectorals. Second dorsal opposite anal. Caudal pit above and below. Caudal narrow, pointed: subcaudal lobe prominent. Pectorals large, long in outer angle, hinder angle short.

One species in temperate and tropical seas.

Glyphis glaucus (Linné)

Janiquin (Canaries), Tintureira (Madeira), Guisjhando (Senegambia)

Figure 13

Squalus glaucus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 235. European Ocean.

Carcharias glaucus LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 194 (Madeira).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 364 (St. Helena).—MELLISS, 1875, 'St. Helena,' p. 112.—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV, p. 51 (Senegambia).—HILGENDORF, 1888, Archiv Naturg., p. 213 (Azores).—RICHARD, 1904 (October 15), Bull. Inst. Océanogr. Monaco, No. 19, p. 29 (Banc Gorringe in N. lat. 36°, W. long. 11°).

Carcharias (Prionodon) glaucus ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 18 (Baie d'Argain, Dakar, Gorée, Guet N'Dar, Portendik, Joalles, Rufisque, Baie Sainte Marie).—OSORIO, 1898, Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 200 (Ilha de S. Thomé).

Prionace glauca ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 6 (Saffi, Morocco in 17 m.; between Fogo and São Islands, Cape Verde).—URIARTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2) LIII, p. 16 (Canaries, Gran Canaria).

Galeus glaucus ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 114 (Tétouan; Santa Maria, Azores; Banc Gorringe; also above).

Squalus adscensionis OSBECK, 1765, 'Reise Ost-Ind., China,' p. 385. Ascension Island.

Body elongate, depressed in front, deepest over pectoral bases, depth about $10 \frac{1}{2}$. Head long, 5; width 2 in its length. Snout greatly depressed, length to eye little greater than width, $2 \frac{2}{5}$ in head. Eye about midway in head length, diameter $7 \frac{1}{2}$ in head. Mouth with rami converging as slight isosceles triangle. Teeth in about 30 rows in each jaw, entire or nearly so, serrated with age. Interorbital slightly convex, $2 \frac{3}{5}$ in head. Last two gill openings above pectoral base. First dorsal origin midway between pectoral and ventral or between snout tip and origin of upper caudal lobe. Second dorsal inserted a little nearer lower caudal lobe tip than first dorsal origin. Anal slightly smaller than second dorsal. Caudal long, little falcate; lower lobe begins a trifle before upper; notch in upper caudal lobe $\frac{1}{3}$ its length.

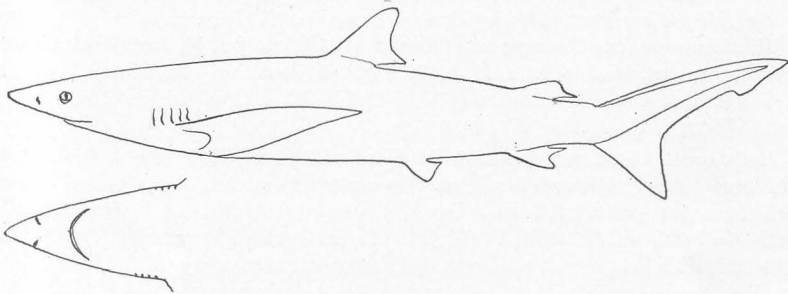


Fig. 13. *Glyphis glaucus*.

Pectoral falcate, width $2 \frac{2}{5}$ its length. Ventral inserted little nearer second dorsal origin than first, broad, truncate behind, $1 \frac{2}{3}$ to anal. Back and upper fins deep blue to bluish black; lower surfaces white. Length to 1896 mm.

Widely distributed in the temperate and tropical seas of the globe. The above description from Italian material. Barnard reports it as *Carcharinus glaucus* (1925, Ann. South African Mus., XXI, p. 26) from Agulhas Bank, South Africa.

Osbeck says¹ that *Squalus adscensionis* "is a fish whose body is bluish at top, and white below; the head is very flat; the eyes are on the sides, and not at the top; the anal fin is near the tail; its length is above two feet; the membrana branchiostega are below the spiracles, and have six rays."

GALEOCERDO Müller and Henle

Galeocerdo MÜLLER AND HENLE, 1837, Sitzs. Akad. Wiss. Berlin, p. 115. Type: *Squalus arcticus* Faber. Monotypic.

Galeodes HECKEL, 1853, Sitzs. Akad. Wiss. Wien, XI, p. 324. Type: *Galeodes priscus* Heckel. Monotypic.

¹ 1771, 'Voy. China, Forster,' II, p. 91.

Boreogaleus GILL, 1861, Ann. Lyc. Nat. Hist. New York, VII, p. 402 (411). Type: *Squalus arcticus* Faber. Orthotypic.

Body elongate, stout. Head depressed, short, wide. Snout broad. Nictitating membrane present. Mouth large, crescentic, labial folds on both jaws. Teeth alike in jaws, large, compressed, oblique, coarsely serrated on both edges, more flattened on outer side and swollen on inner side, also with deep notch on outer edges. Spiracles small, behind eyes. First dorsal over space between pectorals and ventrals. Second dorsal over anal. Caudal elongate, with double notch and pits.

Large sharks in most seas, few species. About forty fossils have been described.

Galeocерdo arcticus (Faber)

Tintorerera (Canaries)

Squalus arcticus FABER, 1829, 'Fische Islands,' p. 17. Iceland.

Galeocерdo arcticus URIARTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2) LIII, p. 17, Figs. 1-4 (dentition, etc.) (Gran Canaria).

Galeocерdo tigrinus ROCHEBRUNE, 1883-1885, 'Faune Sénégalambie,' Poiss., p. 20 (Guet N'Dar; Thionk).

Body broad, depressed, depth $6 \frac{1}{6}$. Head width $1 \frac{5}{8}$ its length, which $11 \frac{5}{6}$. Snout broad, rounded, length 3 in head. Eye anteriorly lateral. Mouth large, begins well before eye; preoral $\frac{2}{3}$ mouth width; space between snout tip and front of mouth 4 in head, mouth width $2 \frac{1}{10}$; mouth corner with longer outer fold. Teeth about 18 in each jaw, broad, compressed, directed laterally, edges finely serrated and 5 small cusps externally. Nostrils lateral, with small flaps, nearer front snout edge than front of mouth. Interorbital convex, $1 \frac{2}{3}$ in head. Third gill opening largest. First dorsal inserted opposite hind basal pectoral edge, height a little less than fin base. Second dorsal inserted midway between ventral origin and caudal pits. Anal inserted below first third of second dorsal base. Caudal nearly 2 in rest of body, subcaudal $2 \frac{4}{5}$ upper lobe. Pectoral falcate, reaches below first dorsal base posteriorly. Ventral small, broad, obtuse. Slate-gray, paler below. Above, also dorsals, caudal and pectoral above, variegated with deep leaden-gray blotches, many on side of trunk elongate and vertical. Length 980 mm.

Widely distributed in tropical seas to about 70° from the equator. A large voracious shark, said to reach upward of 300 cm., feeding largely on mollusks and fish. Described above from an example from Sumatra.

GALEORHINUS Blainville

Galeorhinus BLAINVILLE, 1816, Bull. Soc. Philom., Paris, p. 121. Type: *Squalus galeus* Linné. (Designated by Jordan and Gilbert, 1882, Bull. U. S. Nat. Mus., No. 16, p. 21.)

Galeus (not Valmont, 1768) KLEIN, 1775, 'Gesellsch. Schauplatz,' I, p. 70. Type: *Squalus galeus* Linné. Tautotypic. (Inadmissible.)

Eugaleus GILL, 1864, Proc. Acad. Nat. Sci. Philadelphia, p. 148. Type: *Squalus galeus* Linné. Monotypic.

Body moderately slender, elongate, cavity about half total length. Head moderate, from snout to last gill opening about one-fourth of total, depressed and blunt

forward. Orbit longer than wide; nictitating membrane well developed. Mouth wide, with short labial fold on each jaw. Teeth alike in both jaws, compressed, subtriangular, inclined toward mouth angles, smooth on edges excepting 2 to 4 denticles on outer edge between notch and base. Last gill openings above pectorals. Small spiracle behind eye. First dorsal above space between pectorals and ventrals. Second dorsal above anal. Caudal rather short; subcaudal lobe not very distant from notch behind subcaudal; no caudal pits.

Galeorhinus galeus (Linné)

Cacao (Madeira), Cazon (Canaries), Coulcoull (Senegambia)

Boca dulce, Galludo

Figure 14

Squalus galeus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 234. European Ocean.—POGGI, 1881, (article in 'Guidebook of Canary Isls.'). 'Guia de Santa Cruz de Tenerife,' [p. d. 35].

Eugaleus galeus ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 116 (Povoação in 10 to 16 m.; Mazagan, Morocco, in 11 m.; southwest of Santa Luzia Island, Cape Verde, in 16 m.; Banc Gorringe in 60 to 90 m.).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 229 (Port-Étienne).—URIARTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2)LIII, p. 21 (Canaries).

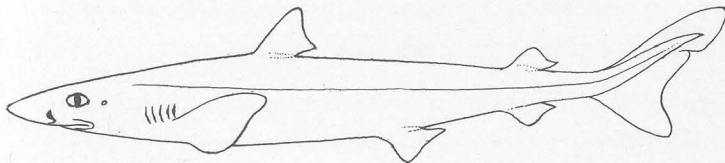


Fig. 14. *Galeorhinus galeus*.

Galeus vulgaris LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 194 (Madeira).

Galeus canis (not Müller and Henle) ROCHEBRUNE, 1883, 'Faune Sénégalaise,' Poiss., p. 20 (Guet N'Dar).—HILGENDORF, 1888, Archiv Naturg., LIV, p. 213 (Azores).—RICHARD, 1904 (October 15), Bull. Inst. Océanogr. Monaco, No. 19, p. 29 (N. lat. 36° 31' 15", W. long. 11° 32' 15", in 68 to 80 m.); 1905 (June 25), *op. cit.*, No. 41, p. 5 (Banc Gorringe); 1908 (December 15), *op. cit.*, No. 126, p. 7 (Banc Gorringe).—ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 8 (Cape Verde and Banc Gorringe material).—RICHARD, 1913 (November 30), *op. cit.*, No. 274, p. 3 (Azores in N. lat. 38°, W. long. 27° to 29°).

Body slender, depth 8 1/5 to 11. Head width about equals greatest body depth, length 5 1/4 to 5 1/2. Snout about equals mouth width, length 2 1/8 to 2 1/5 in head. Eye rather large, center a trifle behind middle in head, measured from snout tip to first gill opening. Mouth broad, obtuse, each mandibular ramus 2/3 width, which is 2 1/5 to 2 1/3 in head. Teeth large, in 30 to 35 rows. Front nasal valve with 2 points, as outer and inner. Gill openings with third and fourth largest. First dorsal larger, nearer pectoral than ventral or behind end of pectoral base. Second dorsal

inserted midway between first dorsal origin and last caudal vertebra. Anal slightly smaller than second dorsal. Caudal less than fourth of length; subcaudal half length of fin. Pectoral longer than dorsal, $\frac{2}{3}$ wide as long, hind edge little concave. Ventral small, equals second dorsal, inserted little nearer anal origin than pectoral origin. Upper surface dull brown to ashy or olive; upper dorsal edge and end of tail darker; under surface, also hind dorsal edges and hind pectoral edge, white. Length to 1120 mm.

Temperate and tropical seas. In the eastern Atlantic north to the British Isles and Scandinavia, and south to the Cape of Good Hope (*Galeorhinus canis* Barnard, 1925, Ann. South African Mus., XXI, p. 28). It is said to reach over two meters in length. The above description from Mediterranean specimens. One 349 mm. long as "Nios cacao" from Terceira, Azores, obtained by William Trelease, July 16, 1894, in the U. S. National Museum.

Mustelidae

Dog Sharks

Body elongate. Head and snout depressed. Eyes lateral. Mouth inferior, crescentic. Teeth small, in many rows, cuspidate to flat, more than one row functional. Nostrils below snout. Spiracles present or absent. First dorsal above space between pectorals and ventrals. Tail compressed.

Small sharks of most warm seas, comprising but a few genera, characterized by their smooth or pavement-like teeth.

KEY TO THE GENERA

- a.—Teeth compressed, cusps three to five, several series in function; labial folds long, upper more than half of jaw LEPTOCHARIAS.
 aa.—Teeth in pavement; labial folds less developed, less than half of jaw MUSTELUS.

LEPTOCHARIAS Müller and Henle

Congo Sharks

Leptocharias (Smith) MÜLLER AND HENLE, 1838, Ann. Mag. Nat. Hist., II, p. 36. Atypic. (Type: *Triaenodon smithii* Müller and Henle.)

Leptocharias MÜLLER AND HENLE, 1838, 'Besch. Plagiostomen,' p. 56. Type: *Triaenodon smithii* Müller and Henle. Orthotypic.

Leptocarcharias GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 348. Type: *Triaenodon smithii* Müller and Henle.

Body elongated, slender. Head short. Snout produced, rounded at end. Nictitating membrane present. Mouth greatly arched. Labial folds long; upper more than half of upper jaw. Teeth equal, small, numerous, with larger median cusp and one to three smaller lateral cusps on each side basally. Front nasal valve with elongated lobe. Spiracle minute. Last gill openings above pectoral bases. First dorsal above space between pectorals and ventrals. Second dorsal above anal, a

little smaller than first dorsal but larger than anal. Caudal without pit at root, and subcaudal small or undeveloped.

One species in West Africa.

Leptocharias smithii (Müller and Henle)

Figure 15

Triaenodon smithii MÜLLER AND HENLE, 1838, 'Besch. Plagiostomen,' p. 56, Pl. XXI. Kabenda Bay.

Leptocharias smithii GARMAN, 1913, Mem. Mus. Comp. Zoöl., XXXVI, p. 164.

Leptocarcharias smithii GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 384 (type).

Leptocarcharias smithi BARNARD, 1925, Ann. South African Mus., XXI, p. 28 (note).—CHABANAUD, 1932, Bull. Étud. Af. Occ. française, XIII, Nos. 3-4, July-December, 1930, p. 4, Pl. I (Baie du Lévrier).

Mustelus osborni FOWLER, 1923 (November 31), Amer. Mus. Novitates, No. 103, p. 1. Mouth of the Congo.

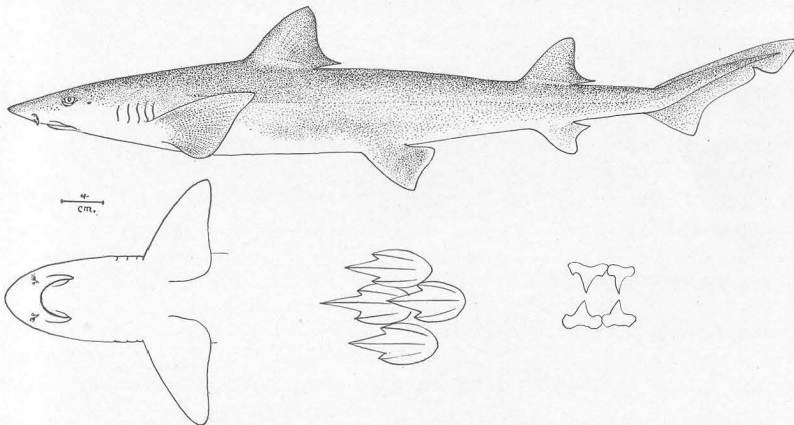


Fig. 15. *Leptocharias smithii*.

Body long, slender, tapering well behind, depth $8\frac{2}{5}$ to end of last caudal vertebra. Head depressed, rather narrow, width $1\frac{2}{5}$ its length, which 7 to last caudal vertebra. Snout moderate, slender in profile. Eye small, front edge of iris midway in head length; pupil apparently circular; nictitating membrane well developed; orbit $3\frac{1}{4}$ in snout. Labial folds long, outer $1\frac{1}{3}$ in preoral length or extends forward $\frac{2}{3}$ to nostril; inner labial groove $1\frac{3}{5}$ in outer. Teeth in about 60 rows above, about 55 rows below; bases of teeth broad, with produced cusps as a well developed median and more or less basal point each side, latter of which may vary more or less to quite obsolete or even absent; edges of all entire, though upper with large median cusp is a trifle narrower than lower; several rows apparently functional in each jaw. Nostril inferior on snout, about midway between eye center and snout tip, width

about $2 \frac{7}{8}$ in internasal; front valve produced in conic point as long as nostril itself. Crown of head broadly convex.

Last two gill openings above pectoral base; fourth $2 \frac{3}{4}$ in snout. Scales tridentate, the median point longest; more or less developed keels from point of each and parallel; body slightly rough to touch. First dorsal origin little nearer snout tip than second dorsal origin, or distinctly behind inner angle of pectorals; height of fin along its front edge slightly less than its basal length. Second dorsal like first, inserted little nearer first dorsal origin than caudal tip. Anal inserted little behind second dorsal origin, fin similar though smaller. Caudal long, $4 \frac{1}{2}$ in total; subcaudal origin begins little before that of upper, lobe moderate. Pectoral width $1 \frac{3}{4}$ its length, hind edge very slightly emarginate. Ventral inserted about midway between first dorsal origin and origin of anal.

Uniform gray-brown above, paler to whitish below. None of fins dusky along edge, generally somewhat pale. Iris pale slaty. Teeth whitish. Length 752 mm.

One specimen obtained by the Congo Expedition at the mouth of the Congo, the type of *Mustelus osborni*. I overlooked Müller and Henle's description because their figure does not show the conspicuous, long labial folds and because *Triaenodon smithii* is usually ascribed to South Africa.

MUSTELUS Linck

Dog Sharks

Mustelus LINCK, 1790, Mag. Neueste Phys. Naturgesch., Gotha, VI (3), p. 31. Type: *Squalus mustelus* Linné. Monotypic.

Mustellus VALMONT, 1768, 'Dict. Hist. Nat.,' Paris, III, p. 138; 1769, XII, p. 523. Type: *Galeus stellatus* Valmont = *Squalus mustelus* Linné. Monotypic. (Inadmissible.)

Myrmillo GISTEL, 1848, 'Naturg. Thierr.,' p. x. Type: *Mustelus vulgaris* Müller and Henle. Monotypic.

Pleuracromylon GILL, 1864, Proc. Acad. Nat. Sci. Philadelphia, p. 148. Type: *Mustelus laevis* Risso. Orthotypic.

Cynais GILL, 1903, Proc. U. S. Nat. Mus., XXV, p. 960. Type: *Squalus canis* Mitchill. Monotypic. (*Cynais* Gill proposed to replace *Mustelus* Cuvier, which is preoccupied.)

Body elongate, slender. Head depressed, short, wide, tapered in front and broadly flat below. Snout rather long, flattened, end rounded. Eye lateral and long. Nictitating membrane present. Mouth inferior, partly angular, rounded in front. Labial folds well developed. Teeth small, in many rows, cuspidate to flat and smooth, arranged like pavement. Nostrils large, well separated. Front nasal valve produced in its outer angle. Spiracles small, close behind eyes. First dorsal large. Anal opposite second dorsal, still smaller. Tail straight, about as long as trunk, without pits, and lower caudal lobe nearly obsolete. Pectorals large.

Small sharks living in most cool seas.

KEY TO THE SPECIES

- a.—Usually with white spots; dorsal origin a short distance behind end of pectoral base, much in advance of hind pectoral edge. *mustelus*.
 aa.—Usually uniform gray; dorsal origin forward of inner angle of pectoral, a little in advance of hind pectoral edge. *canis*.

Mustelus mustelus (Linné)

Jaqueta (Canaries), Tollo (Spanish Sahara)

Squalus mustelus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 235. Europe.*Galeorhinus mustelus* ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 115 (Porto Santo, 11 m.).—URIARTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2)LIII, p. 22 (Canaries).*Mustelus vulgaris* VINCIGUERRA, 1882, 1883, Ann. Mus. Civ. Storia Nat. Genova, XVIII, p. 608 (Madeira); 1890, Lo Spallanzani, Roma, (2) XIX, p. 467 (Spanish Sahara).—PIETSCHMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 99 (Mogador, Agadir, and Azamor in Morocco).

Head broader than high, flattened below. Snout broadly rounded forward. Eye rather large, pupil horizontally elongate, orbit nearly twice preoral length. Mouth large, width a little less than snout length, length less than orbit; labial folds nearly half length of jaws, upper longer. Teeth small, smooth, convex on crown, without notches on edges, without sharp cusp or denticle. Nostrils large, much nearer mouth than end of snout; front valve broad, with somewhat produced rounded lobe. Gill openings wide, greatest width 1/4 less than orbit. Spiracles small, distant from eye 1/4 of orbit. Dorsal large, origin shortly behind end of pectoral base, much before hind edge of pectoral, base length greater than height, equals half space from second dorsal; produced fin end not reaching ventrals. Second dorsal more than half as large as first, middle of base above anal origin. Anal much smaller than second dorsal base and pointed end extending short distance behind that of second dorsal, base about 3/4 its distance from caudal. Caudal moderate, more than 1/5 total length, subcaudal lobe feeble. Pectorals large, width about 2/3 their length, outer angle pointed, inner rounded, hind edge a little concave. Ventrals large, nearer first dorsal than second, hind edge a little concave. Grayish to brownish gray, usually with few to many white spots along sides above lateral line, and with white hind borders to fins. White below. Length 765 mm. (Garman.)

Eastern Atlantic and Mediterranean. Barnard reports it as *Mustelus laevis* (1925, Ann. South African Mus., XXI, p. 29) from Table Bay to Natal in depths to 100 fathoms.

Mustelus canis (Mitchill)

Caneja (Madeira), Tollo (Cape Blanco), Guinondou (Senegambia), Ndom, Ndomé, Ndumé, Nduma (Cameroons)

Figure 16

Squalus canis MITCHILL, 1815, Trans. Lit. Philos. Soc. New York, I, p. 486. New York.*Mustelus canis* JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 339 (Canary Islands).*Mustelus laevis* LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 194 (Madeira).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 385 (Lanzarote, Madeira).—BAADER, 1873-1874, Ber. Senckenberg. Naturf. Gesell., p. 182 (Mogador).—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 22 (Cape Blanco, Portugal, Baie de Tanit).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 300 (on Lowe).—PIETSCHMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 99 (Mogador,

Agadir, and Azamor in Morocco); 1913, Jahrb. Nassau. Ver. Naturkunde, Wiesbaden, LXVI, p. 176 (Bibundi, Cameroon).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 188 (Rio d'Oro).—MONOD, 1927, 'Faune Colon. françaises,' p. 647 (on Pietschmann).

Galeorhinus laevis ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 115 (Mazagan Morocco, in 11 mm.)—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 229 (Port Étienne).—URIASTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2)LIII, p. 22 (Lanzarote, Gran Canaria).

Body long, slender, tapers back from dorsal fin, body cavity less than half of total. Caudal peduncle a little over half of upper caudal lobe. Head rather narrow. Snout depressed, somewhat rounded as seen from above. Eye small, pupil horizontal. Mouth width double its length, shorter than snout, crescentic; labial folds well

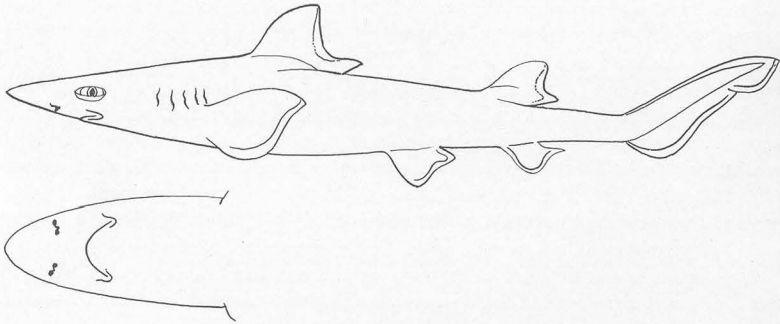


Fig. 16. *Mustelus canis*.

developed. Teeth in pavement, notched. Nostrils large, front valve ends in produced rounded lobe. Spiracle small, close behind eye. Skin with ovate denticles, with two to four low basal keels. First dorsal large, close before hind pectoral edges, behind ends of pectoral bases. Second dorsal over half the size of first, about twice the size of anal. Caudal small, lower lobe also small at first, larger with age. Pectoral large, reaches opposite the first third of dorsal. Ventral about half the size of pectoral. Nearly uniform pale gray, brown or olive to yellowish. Lower surfaces white to yellowish or gray. Young reach a length of 60 cm., often with dorsals and caudal black tipped, light edges behind on fins.

Reaches 1525 cm.

Warmer Atlantic, Mediterranean, and Cape of Good Hope. The above description from American (New Jersey) examples. Barnard reports it as *Mustelus canis* (1925, Ann. South African Mus., XXI, p. 30) from False Bay to Natal in depths to 150 fathoms.

Sphyrnidae

Hammer-Head Sharks

Body behind head compressed. Head much depressed, with wide oculonarial expansion at each side. Eyes distant from middle of head. Mouth inferior, greatly arched forward. Teeth triangular, compressed, bases broad, cusps more or less obliquely directed toward angles of mouth and notched on outer edges. Labial folds rudimentary. Nostrils and eyes on side of hammer. No spiracles. First dorsal above space between pectorals and ventrals. Second dorsal above anal. Caudal with pits at origin, and lower lobe produced.

Large sharks, easily known by the singular form of the head, which is slightly different in each species.

SPHYRNA Rafinesque

Hammer-Head Sharks

Sphyrna RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' pp. 46, 60. Type: *Squalus zygaena* Linné. (Designated by Jordan and Gilbert, 1882, Bull. U. S. Nat. Mus., No. 16, p. 26.)

Cestracion KLEIN, 1776, 'Gesellsch. Schauplatz,' III, p. 523. Type: *Squalus zygaena* Linné. (Designated by Gill, 1861, Ann. Lyc. Nat. Hist. New York, VIII, p. 37.) (Inadmissible.)

Sphyrnias RAFINESQUE, 1815, 'Analyse de la Nature,' p. 93. Type: *Squalus zygaena* Linné. (*Sphyrnias* Rafinesque proposed to replace *Sphyrna* Rafinesque.)

Cestrorhinus BLAINVILLE, 1816, Bull. Soc. Philom., Paris, p. 121. Type: *Squalus zygaena* Linné. (Designated by Fowler, 1911, Bull. 4, Geol. Survey, New Jersey, p. 77.)

Zygaena (not Faber, 1775) CUVIER, 1817, 'Règne Animal,' II, p. 27. Type: *Squalus zygaena* Linné. Tautotypic.

Zygana auct.

Sphyrichthys THIENEMANN, 1828, 'Lehrb. Zool.,' Berlin, III, p. 408. Type: *Squalus zygaena* Linné. Monotypic.

Platysqualus SWAINSON, 1839, Lardner's 'Cap. Cyclop. Nat. Hist.,' II, p. 318. Type: *Squalus tiburo* (not Linné) Swainson = *Sphyrna tudes* Cuvier. Monotypic.

Sphyrna HOVEN, 1858, 'Handb. Zool.,' II, p. 68. Type: *Squalus zygaena* Linné. (Variant of *Sphyrna*.)

Eusphyrna GILL, 1862, Ann. Lyc. Nat. Hist. New York, VIII, pp. 403, 412. Type: *Zygaena blochii* Cuvier. Monotypic.

Reniceps GILL, *idem*. Type: *Squalus tiburo* Linné. Monotypic.

Eye with well-developed nictitating membranes. Teeth alike in jaws. Nostrils distant from one another and from mouth. First dorsal and pectorals large, nearer to pectorals than to ventrals. Second dorsal and anal small. Caudal notched toward tip.

About six species, forming an almost perfect gradation from the narrow hammer-shaped head of the Indian *Sphyrna blochii* to that of the heart-shaped head of *Sphyrna tiburo*.

KEY TO THE SPECIES

- a.—PLATYSQUALUS. Lateral expansions of head kidney-shaped; nostril with frontal groove short or obsolete. *tudes*.
 aa.—SPHYRNA. Nostril with well-developed groove, which extends along front of hammer-shaped head. *zygaena*.

Sphyrna tudes (Valenciennes)

N't'jolah (Senegambia)

Zygaena tudes VALENCIENNES, 1822, Mém. Mus. Hist. Nat. Paris, IX, p. 225, XII, fig. 1. Nice.—ROCHEBRUNE, 1883-1834, 'Faune Sénégalie,' Poiss., p. 22 (Gambia, Casamence).—OSORIO, 1894 (February), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 182 (St. Thomas Island); 1898, *op. cit.*, (2) V, p. 200 (Cape Verde).

Body moderately elongate, trunk rather well compressed, deepest at first dorsal origin, depth 7. Head with edge undulated, 2 emarginations each side and one medianly, length $4 \frac{3}{5}$; greatest hammer length $1 \frac{1}{3}$ its greatest width; hind hammer edge $1 \frac{3}{4}$ its terminal width; front portion of hammer much thicker than hind part. Snout broad, depressed, rather thin. Eye small, partly inferior, anterior at end of hammer, length $3 \frac{2}{3}$ in terminal hammer width. Mouth moderate, rather convergent, length $1 \frac{1}{5}$ its width. Teeth in about 30 rows, slender and sharp. Nostrils distant from eye little over half of eye; nasal flap slender, pointed, short, and groove extending in toward snout tip obsolete, barely evident to median emargination of snout, only developed to second emargination of snout profile. Second and third gill openings largest, fifth above pectoral base. First dorsal origin little nearer that of second than snout tip or about opposite first fourth between pectoral and ventral origins, fin base $1 \frac{1}{2}$ its height. Second dorsal small, origin little nearer upper caudal lobe origin than basal edge of first dorsal. Anal larger than second dorsal, well advanced or about midway between ventral origin and lower caudal lobe. Upper caudal lobe one-fourth of total; subcaudal $2 \frac{1}{3}$ in upper lobe. Pectoral broad, smaller than first dorsal, reaches nearly $\frac{3}{5}$ to ventral, width $1 \frac{1}{5}$ its own length. Ventral inserted little behind first dorsal base or little nearer anal origin than pectoral base. Gray-brown. Length 203 mm.

Tropical Seas. The above described example from Surinam. It is said to reach 1 meter 46 cm. in length.

Sphyrna zygaena (Linné)

Cornuda (Madeira, Cape Blanco), Mdom a matoi, Ndoméa malo, Mudongé (Camerons), Cornudo (Canaries), Diarondoye (Senegambia)

Figure 17

Squalus zygaena LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 234. Europe and America.—BOWDICH, 1825, 'Excurs. Madeira,' p. 75 (Porto Santo).

Squalus zygaena POGGI, 1881, (article in 'Guidebook of Canary Isls.'). 'Guia de Santa Cruz de Tenerife,' [p. d. 35].

Cestracion (Sphyrna) zygaena STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien. LXIV (1), p. 576 (St. Louis); 1882, Denkschr. Akad. Wiss. Wien, XLIV, p. 51 (Senegambia).

Cestracion zygaena ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 117 (Melilla, Morocco, in 10 m.; Povoação, Azores, in 10 m.).—MONOD, 1927, 'Faune Colon. françaises,' p. 647 (Lokundje).

Cestracion zygaena CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 229 (Port-Étienne).—URIARTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2)LIII, p. 21 (Canaries, Tenerife, Gran Canaria).

Sphyrna zygaena PIETSCHMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 99 (Agadir, Morocco); 1913, Jahrb. Nassau. Ver. Naturk., Wiesbaden, LXVI, p. 176 (Bibundi, Cameroon).

Zygaena malleus LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 195 (Madeira); 1843-1860, 'Fishes of Madeira,' I, p. 83, Pl. XII (Madeira).—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 20 (Leybar, Thionk, Sorres, Gambia).—

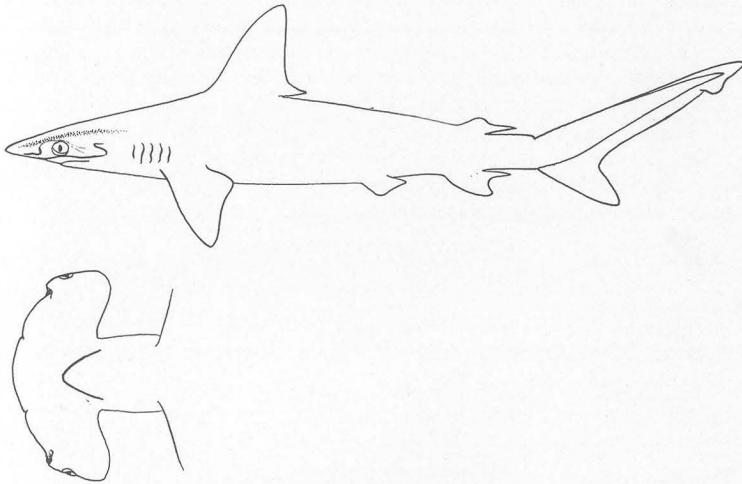


Fig. 17. *Sphyrna zygaena*.

VINCIGUERRA, 1882, 1883, Ann. Mus. Civ. Storia Nat. Genova, XVIII, p. 608 (Santa Cruz de Tenerife); 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 300 (Teneriffe).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 189 (Gorree, Rio d'Oro).

Sphyrna lewini DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 261 (Senegal).

Zygaena leeuwenii ROCHEBRUNE, *op. cit.*, p. 21 (Leybar, Thionk, Sorres, Gambia).

Body rather long and slender, not much compressed. Head depressed, front edge is a wide irregular curve, not continuous with lateral edges of hammer. Width of head at hind edge nearly equals its length across end at eye. Eye rather large, width less than half space from nostril. Mouth large, equals space to snout tip, length little over half its width. Labial folds rudimentary or absent. Teeth alike in jaws, oblique, with nearly straight outer edges, outer deeply notched, very finely serrated in young. Rather deep concave notch above nostril, latter with groove on front edge, more than

half of space to snout middle. Interorbital broadly depressed. First dorsal high, falcate, inserted little nearer snout tip than origin of second dorsal or behind bases of pectorals, higher than base. Second dorsal base half anal length, origin above middle of anal base. Caudal long, lower lobe well produced. Pectoral smaller than first dorsal. Color dark gray, whitish below. Small or young examples mostly dark slaty. Reaches a length of 4575 mm.

Tropical and temperate seas. The above description from American (Massachusetts and New Jersey, Guiana, Panama), Mediterranean, and Sumatran specimens in the Academy. Barnard reports it as *Sphyrna zygaena* (1925, Ann. South African Mus., XXII, p. 32) from the Cape Seas. One 575 mm. from the Azores, obtained in 1894 by William Trelease, in the U. S. National Museum.

Indeed, the wildest fancy of the poet, or the pencil of a Fuseli, could scarcely conjure up a monster more disgusting, frightful and repulsive than a Hammerfish of any considerable size. The strange position of the large and goggle eyes adds much to the deformed appearance of the head; and its strength is, by the fishermen, reported to be quite in correspondence with its frightfulness of aspect and its large and formidable teeth; so that alive, and in its native element, it were not easy to conceive a more terrific monster. Fortunately it does not appear to quit its native depths or to approach very near the shore; for, although by no means uncommon either in Madeira or elsewhere, I find no records of its fatally attacking man. (Lowe.)

ORDER CYCLOSPONDYLI

Squaloid Sharks

No nictitating membrane to eyes. Vertebrae with calcareous lamellae arranged in a ring about central axis. Gill openings before pectorals. Spiracles present. Dorsal fins two, with or without spines. No anal. Caudal bent upward, lower lobe little developed. Pectorals normal, not expanded or deeply notched.

Four families.

KEY TO THE FAMILIES

- a.*—Two dorsals, each with a spine; snout moderate to long; teeth compressed, sectorial to cuspidate. SQUALIDAE.
aa.—Two spineless dorsals; snout short.
b.—Upper teeth raptorial, lower sectorial. DALATIIDAE.
bb.—Teeth sectorial in both jaws. ECHINORHINIDAE.

Squalidae

Spiny Dog Sharks

Body mostly elongate, partly round. Head depressed. Rostral cartilage simple trough-shaped process of skull. Eyes lateral, without nictitating membranes. Mouth inferior, slightly protractile, rather large, moderately arched, upper jaw loosely articulated with skull.

Labial folds and deep groove at each mouth angle. Teeth compressed, various. Nostrils inferior, separate, remote from mouth. Gill openings moderate, all before pectorals. Spiracles rather large. Oviparous. Dorsal fins 2, each armed with spine, first before ventrals. Tail slender, compressed. Lower caudal lobe small or obsolete. Ventrals inserted posteriorly, not much before second dorsal.

Small sharks of comparatively primitive organization, living in most cool seas. About nine genera.

KEY TO THE GENERA

- a.—Dorsal spines without lateral grooves; no notch below terminal part of caudal; teeth alike in jaws.
- b.—Body triangular, dermal fold each side; teeth unlike in 2 jaws. **OXYNOTUS.**
- bb.—Body subcylindrical, dermal fold on tail, when present; teeth alike in 2 jaws. **SQUALUS.**
- aa.—Dorsal spines with lateral grooves; notch below terminal fin.
- c.—Teeth one-cusped, unlike in 2 jaws; nostrils oblique.
- d.—Inner pectoral angles produced; scales subsessile, with converging keels and stout peduncle. **CENTROPHORUS.**
- dd.—Inner pectoral angles not produced; nostrils oblique.
- e.—Scale crowns pinacoid, rounded, excavated, or smooth, on slender peduncles. **CENTROSCYMNUS.**
- ee.—Scale crowns clypeoid, keeled or grooved; upper teeth in 3 groups. **CENTROSELACHUS.**
- eee.—Scales pedunculate, with 3 strong, produced keels. **SCYMNODON.**
- ddd.—Inner pectoral angles not or hardly produced; nostrils transverse.
- f.—Scales leaf-shaped, stalked, with strong median keel. **LEPIDORHINUS.**
- ff.—Scales tricuspid, tridigitate, slender in stalk and cusp; snout much produced. **DEANIA.**
- cc.—Teeth pluricuspid; nostrils slightly oblique; scales unicuspid, slender pointed.
- g.—Teeth pluricuspid above only. **ETMOPTERUS.**
- gg.—Teeth pluricuspid in both jaws. **CENTROSCYLLIUM.**

OXYNOTUS Rafinesque

Oxynotus RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' I, pp. 45, 60. Type: *Squalus centrina* Linné. Monotypic.

Centrina CUVIER, 1817, 'Régne Animal,' II, p. 130. Type: *Squalus centrina* Linné. Tautotypic.

Body stout subtriangular in middle, slender and compressed at tail. Head small, depressed, somewhat flattened on crown. Snout broad, obtuse. Mouth transverse, with labial folds, grooves, and a lip. Teeth unlike in 2 jaws; upper slender, in narrow group; lower compressed, triangular, serrated, functional in single series, except perhaps when about to shed. Spiracles rather large. Scales uniform, rough.

No nictitating folds. Dorsals 2 with deep, imbedded spines, anterior spine rising obliquely forward. No anal.

Two species. Fossils in the Pliocene.

***Oxynotus centrina* (Linné)**

Quelme, Mielga (Canaries)

Figure 18

Squalus centrina LINNÉ, 1758, 'Syst. Nat.', 10th Ed., p. 233. Mediterranean.

Oxynotus centrina PAPPENHEIM, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 97 (Atlantic coast of Morocco).—URIASTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2)LIII, p. 23 (Canaries).

Body elongate, back a little elevated trenchantly; belly and abdomen rather convex and a little thicker; from below pectoral axil along each side of abdomen to ventral origin, there is a thick trenchant ridge; trunk more compressed posteriorly, also caudal peduncle, latter with least depth $1\frac{3}{4}$ its length. Head small, rather compressed, robust; upper profile with pronounced bulge over eye. Snout depressed

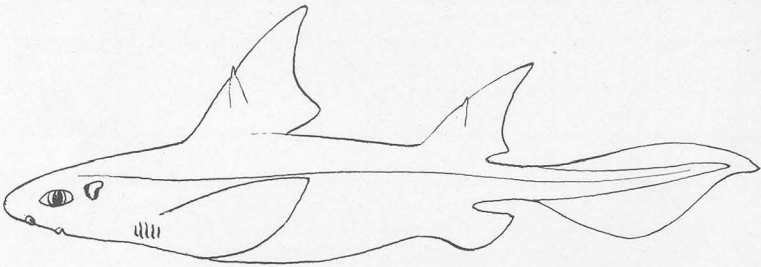


Fig. 18. *Oxynotus centrina*.

edge nearly evenly convex as seen from above, length $\frac{3}{5}$ its width; tip to mouth front $2\frac{1}{2}$ in head. Eye long, depth $2\frac{1}{2}$ its length, center slightly before middle in head length. Mouth moderately broad, transverse, falls about opposite the eye center. Lips rather thin, fleshy. Teeth above in 10 rows, pointed, narrow, sharp, entire, slender, become compressed on each side of jaw, and each extreme lateral or marginal ones notched at least once; lower teeth 9, form sharp cutting edge, with very slight basal cusps and edges all rather obsoletely crenulated. Slight groove extends back from each mouth corner. Nostrils little nearer snout tip than mouth cleft, inferior, large, internasal externally 3 in head. Interorbital wide, slightly concave mediantly. Spiracle little larger than pupil. Scales large, rough, bidentate or tridentate, sometimes keeled, largest on head, back, and lateral abdominal keels.

First dorsal origin about opposite pectoral origin, fin sloping gradually up with broad base to sharp apex, entire front edge of fin $4\frac{1}{3}$ in combined head and trunk; spine pierces fin about midway in its front edge. Second dorsal origin little nearer that of first fin than end of last caudal vertebra, similar, but smaller than first dorsal. Caudal broad. Pectoral pointed, elongate, width $2\frac{2}{3}$ its length, reaching halfway

to ventral. Ventral inserted trifle behind second dorsal origin, width about equals its base. Claspers very small.

Dull uniform brown. Iris slaty, pupil brown. Length 305 mm.

Eastern Atlantic and Mediterranean. Described above from small examples obtained in Italy. Reaches at least 460 mm.

SQUALUS Linné

Squalus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 233. Type: *Squalus acanthias* Linné. (Designated by Gill, 1861, Ann. Lyc. Nat. Hist. New York, VIII, p. 39.)

Acanthorhinus BLAINVILLE, 1816, Bull. Soc. Philom., Paris, p. 121. Type: *Squalus acanthias* Linné. (Designated by Jordan and Evermann, Stanford Publications, 1917, 'Genera of Fishes,' part 1, p. 95.)

Acanthias RISSO, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 131. Type: *Acanthias vulgaris* Risso = *Squalus acanthias* Linné. Tautotypic.

Centrophoroides DAVIS, 1887, Trans. Roy. Dublin Soc., (2) III, p. 478. Type: *Centrophoroides latidens* Davis. Monotypic.

Cirrhigaleus TANAKA, 1912, 'Fishes of Japan,' IX, p. 151. Type: *Cirrhigaleus barbifer* Tanaka. Monotypic.

Body elongate, rather slender, partly round, longer than tail. Head flattened below. Snout produced and tapered. Eye lateral. Mouth slightly arched, wide, with long, straight, deep, oblique groove on each side. Teeth simple, compressed, rather small, alike in both jaws, and points turned aside so greatly that inner edge forms cutting edge. Gill openings before pectorals. Spiracles behind eye, at higher level. Fins moderate. First dorsal larger and much before ventrals; second dorsal behind ventrals. Tail scarcely bent up, with pit; subcaudal lobe produced. Inner pectoral angles not produced.

Small sharks with about three species in temperate seas.

KEY TO THE SPECIES

- a.—Dorsal spine behind and remote from inner pectoral angle. *acanthias*.
 aa.—Dorsal spine near pectoral axil: between inner edge. *fernandinus*.

Squalus acanthias Linné

Dog-fish

Figures 19 and 20

Squalus acanthias LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 233. European Ocean.—ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 11 (Melilla, Morocco, in 10 m.); 1919, Rés. Camp. Sci. Monaco, LII, p. 117 (Melilla and Rabat, Morocco, in 10 to 18 m.).

Spinax acanthias BOWDICH, 1825, 'Excurs. Madeira,' p. 74 (Porto Santo).

Acanthias vulgaris MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 391 (off Morocco, 141 m.; off Cape Bojador, 214 m.).—SCHNAKENBECK, 1931, Mitteil. zool. Mus. Hamburg, XLIV, p. 44 (Walvis Bay).

Body rather long, slender. Head 5, depressed, elongately triangular as seen from above. Snout nearly half of head, end blunt. Eye elongate, slightly anterior, length about 2/5 of snout. Mouth slightly arched, width 2/5 of space to snout tip. Upper teeth narrower and little more inclined than lower. Nostrils little nearer snout tip

than mouth, front valve short, longer and with sharp outer angle, hardly notched in middle. Interorbital widely convex. Fifth gill opening widest. Spiracle moderate, diameter farther back than eye, opens upward. Scales 3 keeled, median keel widest basally and projects basally. First dorsal spine inserted behind inner pectoral angle, fin higher than base. Second dorsal smaller, spine longer than first, nearly as high as

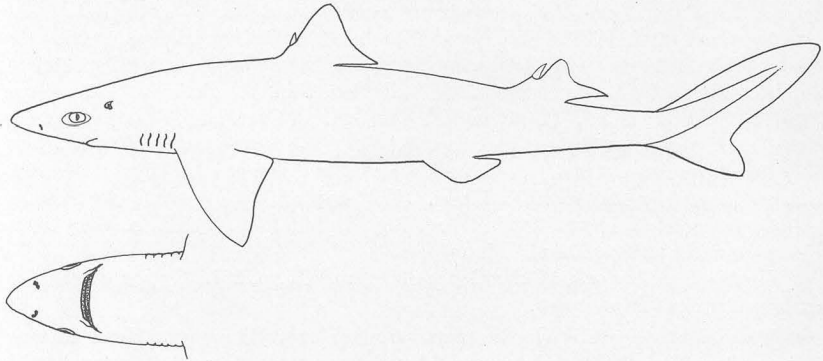


Fig. 19. *Squalus acanthias*.

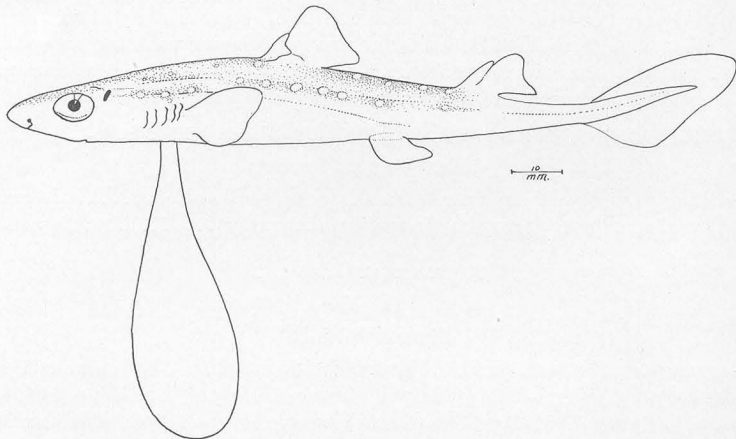


Fig. 20. *Squalus acanthias*, embryo.

fin and nearer caudal than first. Rudimentary dermal fold on each side of tail opposite hind half of space between second dorsal and caudal. Caudal small, lower lobe rounded, half length of upper. Pectoral small, not reaching first dorsal, width trifle more than half its length. Ventral blunt, about midway between pectoral and caudal origins, nearer second dorsal than first dorsal origin. Slaty gray to brown above. Sometimes 2 rows of white spots on each flank, variable in shape and number, usually

a pair near front of each dorsal and another behind, and lower rows much elongate. Lower surface whitish. Young with fins pale edged. Reaches 915 mm.

Atlantic Ocean eastward, ranging south to Morocco. Described above from American (Middle States) examples. Reported by Barnard as *Squalus acanthias* (1925, Ann. South African Mus., XXI, p. 47, Pl. II, fig. 7) from Table Bay to Natal.

***Squalus fernandinus* Molina**

Galludo (Canaries)

Squalus fernandinus MOLINA, 1782, 'Saggio stor. nat. Chile.,' p. 229. Chile.—URIARTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2)LIII, p. 23 (Gran Canaria).

Acanthias blainvillei VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 300 (Grand Canary).

Acanthias blainvillii STASSANO, 1890, Annali di Agricoltura, Roma, pp. 32-33 (Spanish Sahara).—VINCIGUERRA, 1890, Lo Spallanzani, Roma, p. 468 (Spanish Sahara).—OSORIO, 1895 (March), Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 253 (Dahomey); 1898, *op. cit.*, (2) V, p. 201 (Dahomey, Anno Bom).

Squalus blainvillei PIETSCHMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 97 (Atlantic coast of Morocco).

Body depressed anteriorly, trunk moderately compressed, depth 8 to 9 2/5. Head moderately depressed, 5 1/2. Snout broad, tip rounded, length 4/5 its width. Eye narrowly ellipsoid, center little nearer snout tip than first gill opening. Mouth transverse, about midway in eye length, very slightly convex; deep groove at each corner extends forward short space leaving deep pit and narrow labrum at each side of upper lip. Teeth directed laterally, entire, except outer notched, inclined to allow inner edges to form straight cutting edge; each jaw with 3 rows of 26 teeth. Nostrils lateral, inferior, internasal half of preoral; nostril placed about last third in snout. Gill openings before pectorals, last largest or about 1 1/3 in eye. Spiracle large, superior, distant from eye 3 3/4 eye diameters. First dorsal origin nearer snout tip than second dorsal origin or about first third between pectoral and ventral origins; spine broad basally, reaches 4/5 height of fin. Second dorsal inserted a little nearer last caudal vertebra end than first dorsal origin, smaller; spine nearly reaches fin end. Subcaudal origin slightly advanced from upper fin, 3 1/4 in upper. Pectoral broadly triangular, width 1 1/4 its length, reaches 2/5 to first dorsal. Ventral inserted about midway between middle of depressed pectoral and second dorsal origin. Gray-brown above, whitish below. Length 966 mm.

Mediterranean, South Atlantic, and southern Pacific. My examples, described above, from Italy.

Reported by Barnard as *Squalus acutipinnis* (1925, Ann. South African Mus., XXI, p. 48) from Table Bay to Natal.

CENTROPHORUS Müller and Henle

Centrophorus MÜLLER AND HENLE, 1837, Archiv Naturg., I, p. 398. Type: *Squalus granulatus* Schneider. Monotypic.

Entoxychirus GILL, 1862, Proc. Acad. Nat. Sci. Philadelphia, pp. 496, 498. Type: *Squalus uyato* Rafinesque. Monotypic.

Body fusiform. Head depressed. Snout blunt. Eyes large; orbits long, with angle each end; no nictitating membrane. Mouth wide, little arched, with deep groove and labial folds at each angle. Teeth compressed, unlike in jaws; upper with triangular cusp, more erect, lower with inner cutting edge directed outward. Nostrils slightly oblique. Gill openings moderate, before pectoral. Spiracles rather large, directed upward. Scales small, crenate or striate. Dorsals 2, each with spine; spine longitudinally grooved on each side and exposed at top; first dorsal near pectorals, second behind ventrals. Tail without caudal pits, subcaudal fin separated by notch from terminal. Pectorals medium, inner angle produced.

KEY TO THE SPECIES

- a.—*ENTOXYCHIRUS*. Teeth not serrate..... *uyato*.
 aa.—*CENTROPHORUS*. Teeth serrate..... *granulosus*.

***Centrophorus uyato* (Rafinesque)**

Moumougnor (Senegambia)

Figure 21

Squalus uyato RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 13. Sicily.

Acanthias uyatus ROCHEBRUNE, 1883, 'Faune Sénégalambie,' Poiss., p. 24 (Dakar, Gorée, Guet N'Dar, Cape Roxo, Cape Sainte-Marie, Saloum, Leybar).

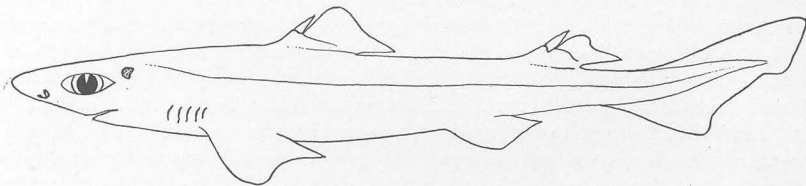


Fig. 21. *Centrophorus uyato*.

Body moderately compressed, back scarcely elevated except at spinous dorsal origin, depth 8. Head depressed, upper surface little more convex, $4 \frac{3}{5}$. Snout broadly depressed, length $\frac{2}{3}$ its width, end broadly rounded, length $\frac{2}{3}$ in head. Orbit large, elongately ellipsoid or vertical exposure half its length, slightly advanced in head. Mouth wide, transverse, very slightly convex, preoral nearly half of head; external groove at each angle, posteriorly much longer; folded flap at each angle within groove and inside cavity concealed groove extends out at each corner of lower lip short space leaving latter as free external fold; tip of mandible opposite middle of eye. Teeth large, well compressed, notched on each outer edge, though otherwise entire, in 3 longitudinal rows with third or median forming cutting edges, rows about 30; upper teeth much smaller, rows about 44. Nostrils large, each half of internasal, placed about $\frac{2}{5}$ in preoral length. Last gill opening above pectoral base, $\frac{1}{3}$ of preoral length. Spiracle little above upper eye edge, half of internasal. First dorsal origin about midway between second dorsal origin and snout tip; spine nearly straight,

compressed, slightly over half of fin. Second dorsal origin little nearer end of last caudal vertebra than first dorsal origin, fin small; spine $4/5$ height of fin, little curved. Caudal little over $1/4$ total; subcaudal about 3 in upper. Pectoral short, $2/3$ in first dorsal base, width $1\ 2/3$ its length. Ventral inserted little nearer pectoral origin than end of last caudal vertebra, fin trifle past second dorsal origin. Rusty brown above, belly and lower surfaces whitish. Length 413 mm.

Mediterranean and eastern Atlantic. The above description from an Italian example.

Centrophorus granulosus (Schneider)

Squalus granulosus SCHNEIDER, 1801, 'Syst. Ichth., Bloch,' p. 135. No locality.

Centrophorus granulosus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 420 (Madeira).—JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 339 (Canary Islands).

Body elongate, tapers from pectoral base, which is the point of greatest depth, latter $7\ 2/5$. Head large, conic, depressed anteriorly, about $5\ 1/4$. Snout broad, depressed, about as wide as long, 3 in head. Orbit long, narrow, ellipsoid slit, 4 in head. Mouth broadly transverse, form slightly convex, each angle with deep groove about $2/5$ to first gill opening. Teeth rather fine; upper erect, small, well compressed, entire, single cusp; lower teeth large, well compressed, rather broadly triangular, directed laterally so inner margin forms cutting edge and outer edge of each tooth deeply notched. Nostrils large, equal about half internasal which $1\ 5/6$ to front edge of upper jaw, nostrils at first third between snout tip and front edge of upper jaw. Last gill opening longest, above pectoral base. Spiracle large, little above the hind edge of eyelid and distant about its own length. Scales 3 to 6 keeled, many keels often more or less obsolete. First dorsal spine inserted about midway between snout tip and origin of second dorsal spine. Latter much nearer last caudal vertebra than hind basal edge of first dorsal or well behind ventral base. Caudal broad, upper lobe inserted well behind origin of lower lobe; subcaudal lobe about $1/3$ of caudal fin. Pectoral reaches middle of first dorsal base, width slightly less than half its length. Ventral inserted near last $2/5$ between hind basal edge of first dorsal and origin of second dorsal spine. Light brownish to cinnamon brown, paler on belly and lower surface of head. Length 843 mm.

Mediterranean and eastern Atlantic. The species is said to reach 1080 mm., or more. The above description from Mediterranean material. Reported by Barnard as *Etmopterus granulosus* (1925, Ann. South African Mus., XXI, p. 49) from off Cape Point in depths to 800 fathoms.

CENTROSCYMNUS Bocage and Capello

Centroscymnus BOCAGE AND CAPELLO, 1864, Proc. Zool. Soc. London, p. 263.

Type: *Centroscymnus coelolepis* Bocage and Capello. Monotypic.

Body subfusiform, slightly compressed. Eye large, without nictitating membrane. Mouth transverse, slightly curved; angles with deep groove and labial folds. Teeth dissimilar; upper small, lanceolate, raptorial, in 3 groups, the middle of which is outside (in front) of lower jaws; lower teeth broad, sectorial, with oblique triangular cusps. Nostrils oblique, distinct from mouth cavity. Spiracles moderate, with large

prespiracular cavity extending forward to orbit. Body scales pedicellate, with crown depressed and smooth above pedicel, edges striate to carinate; head scales sessile, carinate. Dorsals small, spines hardly visible or hidden. No anal. Caudal rather short and deep, with subcaudal lobe. Pectorals small, inner angle not produced.

KEY TO THE SPECIES

- a.—Snout from mouth shorter than space from eye to first gill opening; ends of spines exposed. *coelolepis*.
 aa.—Snout from mouth longer than distance from eye to first gill opening; spines concealed. *cryptacanthus*.

Centroscymnus coelolepis Bocage and Capello

Figure 22

Centroscymnus coelolepis BOCAGE AND CAPELLO, 1864, Proc. Zool. Soc. London, p. 263, Fig. 4. Portugal.—CAPELLO, 1872, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, IV, No. 13, p. 88 (Madeira).—REGAN, 1908, Ann. Mag. Nat. Hist., London, (8) II, p. 49 (Azores).—ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 13 (Azores, Morocco, Cape Verde, west of Terceira in 930 to 1998 mm.); 1919, Rés. Camp. Sci. Monaco, LII, p. 120 (north of San Miguel, north of San Jorge; and above materials).

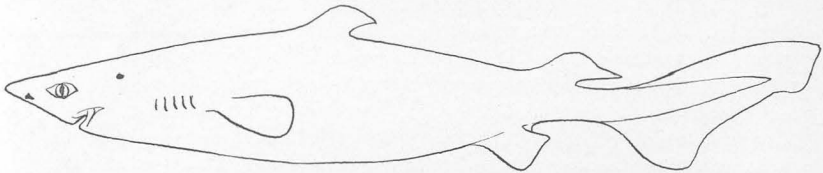


Fig. 22. *Centroscymnus coelolepis*, from Goode and Bean.

Body robust, subfusiform, body cavity little over 2/3 total. Snout short, depressed, end broadly rounded. Eyes large, orbit elongate, more than half snout length, with slight angle in front and angular fold in skin behind. Mouth wide, width greater than snout length; deep groove and labial folds at each angle, lower fold not half so long as jaw. Teeth in 70 rows above, 42 rows below; upper lanceolate, 4 or 5 rows functional; lower wide, compressed, cutting edge directed obliquely toward mouth angles, 1 series functional except when about to be dropped; upper teeth more numerous, in 3 groups or lower front group of 24 to 26 rows nearer symphysis resting in front (outside) of lower jaws, and more prominent and lateral group near each mouth corner of smaller teeth resting inside of (between) lower jaws. Nostrils oblique, nearer snout end than mouth. Gill openings narrow, not so wide as orbit, equally spaced, before pectoral. Spiracles half as long as orbit, open upward. Scales pedicellate; larger, smooth and somewhat concave on top near forward edge on flanks, smaller with feeble striae on head and neck, very small toward fin edges; fin axils naked. Dorsal spines small, hardly projecting; fins small, first in front half of total length, second equally large, more pointed and near forward end of hind third of total,

twice as long as wide, origin above or slightly behind middle of ventral bases. Sub-caudal separated from terminal part of caudal by a notch, lobe moderately produced. Pectorals medium, not reaching dorsal origin. Ventrals larger than second dorsal, ends not reaching as far backward. Deep chestnut brown, lighter near center of larger scales, a little darker on snout and fins. (Garman.)

Deep water off Madeira, Portugal, and New England. The species reaches 1040 mm. According to Vaillant, 13 to 15 young are produced by one female. It ranges in depth to 200 or 500 fathoms. Two 628 to 850 mm. from Funchal, Madeira, obtained by Adolfo Cesar di Noronha, in the U. S. National Museum.

Centroscymnus cryptacanthus Regan

Centroscymnus cryptacanthus REGAN, 1906, Ann. Mag. Nat. Hist., London, (7) XVIII, p. 437. Madeira.—GARMAN, 1913, Mem. Mus. Comp. Zool., XXXVI, p. 206.

Centrophorus coelolepis (not Bocage and Capello) GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII p. 423 (Madeira).

Snout from mouth greater than space between eye and first gill opening. Front labial fold equal to its distance from symphysis. Upper teeth small, narrow, lanceolate. Internarial space less than half preoral length of snout. Scales smooth, depression at base, except those on head and upper and lower parts of body to first dorsal; each of which with 3 parallel keels produced behind edge. First dorsal shorter than second, base about half height, or 1/6 of interdorsal space. Second dorsal base without spine, 3/4 distance from caudal. Dorsal spines short, hidden beneath skin. Pectoral not reaching vertical from first dorsal, hinder angle rounded. Ventral reaches vertical from end of second dorsal. Uniform dark brown. Length 698 mm. (Garman.)

Madeira.

CENTROSELACHUS Garman

Centroselachus GARMAN, 1913, Mem. Mus. Comp. Zool., XXXVI, p. 206. Type: *Centrophorus crepidater* Bocage and Capello. Monotypic.

Body elongate. Head short. Snout moderately produced, depressed, broad. Mouth transverse, with grooves and labial folds. Upper teeth erect, small, short, with triangular cusps, in 3 groups; lower teeth broader, oblique, not serrate. Nostrils oblique. Spiracles large. Scales uniform, with slender vertical peduncle and broad, rounded, pluricarinate crown. Fins rather small, angles hardly produced. Dorsal spines slightly exposed, anterior spine near pectorals, posterior near caudal. Tail short.

One species.

Centroselachus crepidater (Bocage and Capello)

Figure 23

Centrophorus crepidater BOCAGE AND CAPELLO, 1864, Proc. Zool. Soc. London, p. 262, Fig. 3. Portugal.—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 421 (Madeira).

Centroscymnus crepidater REGAN, 1908, Ann. Mag. Nat. Hist., London, (8) II, p. 50.

Body moderately elongate, subround, cavity long. Snout broad, depressed. Mouth wide, arched forward, deep grooves at angles; labial folds forward toward middle. Teeth unlike, not serrate; upper small, narrow, short, triangular, nearly erect, in median and 2 lateral groups; lower broader, compressed, oblique. Nostrils oblique, nearer snout end than mouth. Gill openings narrow, before pectoral. Spiracles large, behind eye. Scales rather large, peduncle slender, erect, below middle



Fig. 23. *Centroselachus crepidater*, modified from Bocage and Capello.

of flattish rounded crown, which roughened by 5 to 7 divergent keels. Dorsals nearly equal, spines with short apex exposed; first spine about midway from second and snout end; second spine much nearer caudal end than first dorsal base; origin of second dorsal above middle of ventral bases. Caudal short, with feeble subcaudal lobe and shallow notch between subcaudal and terminal portions. Pectorals short, rounded, reaches nearly to dorsal origin. Ventral ends below end of second dorsal base. Dark rusty brown. (Garman.)

Deep water off Madeira and Portugal. Reaches 890 mm.

SCYMNODON Bocage and Capello

Scymnodon BOCAGE AND CAPELLO, 1864, Proc. Zool. Soc. London, p. 263. Type: *Scymnodon ringens* Bocage and Capello. Monotypic.

Zameus JORDAN AND FOWLER, 1903, Proc. U. S. Nat. Mus., XXVI, p. 632. Type: *Centrophorus squamulosus* Günther. Monotypic.

Body slightly triangular in cross section. Head flattened on crown, wide posteriorly. Mouth large, arched forward, with deep straight groove at each angle and with labial folds. Teeth dissimilar in jaws; upper awl-shaped, raptorial; lower compressed, smooth on edges, sectorial, more or less oblique. Nostrils below snout, far forward, oblique. Spiracles large, behind eyes, somewhat elevated. Two small dorsal fins, spine shortly exposed. Caudal well developed, vertebral axis raised backward, subcaudal lobe rather weak.

Four species.

Scymnodon ringens Bocage and Capello

Figure 24

Scymnodon ringens BOCAGE AND CAPELLO, 1864, Proc. Zool. Soc. London, p. 263, Fig. 5. Portugal.—CAPELLO, 1872, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, IV, No. 13, p. 88 (Madeira).

Centroscymnus obscurus VAILLANT, 1888, 'Expéd. "Travailleur" et du "Talisman,"' Poiss., p. 67, Pl. II, fig. 2, *a-b*. Coast of Soudan, in 1400 to 1435 m.

Snout large, short, subconic, length about half space from eye to spiracle, or little less. Mouth wide, deep groove at each angle and with labial folds. Upper teeth raptorial, subulate; lower compressed, sectorial, with quadrangular base on which triangular, smooth-edged more or less oblique cusp. Nostrils oblique, at end of front third of preoral length. Spiracle large, nearly parallel with upper surface of head.

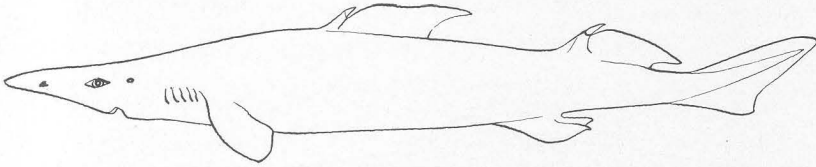


Fig. 24. *Scymnodon ringens*, from Bocage and Capello.

Scales small, tricarinate, with small pedicel. Dorsal spines exposed at point, that of first about midway between origins of pectorals and ventrals. First dorsal narrow; second twice as wide, origin above hind ends of ventral bases. Caudal short, deep. Pectoral medium, oblong, rounded. Uniform brown to blackish. Reaches 1220 mm. (Garman.)

Eastern Atlantic from off the Soudan to Madeira and Portugal, in deep water.

LEPIDORHINUS Bonaparte

Lepidorhinus BONAPARTE, 1838, Nuovi Ann. Sci. Nat., Bologna, II, p. 207. Type: *Squalus squamosus* Bonnaterre. Monotypic.

Machephilus JOHNSON, 1867, Proc. Zool. Soc. London, p. 713. Type: *Machephilus dumerili* Johnson. Monotypic.

Body elongate, subround. Head depressed. Snout rather broad and rounded. Eyes large, without nictitating folds. Mouth large, crescentic, with deep groove and labial folds on both jaws at angles. Teeth all sectorial, dissimilar in jaws; upper pointed, cusp more erect; lower broader, cusp directed toward mouth angles; median tooth present or absent above and below. Nostrils transverse, before middle in preoral. Gill openings medium, before pectoral. Spiracles large, open upward. Scales small, close together, leaf-shaped, pedunculate on trunk with strong median keel and weaker laterals, sessile with convergent keels on snout. Dorsals elongate, first near pectorals. Caudal short, deep; subcaudal lobe not produced. Pectorals small, inner angles little produced.

Four species.

Lepidorhinus squamosus (Bonnaterre)

Ramudo, Raimudo (Madeira)

Figure 25

Squalus squamosus BONNATERRE, 1788, 'Tabl. Ichth.,' p. 12. No locality. (On "L'écailleux" Broussonet, 1780, Mém. Acad. Sci. Paris, p. 675.)

Centrophorus squamosus LOWE, 1852, Ann. Mag. Nat. Hist., London, (2) X, p. 55 (Madeira).—HILGENDORF, 1888, 'Archiv Naturg.,' p. 213 (Azores).—RICHARD, 1912 (December 10), Bull. Inst. Océanogr. Monaco, No. 251, p. 9 (N. lat. 38°, W. long. 28°; N. lat. 47° to 48°, W. long. 6° to 7°, in 920 m.).

Machephilus dumerili JOHNSON, 1867, Proc. Zool. Soc. London, p. 713. Madeira.

Centrophorus dumerilii GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 422 (type).

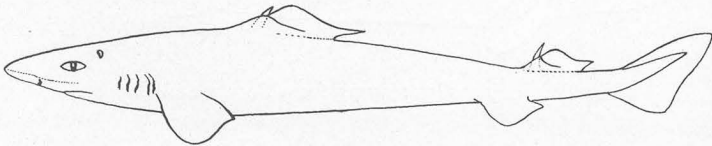


Fig. 25. *Lepidorhinus squamosus*, from Müller and Henle.

Body robust, cavity little over $\frac{3}{5}$ entire length. Head depressed and tapering. Snout blunt. Mouth not greatly arched, farther from snout tip than first gill opening; with deep groove and labial folds at angle, upper fold not half the length of jaw. Teeth in 29 to 35 rows; upper cusps nearly equilateral triangles to sharper; in front erect, laterally more oblique; lower broader, very oblique, cusp directed toward mouth angle. Variably median tooth present above or below. Nostrils transverse; valve with short projection. Gill openings before pectoral, width less than internarial. Spiracle medium, about half eye diameter distant from orbit. Scales leaf-shaped, on slender peduncle, with strong median keel and 1 or 2 weaker laterals each side, produced behind edges; scales on snout sessile, keels convergent. First dorsal near pectoral bases, base about $\frac{3}{5}$ interdorsal space, hind angle produced; spine less than height of fin, less than half exposed. Second dorsal origin nearly above ventral axils, base less than half interdorsal space, hind end almost to caudal. Caudal less than $\frac{1}{4}$ of total, depth nearly half length; subcaudal lobe slightly produced. Pectorals small, hardly reach dorsal origin, inner angle slightly produced with age. Grayish to grayish brown. Length 1418 mm. (Garman.)

Azores and Madeira to the North Sea and Iceland.

DEANIA Jordan and Snyder

Dearia JORDAN AND SNYDER, 1901, Proc. U. S. Nat. Mus., XXV, p. 80. Type: *Dearia eglantina* Jordan and Snyder. Monotypic.

Nasisqualus H. M. SMITH, 1912, Proc. U. S. Nat. Mus., XLI, p. 681. Type: *Nasisqualus profundorum* H. M. Smith. Monotypic.

Body elongate, partly fusiform, slightly compressed. Head depressed. Snout longer than rest of head, blunt, spatuliform. Eyes large, without nictitating membrane. Mouth behind center in head, with deep groove and labial folds at each angle. Teeth compressed, triangular, sectorial, diverse, cusps erect to very oblique. Nostrils transverse, before middle in head. Gill openings narrow, before pectoral. Spiracles large, superior, behind eyes. Scales very small, each with slender peduncle on broad polygonal or radiating base and crowned with 3 or 4 slender acuminate cusps. Two dorsals, each with compressed spine each side of which bears a groove; first dorsal above space between pectorals and ventrals, second behind ventrals. No anal. Tail much shorter than body; lower caudal lobe hardly produced.

Species about six, in the Mediterranean, Atlantic, and Japan.

***Deania calceus* (Lowe)**

Sapata (Madeira)

Figure 26

Acanthidium calceus LOWE, 1839, Proc. Zool. Soc. London, VII, p. 92. Madeira; 1843, Trans. Zool. Soc. London, III, part 1, p. 19 (Madeira).—GARMAN, 1913, Mem. Mus. Comp. Zool., XXXVI, p. 216 (Madeira).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 119 (Azores; Pico).

Centrophorus calceus LOWE, 1843, Proc. Zool. Soc. London, XI, p. 93 (Madeira).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 423 (Madeira).—VAILLANT, 1888, 'Expéd. "Travailleur" et du "Talisman,"' Poiss., p. 71, Pl. III, fig. 1, a-d (Banc d'Arguin in 1230 m.).—RICHARD, 1905 (October 15), Bull. Inst. Océanogr.

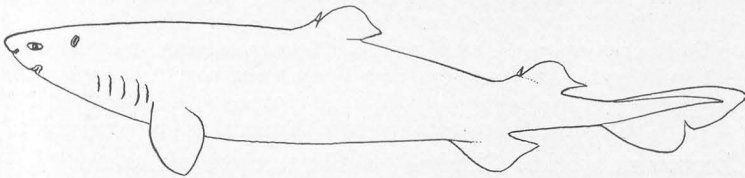


Fig. 26. *Deania calceus*, modified from Bocage and Capello.

Monaco, No. 46, p. 29 (N. lat. 37° 35', W. long. 25° 48' 20', in 605 m.).—REGAN, 1908, Ann. Mag. Nat. Hist., London, (8) II, p. 51.—ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 13 (Azores in 605 to 1378 m.).—RICHARD, 1912 (December 10), *op. cit.*, No. 251, p. 9 (N. lat. 38°, W. long. 28°, in 810 m.).

Centrina salviani (not Risso) LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 194 (Madeira).

Centrophorus crepidalbus BOCAGE, 1872, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, IV, No. 13, p. 88 (Madeira).

Body elongate, subfusiform. Head depressed. Snout very long, broad, spatuliform, half length of head. Mouth wide; deep groove and labial folds at angles. Teeth not serrated, diverse; upper with narrower and more erect cusps, oblique toward mouth angles; lower teeth broader, cutting edge oblique, more nearly hori-

zontal. Nostrils transverse, about $\frac{3}{5}$ of space from mouth to snout tip; internarial width less than $\frac{1}{3}$ preoral length. Gill openings narrow, before pectoral. Spiracles large, open upward, less than orbit length behind eye. Scales minute, with broad polygonal base and slender erect peduncle from top of which crown bends backward in 3 slender cusps. Dorsal spine about midway from snout to caudal, compressed, groove along each side. First dorsal base, without spine, little longer than second dorsal base, more than half interdorsal space; end of fin acuminate. Second dorsal higher than first, spine nearly as high as fin, base much longer than space from caudal, end of fin reaches latter. Tail short, about 3 in total; caudal short, subcaudal angle hardly produced. Pectoral rather small, subtruncate, hind angles rounded, not reaching below first dorsal spine. Ashy to grayish brown. (Garman.)

Eastern Atlantic in deep water. Reaches 930 mm.

ETMOPTERUS Rafinesque

Etmopterus RAFINESQUE, 1910, 'Caratteri Nuov. An. Sicil.,' p. 14. Type: *Squalus aculeatus* Rafinesque. Monotypic.

Spinax CUVIER, 1817, 'Règne Animal,' II, p. 129. Type: *Squalus spinax* Linné. Tautotypic.

Acanthidium LOWE, 1839, Proc. Zool. Soc. London, VII, p. 91. Type: *Acanthidium pusillum* Lowe. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 2, p. 195.)

Body subcylindrical or fusiform, longer than tail. Snout produced, broad, blunt. Eyes large, lateral, shielded by pigment in upper front of orbit, without nictitating membrane. Mouth transverse, not greatly arched, with deep groove and labial folds at each angle. Teeth unlike; upper raptorial, pluricuspid; lower sectorial, compressed, bladelike. Nostrils far forward, near snout edges. Spiracles large, behind eye superiorly, open upward. Scales small, with broad quadrangular or radiate bases and with or without erect cusp. Two dorsals, each with compressed spine, doubly grooved on each side, hinder spine larger, behind ventrals. No anal. Caudal short, without pit in front, with shallow notch between subcaudal and terminal portions.

About nine species. Sharks of small size, mostly from great depths, more or less luminous, and the young have a common pattern of markings.

KEY TO THE SPECIES

- a.*—Scales setiform, not forming ridges. *spinax*.
aa.—Scales placoid, with raised edges. *pusillus*.

Etmopterus spinax (Linné)

Figure 27

Squalus spinax LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 233. Europe.

Etmopterus spinax ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243. p. 16 (Azores in 605 to 1998 m.); 1919, Rés. Camp. Sci. Monaco, LII, p. 122 (Maio, Cape Verde Islands, in 1300 m.; also above materials).

Centrina niger LOWE, 1833, Proc. Zool. Soc. London, p. 144. Madeira; 1843, Trans. Zool. Soc. London, III, p. 19 (note).

Spinax niger RICHARD, 1905 (October 15), Bull. Inst. Océanogr. Monaco, No. 46, p. 29 (N. lat. $37^{\circ} 35'$, W. long. $25^{\circ} 48' 20''$, in 605 m.).—REGAN, 1908, Ann. Mag. Nat.

Hist., London, (8) II, p. 43.—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 392 (off Morocco in 535 m.).

Body rather slender, depressed somewhat anteriorly, trunk well compressed, depth $6 \frac{1}{2}$ to $9 \frac{4}{5}$? Head small, about 5 to $5 \frac{5}{6}$. Snout broadly depressed, rather obtusely or broadly triangular as seen from above, with rounded tip; length $\frac{2}{3}$ its width, or $2 \frac{7}{8}$ to $3 \frac{1}{8}$ in head. Eye large, elongately ellipsoid, center about first $\frac{2}{5}$ in head; iris 3 to 5 in head. Mouth rather large, transversely convex or obtusely triangular below, length $\frac{1}{3}$ its width, front edge of upper jaw about last third in eye. Groove outside each mouth corner forms deep pit or pocket. Upper teeth erect, quincuspid, median cusp longest, slender; lower teeth all directed laterally, outer edge with single deep notch. Nostrils lateral on snout below, equal internasal, placed at first fourth of preoral; each with 2 short obsolete fleshy points.

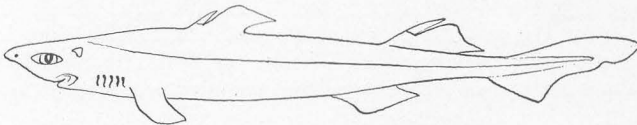


Fig. 27. *Etmopterus spinax*, from Bonaparte.

Last gill opening before pectoral base, first largest, or $\frac{1}{3}$ of interorbital. Spiracle little elevated from eye and distant space $\frac{1}{3}$ of interorbital, length $4 \frac{1}{8}$ in same. Scales setiform, velvety to touch, finer on fins. First dorsal origin trifle nearer second than snout tip; spine about half front fin edge, upper $\frac{3}{5}$ exposed; fin smaller than second. Origin of second dorsal about midway between first and end of last caudal vertebra or over hind basal portion of ventral; spine well compressed, $\frac{3}{4}$ front edge of fin. Lower caudal lobe little before upper. Pectoral short, end falls well before dorsal. Ventral inserted midway between tip of lower jaw and caudal tip. Upper surface brown, lower surface darker to blackish. Length 416 mm.

Eastern Atlantic and Mediterranean, north to the British Isles and Scandinavia. Reported by Barnard as *Etmopterus spinax* (1925, Ann. South African Mus., XXI, p. 49) from off Cape Point in 417 fathoms. The above description is from Italian examples.

***Etmopterus pusillus* (Lowe)**

Gata negra, Raimudo pequeno (Madeira)

Figure 28

Acanthidium pusillum LOWE, 1839, Proc. Zool. Soc. London, VII, p. 91. Madeira; 1839, Trans. Zool. Soc. London, III, part 1, p. 19 (Madeira); 1843-1860, 'Fishes of Madeira,' p. 37, Pl. VI (Madeira).

Spinax pusillus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 425 (Madeira).—VAILLANT, 1883, 'Expéd. "Travailleur," et du "Talisman,"' Poiss., p. 72 (Canal de Saint-Vincent, Saint-Antoine, Cape Verde Islands, in 580 m.).—COLLETT, 1890, Bull. Soc. Zool. France, XV, p. 219 (Funchal).—REGAN, 1908, Ann. Mag. Nat. Hist., London, (8) II, p. 44.

Etmopterus pusillus, ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 16 (Azores, in 785 to 1998 m.).—GARMAN, 1913, Mem. Mus. Comp. Zool., XXXVI, p. 288 (Madeira).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 122 (Azores materials).—URLARTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2)LIII, p. 24 (Gran Canaria).

Centrina niger (not Cuvier) LOWE, 1833, Proc. Zool. Soc. London, I, p. 144 (Madeira); 1837, Trans. Zool. Soc. London, II, part 3, p. 194 (on 1883 record).

Head little less than one-fourth of total, depressed, crown slightly convex transversely. Snout broad, length about equals orbit, end bluntly rounded. Eye large, orbit nearly half of preoral, with crescentic translucent area at edge above hinder half of eye, possibly luminous; hind eye corner above mouth angle, nearly midway from snout end to pectoral. Mouth wide; deep groove and short labial folds on both jaws at angles. Teeth 27 rows above, 42 rows below; upper with long straight median cusp, short lateral one each side basally, hindmost tooth like lower; lower cutting edge obliquely, cusp obliquely turned toward mouth angle. Nostrils midway in snout. Scales small, irregular, variable, diverse on different parts of body; commonly with broad tetragonal four-pronged base under skin and small exposed quad-

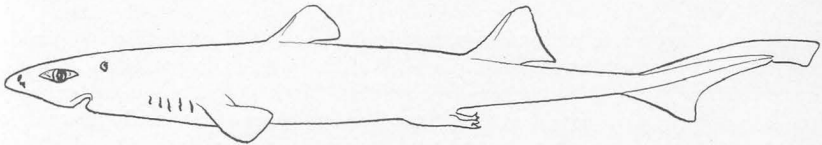


Fig. 28. *Etmopterus pusillus*, from Goode and Bean.

angular superstructure surrounded by a ridge with or without serrations or spinules and with hindmost angle produced in depressed spine; sometimes scale concave, again convex, or may form tubercle or short spine. First dorsal much narrower than second; base without spine little more than half as long; spine midway from orbit to spine of second dorsal. Second dorsal origin above ventral axils; spine nearly twice height of first, nearly as high as fin; hind fin edge concave and hind angle much produced. Caudal little less than one-fourth of total; subcaudal deep, slightly lobed anteriorly, concave and narrow posteriorly, separated from terminal by shallow notch. Pectorals not reaching first dorsal origin, subtruncate on hind edge, inner angle rounded. Ventral ends reaching little behind spine of second dorsal. Back brown, lower surfaces black. Inside of upper forward half of orbit heavily pigmented as an ocular shield. Inside mouth black. Length 292 mm. (Garman.)

Deep waters of Madeira, Cape Verde Islands, West Indies, and Japan, in depths of from 200 to nearly 300 fathoms. Eight 275 to 468 mm. from Funchal, Madeira, obtained by Adolfo Cesar di Noronha, in the U. S. National Museum.

CENTROSCYLLIUM Müller and Henle

Centroscyllum MÜLLER AND HENLE, 1838, 'Beschr. Plagiostomen,' p. 191. Type: *Spinax fabricii* Reinhardt. Monotypic.

Paracentroscyllum ALCOCK, 1889, Ann. Mag. Nat. Hist., London, (6) IV, p. 379. Type: *Paracentroscyllum ornatum* Alcock. Monotypic.

Body elongate, fusiform. Head broad. Snout short, depressed, blunt. Eye large, orbit elongate; no nictitating membrane. Mouth wide, moderately arched; deep groove and labial folds at each angle. Teeth small, raptorial, with 3 to 7 sharp cusps. Nostrils oblique, in forward half of snout. Gill openings narrow, before pectorals. Spiracle behind eye, elevated, opens upward. Scales small, commonly with broad base and slender acuminate cusp. Dorsal spines much exposed, grooved longitudinally on each side. First dorsal near pectorals, second behind ventrals. No anal. Caudal without pits; subcaudal deep, without much produced lobe.

About five species.

Centroscyllum fabricii (Reinhardt)

Figure 29

Spinax fabricii REINHARDT, 1828, Danske Vidensk. Selsk. Förh., Kjøbenhavn, III, p. 16. Greenland.

Centroscyllum fabricii VAILLANT, 1888, 'Exped. "Travailleur" et du "Talisman," Poiss., p. 72 (Banc d'Arguin in 1495 m.).

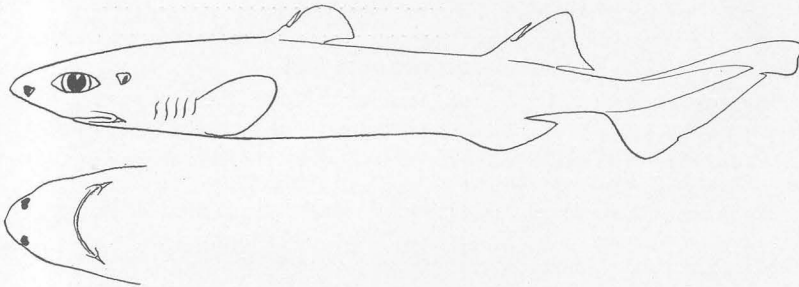


Fig. 29. *Centroscyllum fabricii*.

Body moderately elongate, rather depressed, depth $6 \frac{1}{3}$. Head depressed, evenly convex above and below, width $1 \frac{1}{2}$ its length, which $4 \frac{1}{3}$ in body. Snout obtuse, length half its width or $3 \frac{2}{3}$ in head. Eye large, little longer than deep, slightly advanced or $3 \frac{2}{3}$ in head. Mouth broadly convex, transverse, mandible tip about last fourth in eye. Teeth triangular, small, compressed, in about 30 rows. Short fold forms deep pit outside each mouth corner. Nostrils inferior, at first fourth in preoral, about $\frac{3}{4}$ of internasal which is $\frac{2}{3}$ mouth width. Last gill opening before pectoral, largest, $2 \frac{1}{2}$ in mouth width. Spiracle moderate, eye diameter behind eye. First dorsal origin midway between hind basal edge of second dorsal and snout tip; spine very robust, short, blunt, about $\frac{2}{3}$ of fin. Second dorsal origin much nearer first than end of last caudal vertebra, larger than first dorsal; spine like that of first

dorsal, $\frac{4}{5}$ of fin. Expansion of upper caudal lobe $\frac{1}{5}$ its length. Pectoral rounded, reaches first fourth in first dorsal base. Ventral base before second dorsal, insertion at last third of interdorsal. Dull slaty-gray generally, in young fins paler marginally. Length 140 mm.

North Atlantic, from Banc d'Arguin to Greenland. Goode and Bean¹ have questioned Vaillant's record, though apparently without just cause. Vaillant's specimen was 175 mm. long. It is upon this record that I include the species within the present limits. The above description is from an American example, obtained on George's Bank.

Dalatiidae

Body subfusiform, cavity more than half total length. Snout subconic. Eyes without nictitating membrane. Mouth transverse, with labial folds. Teeth unlike in jaws, upper raptorial, lower sectorial. Gill openings moderate to narrow. Spiracles small. Scales uniform. Two small dorsals, spine absent, or rudimentary in rare cases. No anal. Tail short, without lateral folds or caudal pits.

KEY TO THE GENERA

- a.*—Second dorsal much longer than first. EUPROTOMICRUS.
aa.—Second dorsal nearly equals first.
 b.—Second dorsal near pectoral. DALATIAS.
 bb.—Second dorsal near ventral. ISISTIUS.

EUPROTOMICRUS Gill

Euprotomicrus GILL, 1864, Proc. Acad. Nat. Sci. Philadelphia, p. 264. Type: *Scymnus (Laemargus) labordii* (Quoy and Gaimard) Müller and Henle. Monotypic.

Squaliolus SMITH AND RADCLIFFE, 1912, Proc. U. S. Nat. Mus., XLI, p. 683. Type: *Squaliolus laticaudus* Smith and Radcliffe. Orthotypic.

Body elongate, fusiform. Head thick. Snout short and subconic. Eyes without nictitating membranes. Mouth transverse, deep straight groove at each angle. Upper teeth small, subulate; lower larger, compressed, smooth edged, with sharp, somewhat oblique cutting edges. Nostrils near snout end. Gill openings narrow, before pectorals. Spiracles rather wide, behind eye. Scales minute, flattened, uniform. First dorsal small, without or with a small spine, behind pectorals. Second dorsal much longer, spineless. No anal. Caudal short and deep.

Euprotomicrus sarmenti (Noronha)

Figure 30

Squaliolus sarmenti NORONHA, 1926, Ann. Carnegie Mus., XVI, No. 3-4, p. 386, Pl. xxxv. Madeira.

Body somewhat robust, rounded trihedral in section. Caudal peduncle short, slender, flat above and below. Head 4 to last vertebra, narrow, width $2\frac{4}{5}$ its length. Snout $2\frac{3}{5}$ in head, and triangular as seen from above. Eye $5\frac{2}{3}$, 2 in snout, $1\frac{1}{2}$ in interorbital. Mouth small, labial fold short. Upper teeth with very

¹1895, 'Ocean. Ichth.', p. 11.

narrow sharp cusps, conicocompressed; lower 7+1+8, triangular cusps rather narrow. Scales small sessile quadrangular tubercles, each with 4 ridges. First dorsal nearer pectorals than ventrals, before midlength, with small concealed spine. Second dorsal unarmed. Caudal with two triangular lobes. Pectoral reaches a little behind first dorsal origin. Ventral close before second dorsal. Blackish brown above, slaty black below. Fins, except caudal, with free edges whitish. Length 246 mm. (Noronha.)

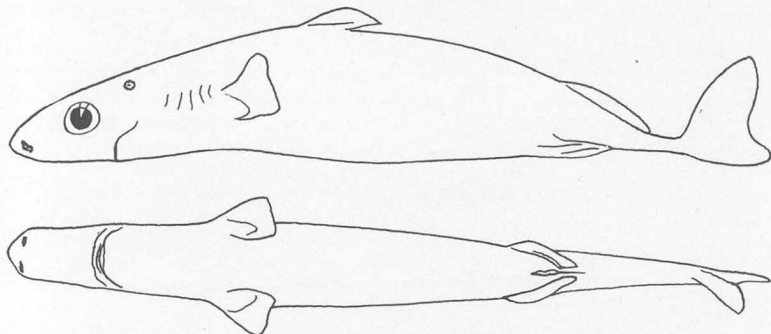


Fig. 30. *Euprotomicrus sarmenti*, from Noronha.

Madeira. I examined the type some years ago when it was compared by Dr. Henn in the U. S. National Museum.

DALATIAS Rafinesque

Dalatias RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 10. Type: *Dalatias sparophagus* Rafinesque. (Designated by Gill, 1861, Ann. Lyc. Nat. Hist. New York, p. 39.)

Scymnus (not Kugelmann, 1814) CUVIER, 1817, 'Règne Animal,' II, p. 130. Type: *Squalus americanus* Gmelin. Monotypic.

Scymnorhinus BONAPARTE, 1846, 'Cat. metod. pesc. Europei,' p. 16. Type: *Squalus licha* Bonnaterre. Monotypic.

Borborodes GISTEL, 1848, 'Naturg. Thierr,' p. x. Type: *Squalus licha* Bonnaterre. (*Borborodes* Gistel proposed to replace *Scymnus* Cuvier.)

Elongate, fusiform. Snout subconic, end bluntly rounded. No nictitating folds. Mouth transverse, with deep straight groove and labial folds at each angle; villous upper lip before teeth. Upper teeth raptorial, lanceolate; lower sectorial, compressed, serrated on edges, nearly erect in middle of mouth. Nostrils anterior; valve with rounded lobe on inner half. Gill openings rather small. Spiracles wide, transverse, behind eye, superior, opening upward. Scales minute, carinate. Dorsals short, spineless, first before ventrals. No anal. Caudal large, subcaudal deep; tail shorter than body.

One species.

Dalatias licha (Bonnaterre)

Gata (Madeira)

Figure 31

Squalus licha BONNATERRE, 1788, 'Tabl. Ichth.,' p. 12. Cape Breton, France. (On "Le liche" Broussonet, 1780, Mém. Acad. Sci., Paris, p. 677.)

Scymnus licha BOWDICH, 1825, 'Excurs. Madeira,' p. 74 (Porto Santo).

Scymnus licha GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 425 (Madeira).—COLLETT, 1893, Bull. Soc. Zool. France, XV, p. 219 (Funchal).—ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 17 (Funchal).

Scymnorhinus licha URLARTE AND MATEU, 1931 (October 15), Not. Resúm. Inst. Españ. Océanogr., Madrid, (2)LIII, p. 26 (Gran Canaria).

Scymnus nicaeensis LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 194 (Madeira).

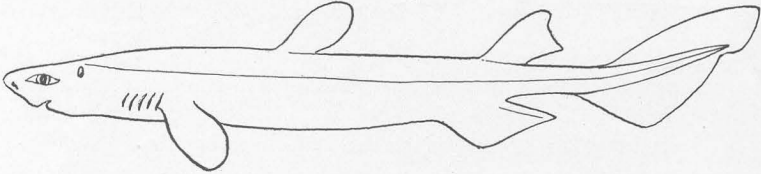


Fig. 31. *Dalatias licha*, from Bonaparte.

Body moderately slender, tapering, trunk robust, little compressed, depth $8 \frac{2}{3}$ to 9. Head moderate, robust, rather more depressed above, $6 \frac{1}{2}$. Snout broadly depressed, length one-half its width, viewed from above forms obtuse angle with rounded tip. Eye long, ellipsoid, with broad free lids leaving spacious cavities inside. Mouth broad, transverse, outline but slightly convex forward, with mandible tip midway in eye; deep broad fold over each mouth corner enclosing spacious cavities at jaw angles. Teeth large, erect, slender, in 18 rows; upper entire, pointed, slightly directed laterally, numerous, and in several irregular rows following one another; lower broadly compressed, triangular, forming sharp cutting edge. Nostrils inferior on snout, about as long as vertical eye diameter; internasal about $2 \frac{1}{3}$ in interorbital; about first fourth in preoral length. Last gill opening longest, equals $\frac{2}{5}$ of preoral. Spiracle distant $1 \frac{2}{3}$ its own length from eye, which is $2 \frac{4}{5}$ in preoral. First dorsal origin midway between front edge of spiracle and second dorsal origin. Second dorsal origin nearer first than end of trunk by space equal its own base. Caudal broad, origin of lower lobe advanced from upper. Pectoral moderate, rather ovoid, reaches dorsal origin, width half its length. Ventral inserted opposite last fourth between second dorsal origin and hind basal edge of first dorsal. Chocolate to cinnamon brown. Length 858 mm.

Mediterranean and Atlantic. The above description is from Italian examples.

ISISTIUS Gill

Isistius GILL, 1864, Proc. Acad. Nat. Sci. Philadelphia, p. 264. Type: *Scymnus brasiliensis* Quoy and Gaimard. Monotypic.

Leius KNER, 1865, Denkschr. Akad. Wiss. Wien, XXIV, p. 9. Type: *Leius ferox* Kner. Monotypic. (Versus *Leia* Meigen, 1818.)

Body long, subfusiform. Head subconic. No nictitating folds. Mouth transverse, with straight deep groove, covering labial folds at each angle, ending at end of transverse fold in front of and covering the distinct upper lip; upper teeth raptorial, slender, subconic; lower sectorial, compressed, with smooth-edged triangular cusp, erect. Nostrils anterior; nasal valve with short median process. Gill openings narrow. Spiracles transverse. Scales minute, polygonal or quadrangular with central depression on crown, in pavement. Pectorals, dorsals, and ventrals small, caudal short. Tail short, without lateral folds or basal pits.

Isistius brasiliensis (Quoy and Gaimard)

Scymnus brasiliensis (Cuvier) QUOY AND GAIMARD, 1824 'Voy., "Uranie," ' Zool., p. 198. Brazil.

Isistius brasiliensis GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 429 (Gulf of Guinea).—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 25 (Cape Verde).—LAMPE, 1914, 'Deutsche Südpolar Exped.,' Fische, XV (2), p. 214 (southwest of Sierra Leone, N. lat. 0°, W. long. 16° to 18°).

Scymnus torquatus DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 261 (St. Jago, Cape Verde).

Body cavity about 2/3 total. Head subconic, crown somewhat flattened. Eye large, orbit with angle in hind border. Mouth moderate, transverse, with deep groove at each angle, with labial folds and distinct upper lip. Teeth dissimilar, smooth-edged; upper in 33 rows, slender, pointed, more or less oblique and movable, several rows functional; lower broad, with erect triangular cusp, in 31 rows, single series in function except when outer about to be dropped. Nostrils advanced, valve with short sharp median process. Gill openings small, narrower than spiracle, rather above level of pectorals. Spiracle large, behind eye about length of orbit, at higher level, open upward. First dorsal very small, end of base above ventral origins, hind edge truncate. Second dorsal little larger than first, end of base near middle of space between ventral bases and caudal base, fin triangular. Tail about 1/6 of total, depth about equals its length; subcaudal longer than rest of fin anterior to shallow notch separating it from terminal. Pectorals small, subtruncate, angles rounded. Brown, light to dark, with darker band around neck, across gill openings; lower surfaces lighter to white, except perhaps blackish nuchal collar. Lower surfaces of body, head, pectorals, ventrals and caudal luminous in life. Length 512 mm. (Garman.)

Tropical and temperate seas.

Echinorhinidae

Bramble Sharks

Body massive; subfusiform. Head depressed. Snout wide, tapering. Eyes without nictitating membrane. Mouth crescentic, without labial folds. Teeth sectorial, alike in jaws, cusps oblique, notched each

side at base. Spiracles small. Dermal armature with scattered tubercles. Two small dorsals, without spine, above tail. No anal.

ECHINORHINUS Blainville

Echinorhinus BLAINVILLE, 1816, Bull. Soc. Philom., Paris, p. 121. Type: *Squalus spinosus* Gmelin. Monotypic.

Goniodus AGASSIZ, 1836, 'Poiss. Foss.,' III, p. 183. Type: *Squalus spinosus* Gmelin. Monotypic.

Body longer than tail, subfusiform. Head depressed. Snout tapering. No nictitating membranes. Mouth wide, arched forward; deep labial folds around angles. Teeth sectorial smooth-edged, alike in 2 jaws, broad, compressed, with cusp directed toward mouth angles and with one or more denticles at each side of base. Nostrils nearly midway from mouth in preoral. Gill openings 5, last before pectoral. Spiracles minute. Skin with scattered tubercles or bucklers. Two dorsals, close together, behind middle of total length, without spine. Tail short, without caudal pits or lateral folds.

One species.

Echinorhinus brucus (Bonnaterre)

Moumoujh (Senegambia)

Figure 32

Squalus brucus BONNATERRE, 1788, 'Tabl. Ichth.,' p. 11. The Ocean. (On "Le boucle" Broussonet.)

Echinorhinus spinosus ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 25 (Cape Blanco, Portendick, Guet N'Dar, Dakar, Gorée).

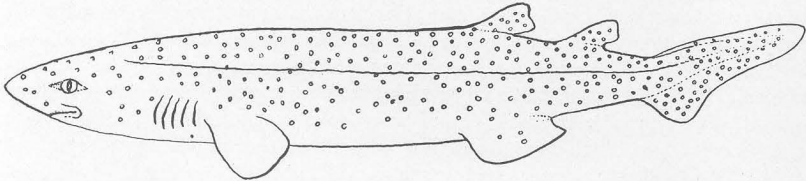


Fig. 32. *Echinorhinus brucus*, modified from Day.

Body elongate, slender to massive. Snout short, tapering from eyes, rounded at end. Eye moderate, pupil erect. Mouth crescentic, width greater than snout length; labial folds around angles. Teeth alike in jaws, in 20 or more rows, compressed, sectorial, cusp with cutting edge inclined nearly to horizontal, and 1 or 2 notches each side of base, 1 series functional except at about time of renewal, without or with a small erect tooth having a single denticle on each side at base. Nostrils nearer mouth than snout end, valve with pointed lobe in middle. Gill openings medium, anterior farther apart, hindmost widest. Spiracles small, a short distance behind eye. Bucklers scattered, irregular, radiate based, surmounted by sharp spine. Dorsals and ventrals behind midtotal length, the dorsals small and rounded. First dorsal inserted

above middle of ventral bases. Second dorsal little smaller than first, alike in shape, behind ventrals, not reaching caudal. Caudal about 1/4 total, vertebral axis rising backward; subcaudal rather deep, without distinct lobe, hind edge concave, separated sometimes by shallow notch from pointed terminal. Pectorals short, subtruncate, angles rounded. Back brown, tinted with purple or violet, with or without blotches of darker; lower surfaces lighter to whitish. Length 2745 mm. (Garman.)

Tropical and temperate Atlantic and Pacific, also the Mediterranean and Australia. Reported by Barnard as *Echinorhinus spinosus* (1925, Ann. South African Mus., XXI, p. 46, Pl. II, fig. 6) from Saldanha and Table Bays and Agulhas Bank in 30 to 50 fathoms.

ORDER RHINAE

Rhinoid Sharks

Mouth broad, anterior or inferior. Snout sometimes prolonged into a saw. Vertebrae with calcareous lamellae ranged in several concentric series or rings about central axis. Gill openings before pectoral. Dorsal fins small, posterior. Pectorals sometimes modified into lateral expansions.

Two widely divergent families, the angel sharks and the saw sharks, constitute this order. They graduate toward the skates. The saw sharks form an almost perfectly connected link between the skates and the saw fishes.

Squatinae

Angel Sharks

Body much depressed, wide. Head broad, depressed. Snout obtuse. Mouth anterior. Teeth conic, pointed, distant, 3 or 4 rows functional. Nostrils on front snout edge, with skinny flaps. Gill openings wide, partly inferior, partly hidden by pectoral bases. Spiracle wide, crescentic, behind eyes. Scales variable, somewhat stellate with slender hooked cusp, conical terminally and ridged with 4 keels basally, bases wide in young. Two fleshy keels extend down in front, and, in rare cases, a smaller median lies between and a stronger one passes down each side, or these may be followed by more. Sometimes keel on each side stronger and reaches outer edge where a similar one runs directly forward. Later, especially on middle of back, the scales become more placoid or tubercular, and on edges of fins and lower surface the crowns become leaf-shaped or imbricated. Dorsal fins 2, small, partly equal, on tail behind ventrals, and without spines. Caudal small.

Small sharks of peculiar appearance, mostly referred to a single genus.

SQUATINA Duméril

Squatina DUMÉRIL, 1806, 'Zool. Analyt.,' pp. 102, 342. Type: *Squatina angelus* Duméril = *Squalus squatina* Linné. Tautotypic.—VALMONT, 1768, 'Dict. Hist. Nat.,' I, p. 273; 1769, XI, p. 46; 1769, XII, p. 593. (Inadmissible.)

Rhina KLEIN, 1776, 'Gesellsch. Schauplatz.,' II, p. 587. Type: *Squalus squatina* Linné. Monotypic. (Inadmissible.)

Squalraia PYLAIE, 1834, Congrès Sci. France, Poitiers, p. 526. Type: *Squalraia acephala* Pylaie = *Squalus squatina* Linné. (Not *Squaloraia* Riley, 1826.)

Thaumas MÜNSTER, 1842, 'Beitr. Petrefaktenk.,' V, p. 62. Type: *Thaumas alifer* Münster. Monotypic.

Phorcymus THIOLLIÈRE, 1854, 'Poiss. Foss. Bugey,' Lyons, p. 9. Type: *Phorcymus catulina* Thiollière. Monotypic.

Scaldia LE HON, 1871, 'Prélim. Mém. Poiss. Tert. Belgique,' p. 7. Type: *Scaldia biforis* Le Hon. Monotypic.

Trigonodus (not Newberry and Worthen, 1866) WINKLER, 1878, Arch. Mus. Teyler, Haarlem, IV, p. 14. Type: *Squatina prima* Noetling. Monotypic.

Head short. Eyes small, superior, eyeball free from orbital edge. Mouth broad. One labial fold above and 2 below. Thin fold along each side, from nostril to angle of jaws. Front nasal valve with 2 cirri and more or less fringed in young. Caudal axis not raised, upper caudal lobe shorter, and lower lobe widens backward. Blunt keel on each side of tail behind. Pectorals large, expanded in width of body, not joined to side of head, and deeply notched at base. Ventrals large.

About eight living species in temperate and tropical seas.

KEY TO THE SPECIES

- a.—Folds at side of head not produced into lobes; dermal denticles tricarinate. *africana*.
 aa.—Folds at sides of head produced into an angular lobe on each side; dermal denticles not carinate. *squatina*.

Squatina africana Regan

Pezzidianchi (Canaries)

Squatina africana REGAN, 1908, Ann. Natal Gov. Mus., I, part 3, p. 248, Pl. xxxviii. Durban Bay, Natal; 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 124 (off Lagos).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 191 (Gorrei).

Rhina africana CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 230 (Rio de Oro; Gorrei).

Head 4 to origin of upper caudal lobe; greatest disk width $1\frac{2}{3}$; snout $3\frac{2}{3}$ in head; mouth width $1\frac{5}{6}$; interorbital $2\frac{3}{4}$.

Head broad, depressed, width but slightly greater than its length. Snout as seen from above, flattened, with slight median emargination in profile. Eye small, about once its diameter distant from profile of head, $\frac{1}{4}$ of interorbital. Each jaw with about 20 rows of teeth. Interorbital level, with slight superciliary convexity each side. Spiracle longer than eye, $2\frac{1}{4}$ in interspiracle space; little less than interorbital. Denticles largely simple, often with 1 or 2 feeble small ones to larger. Row of enlarged superciliary denticles and several each side of snout. Folds at side of head not forming lobe. Outer nasal flap with entire edge; inner flap with 2 simple tentacles but

little shorter than eye, the outer with a fringed basal lobe. Lower surface of body smooth, except wide finely roughened margins of pectoral, ventral, and tail. Length of first dorsal little more than interdorsal space; second dorsal little shorter than first; interdorsal less than distance between second dorsal and caudal. Hind caudal edge concave. Outer pectoral angle a right angle. Ventral not reaching opposite origin of first dorsal.

Upper surface drab, darker submarginally on pectorals and ventrals, which are very narrowly margined with white. Body with scattered whitish spots above, smaller and crowded on front half of head; larger white spots on middle of disk and tail, and former with smaller ones scattered between. Dorsals and caudal largely dusky to blackish with pale to whitish edges or borders. Lower surface pinkish. Pectoral and ventral broadly dusky to black. Length 270 mm.

Coasts of Africa, from Lagos to Natal. Described above from an example from Natal. It differs a little from Regan's figure in the dark submarginal portions of the fins, doubtless due in a measure to formalin preservation. The species is said to reach 800 mm.

***Squatina squatina* (Linné)**

Pez angel (Canaries)

Figure 33

Squalus squatina LINNÉ, 1758, 'Syst. Nat.', 10th Ed., p. 233. European Ocean.

Rhina squatina MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 392 (off Cape Bojador, 214 m.).

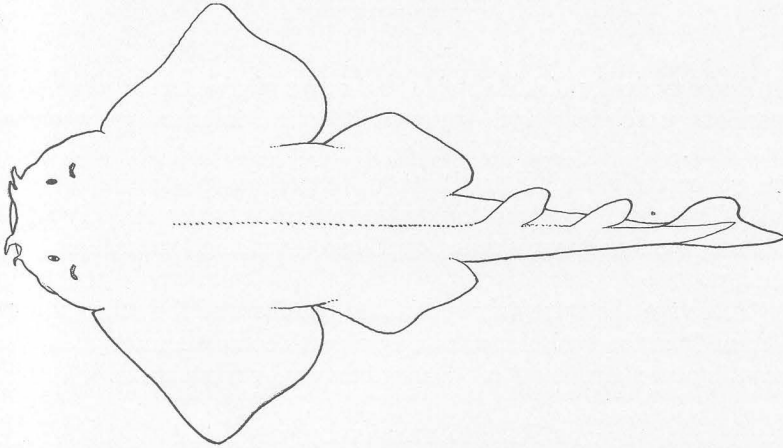


Fig. 33. *Squatina squatina*.

Squatina squatina ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 124 (Melilla and Mozagan, Morocco, 10 to 11 m.).

Squatina angelus VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II, part 2, p. 102 (Canaries).—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 403

(Santa Cruz, Teneriffe).—VINCIGUERRA, 1892, *Atti Soc. Ital. Sci. Nat.*, XXXIV, p. 300 (Canaries).

Body widest and deepest first $2/5$ its length; rather thick prominent keel along each side of caudal peduncle; depth $14\ 1/2$. Head with front profile rather evenly convex, constriction of neck about $1\ 2/3$ in greatest head width; length 6. Snout broadly depressed, little emarginate along front edge as viewed above. Eye distant from edge of head but little more than its diameter. Upper jaw slightly protrudes. Teeth slender, entire, about 22 rows in each jaw. Viewed laterally, the maxillary reaches hind eye edge. Nostrils lateral on snout; internasal about $1\ 1/8$ in inter-orbital; broad posterior cutaneous nasal flap. First gill opening slightly longest. Spiracle $1\ 1/8$ in eye. Scales mostly enlarged or thorny on top of head, especially on sides and supraocular region; vertebral row from gill openings to first dorsal; vertical fins with rather large scales, fine scales on pectorals and ventrals above; smooth below except broad pectoral and ventral edges, and small patch on breast, also all of tail below. First dorsal expanded above, base $2\ 1/3$ its length, reaches $4/5$ to second dorsal. Last dorsal a trifle smaller, inserted nearly midway between first dorsal origin and that of upper caudal lobe, base $2/5$ its length. Origins of caudal opposite. Body width at outer pectoral tips $1\ 5/7$ in total length or $1\ 3/4$ in its own length. Width of ventral $2\ 1/2$ its length. Gray to reddish brown, uniform to thickly sprinkled with darker spots and dots. Reaches 950 mm. or more.

Eastern Atlantic and Mediterranean. The above description from small Italian examples 311 mm.

ORDER BATOIDEI

Rays

Body typically disklike, wide, flat edges of disk usually formed by expanded pectorals. Eyes superior. Mouth inferior, more or less protractile. Gill openings 5, inferior, slitlike. Spiracles present. Vertebrae cyclospindylous. Dorsal fins, when present, placed on tail. No anal. Caudal small or wanting, tail comparatively slender. Pectorals with long basal and many radial cartilages extending forward above gill openings.

These are the extremely specialized members of the subclass, very different from the typical sharks, though with complete intergradations. Excepting the skates most of the members are ovoviviparous.

KEY TO THE SUBORDERS

- a.*—Tail comparatively thick, with 2 dorsals and a caudal fin, but no serrated caudal spine.....SARCURA.
aa.—Tail comparatively slender, dorsal fin single or wanting and tail above usually armed with one or more serrated spines.

MASTICURA.

SUBORDER SARCURA

Thick-tailed Rays

Disk small to large, broad and rounded, sometimes with an electric battery each side of head. Usually nasoral grooves. Rostral cartilages present or absent. Tail comparatively thick, with 2 dorsals and a caudal fin, but without serrated caudal spine. Pectorals widely separated or continued forward to end of snout. Claspers unsegmented, rarely incomplete.

KEY TO THE FAMILIES

- a.*—Snout sawlike, produced into a long, thin, flat blade armed with row of strong teeth placed in sockets along each edge; body somewhat sharklike, disk narrow, gradually passing into tail.
PRISTIDAE.
- aa.*—Snout not sawlike; body more disklike.
- b.*—No electric organs; skin not perfectly smooth; tail strong, with two dorsals and well-developed caudal.
- c.*—Disk moderate or small, pectorals not reaching end of snout; rostrum more or less produced; no nasoral grooves. RHINOBATIDAE.
- cc.*—Disk large, broad, rounded, pectorals reaching end of snout; nasoral grooves rudimentary or absent.
DISCOBATIDAE.
- bb.*—Electric organs present; nasoral grooves present.
- d.*—Skin variously roughened; electric organs rudimentary in caudal region. RAJIDAE.
- dd.*—Skin perfectly smooth; electric organs as honey-comblike tubes between pectoral fins and head.
TORPEDINIDAE.

Pristidae

Saw Fishes

Body long, depressed, disk small. Snout sawlike, much produced, flat, with a row of strong teeth on each side set at right angles to saw. No nictitating membranes, tentacles, or electric battery. Teeth in jaws minute and obtuse. Nostrils inferior, without nasoral grooves. Gill openings moderate. Spiracles wide, behind eyes. Dorsal fins large, without spines, first nearly opposite ventrals. Caudal well developed, bent upward; fold along each side of tail. Pectorals moderate, front edge quite free, not reaching head.

Large sharklike rays with the disk gradually passing into the tail.

A single living genus, the exact raylike prototype of the saw sharks (*Pristiophoridae*).

PRISTIS Linck

Pristis LINCK, 1790, Mag. Neuste Phys. Naturgesch., Gotha, VI (3), p. 31. Type: *Squalus pristis* Linné. Tautotypic.

Pristobatis BLAINVILLE, 1816, Bull. Soc. Philom., Paris, p. 121. Type: *Pristis antiquorum* Latham. (Designated by Fowler, 1911, Bull. IV, Geol. Survey, New Jersey, p. 81.)

Pristibatis, *Pristobatus* auct.

Myriosteon GRAY, 1864, Proc. Zool. Soc. London, p. 163. Type: *Myriosteon higginsii* Gray = *Pristis* Linck. Monotypic. (Supposed to be an echinoderm.)

Pristiopsis FOWLER, 1905, Proc. Acad. Nat. Sci. Philadelphia, p. 459. Type: *Pristis perrotleti* Müller and Henle. Monotypic.

Eopristis STROMER, 1905, Beitr. Pal. Geol. Oester.-Ung., XVIII, p. 52 (16). Type: *Pristis (Eopristis) reinachi* Stromer. Monotypic.

Teeth in saw firmly embedded, except in very young. Orbital edge not free from eye in its upper half, lower half serving as nictitating membrane when eye retracts. Mouth transverse. Teeth small, smooth, pavement-like, 70 to 178 or more rows above. Nostrils moderate, oblique. Spiracles moderate, behind eyes. Intestine with about 8 turns in spiral valve. Pelvis convex in front, without lateral processes directed forward from each end. Pectorals united to head along gills. Caudal axis slightly raised.

Bottom-dwellers in tropical and partly tropical seas, some entering fresh water. About six species.

KEY TO THE SPECIES

- a.—Dorsal origin opposite ventral origin; subcaudal lobe absent.
 b.—Rostral teeth 24 to 32. *pectinatus*.
 bb.—Rostral teeth 16 to 20. *pristis*.
 aa.—Dorsal origin before ventral origin; subcaudal lobe small; rostral teeth 17 to 22. *microdon*.

Pristis pectinatus Latham

Njonga, Dzonga (Cameroons)

Figure 34

Pristis pectinatus LATHAM, 1794, Trans. Zool. Soc. London, II, p. 278, Pl. xxvi, fig. 2 (saw). In the ocean.—CAPELLO, 1872, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, IV, No. 13, p. 88 (Angola).—OSORIO, 1898, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 52 (Angola).

Pristis occa DUMÉRIL, 1865, 'Hist. Nat. Poiss.,' I, p. 479. No locality.—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 26 (Falémé, Gambia, Saloum).

Pristis woermannii J. G. FISCHER, 1883, Jahrb. Hamburg. Wiss. Anst., p. 39. West Africa.—MONOD, 1927, 'Faune Colon. françaises,' p. 648 (on Fischer).

Snout moderately wide, teeth 24 to 32, not grooved on hind edge in young, closer forward, length sometimes irregular. Eye moderate. Mouth slightly undulate in young. Teeth in jaws in 90 to 178 rows above, 85 to 175 rows below. Nostrils and

spiracles slightly inclined. Young with scales broadly rounded, stalks short, crowns leaf-shaped, generally are sharply angled behind over greater part of body. Crowns on fin edges, about snout, and on head become smooth, without stalks and button-like with age. Low keel each side of tail. Angles of fins somewhat distinct. First dorsal inserted opposite ventral insertion, or slightly backward. Second dorsal a little smaller. No lower caudal lobe. Outer pectoral angle blunt, edges nearly straight. Color dark gray or brown above, paler or whitish below. Reaches 4565 mm. and over.

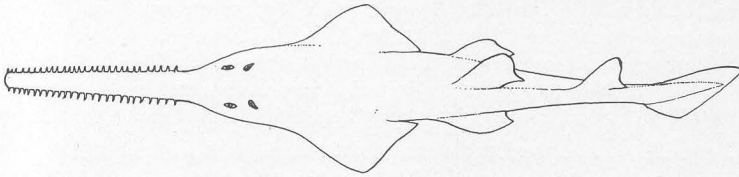


Fig. 34. *Pristis pectinatus*.

Tropical and temperate seas. The above description from American examples (Mexico, Guiana, West Indies). Reported by Barnard as *Pristis pectinatus* (1925, Ann. South African Mus., XXI, p. 57) from Natal to Delagoa Bay.

***Pristis pristis* (Linné)**

Say jhne (Senegambia)

Squalus pristis LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 235. Europe.

Pristis antiquorum DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 261 (Senegal).—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LXIV (1), p. 577 (Senegal).—PETERS, 1876, 1877, Monatsb. Akad. Wiss. Berlin, p. 252 (Victoria, Cameroon).—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV, p. 51 (Senegambia).—ROCHEBRUNE, 1883–1884, 'Faune Sénégalie,' Poiss., p. 26 (Falémé, Gambia, Saloum).—MONOD, 1927, 'Faune Colon. françaises,' p. 448 (on Peters).

Rostrum broad, tapering, with 15 to 16 teeth on each edge. Origin of first dorsal above that of ventrals. Second dorsal about large as first, not reaching caudal. No subcaudal lobe. (Garman.)

Mediterranean and Atlantic. It is said to reach a size as large as that of the preceding species.

***Pristis microdon* Latham**

Say jhne (Senegambia)

Pristis microdon LATHAM, 1794, Trans. Linn. Soc. London, II, p. 280, Pl. xxvi, fig. 4. No locality.

Pristis perotteti (Valenciennes) MÜLLER AND HENLE, 1838, 'Beschr. Plagiostomen,' p. 104. Senegal.

Pristis perroteti DUMÉRII, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 261 (Senegal).—DUMÉRII, 1865, 'Hist. Nat. Poiss.,' I, p. 474 (types of *Pristis perroteti* Müller and Henle).—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LXIV, (1), p. 577 (St. Louis); 1882, Denkschr. Akad. Wiss. Wien, XLIV, p. 51 (Senegambia).—ROCHEBRUNE, 1883-1884, 'Faune Sénégalie,' Poiss., p. 25 (Falémé, Gambia, Saloum).—PELLEGRIN, 1923, 'Poiss. Eaux douces Af. Occ.,' p. 32 (Sassandra, Ivory Coast).

Pristis perroteti BOULENGER, 1909, 'Cat. Fresh-water Fishes Africa,' I, p. 3, Fig. 2 (Gambia).

Rostrum broad, tapering, teeth in 17 to 22 pairs, rather distant from one another, grooved behind to form 2 cutting edges of which lower more prominent. Teeth in jaws pavement-like, 70 rows above, 72 rows below. Dorsals rather large, of equal height, hind angles produced; first dorsal origin more than half length of base forward from the origins of the ventrals; second shorter in base and in total length, not reaching caudal. Supracaudal pointed; subcaudal with small lobe. (Garman.)

Tropical seas, entering rivers. Several saws in the Academy, likely this species, show the teeth variably ranging 16 to 18 on each side. They are from Brazil, Surinam, and the Gulf of Mexico.

Rhinobatidae

Guitar Rays

Body, head, and tail depressed. Disk broad behind, tapers forward. Orbit with low fold below eye and projecting shield above pupil. Teeth small, numerous, in pavement. Nostrils oblique; each valve in three sections, an outer and inner separated by an elongate lobe. Spiracles large, close to eye. Tail strong, wide at base, with two dorsals, moderate to small caudal fin and dermal fold each side. Pectorals extend opposite gill openings, but not on snout.

Five genera.

KEY TO THE GENERA

a.—Ventrals distant from pectorals; dorsal opposite ventrals; subcaudal lobed.

RHYNCHOBATUS.

aa.—Ventrals close to pectorals; dorsal behind ventrals; subcaudal small, not lobed.

RHINOBATOS.

RHYNCHOBATUS Müller and Henle

Rhynchobatus MÜLLER AND HENLE, 1838, 'Beschr. Plagiostomen,' p. 111. Type: *Rhynchobatus laevis* Schneider. Monotypic.

Rhynchobatus, *Rhincobatis* auct.

Disk subtriangular, longer than wide. Snout elongate, pointed; rostral cartilages long, troughlike. Mouth with moderately developed labial folds and labial cartilages. Teeth unlike. Nostrils wide, oblique, valves not crossing internarial space. Pectorals narrow, not extending beyond nostrils.

Two species.

Rhynchobatus lübberti Ehrenbaum

Kioker, Guitarra (Senegambia)

Figure 35

Rhynchobatus lübberti EHRENBaum, 1914, Fischerbote, VI, p. 303, Fig. Cameroon; 1915, 'Ueber Küstenfische von Westafrika,' p. 69, Fig. p. 70.—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 193, Fig. 56 (Senegambia).—MONOD, 1927, 'Faune Colon. françaises,' p. 648 (compiled).

Rhynchobatus djeddensis (not Forskål) ROCHEBRUNE, 1883, 'Faune Sénégal-gambie,' Poiss., IV, p. 27 (Barbarie, Baie d'Arguin, Cape Verde).

Rhynchobatus atlanticus REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) IV, p. 124. Lagos.—NORMAN, 1926, Proc. Zool. Soc. London, p. 944 (type).

Disk width in female $5/7$, in male $4/5$ length to vent; snout angle less than 60° , junction of rostral cartilages, $2/5$ length from snout tip. Mouth slightly bent forward

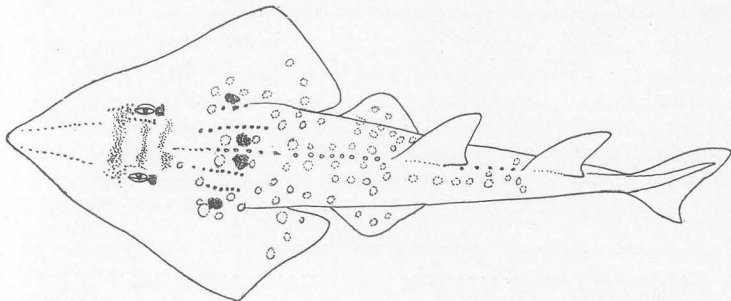


Fig. 35. *Rhynchobatus lübberti*, modified from Metzelaar.

medianly, otherwise straight; width between outer corners of labial folds $2\frac{2}{9}$ in female, $2\frac{2}{3}$ in male, in preoral snout. Internasal $2/3$ nostrils; front narial lobe small, inner section continued $1/3$ in male, $2/7$ in female, of space to inner edge of nostril. Inner section of posterior valve much the broadest. Spiracles large, with 2 folds, the outer one slightly larger. Row of prominent compressed median spines on orbital ridges and rostral ridges; pair on snout tip; 2 medial rows of 8 spines, and extra outer pair on shoulder. Dorsals equal, base of first ends on level with angles of ventral.

Mouse-gray, with black crossbars and paler areas in interorbital. White edge of snout extends back on pectorals. Pair of conspicuous inky blotches near median line, on level with pectoral angles. Behind pectoral angles body spotted, very sharply defined as symmetrically arranged circular white spots, extending on pectoral and tail to second dorsal. Large, jet-black blotch covers lower side of snout. Female brighter. Length of male 590 mm., female 580 mm. (Metzelaar).

Senegambia to Cameroon.

RHINOBATOS Linck

Rhinobatos LINCK, 1790, Mag. Neuste Phys. Naturgesch., Gotha, VI (3), p. 32. Atypic. Type: *Raja rhinobatos* Linné.

Rhinobatus, *Rhinobatis*, *Rhinobates* auct.

Leiobatus (not Walbaum) RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 16. Type: *Leiobatus panduratus* Rafinesque. Monotypic.

Aellopos MÜNSTER, 1836, Neues Jahrb. Mineral., p. 581. Type: *Aellopos elongatus* Münster. Monotypic.

Euryarthra AGASSIZ, 1843, 'Poiss. Foss.,' III, p. 382. Type: *Euryarthra münsteri* Agassiz. Monotypic.

Glaucostegus BONAPARTE, 1846, 'Cat. Pesci Europ.,' p. 14. Type: *Rhinobatus cemiculus* G. St.-Hilaire. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 2, p. 225.)

Spathobatis THIOLLIÈRE, 1849, Ann. Soc. Agric. Lyon, I, p. 63. Type: *Spathobatis bugesiacus* Thiollière. Monotypic.

Aptychotrema NORMAN, 1926, Proc. Zool. Soc. London, p. 977. Type: *Rhinobatus (Syrhhina) bougainvillei* (Valenciennes) Müller and Henle.

Disk subtriangular, wider and rounded posteriorly. Snout elongate, pointed, formed by long rostral cartilages and vascular area each side. Nostrils oblique to horizontal, anterior valves not joined across space behind them, not reaching mouth. Spiracles large, usually with two folds on hind edge, rarely one or none. Dorsals behind ventrals. Tail depressed, robust anteriorly. Caudal small, subcaudal weak and without lobe. Pectorals rather narrow, most developed behind shoulder girdle, narrowing to acute forward, not produced into snout. Ventrals close to pectorals.

KEY TO THE SPECIES

- a.—Rostrum white below. *rhinobatos*.
 aa.—Black blotch beneath snout tip. *cemiculus*.
 aaa.—Angular black spot below snout tip, usually with black streak variously along each edge posteriorly. *percellens*.

Rhinobatos rhinobatos (Linné)

Guitarra (Cape Blanco), Gnouà (Gaboon), Yana (Dakar)

Figure 36

Raja rhinobatos LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 232. Genoa; Venice.

Rhinobatus rhinobatus CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 230 (Port-Étienne).

Rhinobatus (Syrhhina) columnae STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LXI (1), p. 577 (St. Louis).

Rhinobatus columnae CAPELLO, 1872, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, IV, No. 13, p. 88 (Mossamedes).—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV, p. 51 (Senegambia); 1882, *op. cit.*, XLV (1), p. 14 (Gorée).—OSORIO, 1898, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 201 (Angola).—PELLEGRIN, 1907, Act. Soc. Linn. Bordeaux, LII, p. 76 (Dakar); 1913, Bull. Soc. Zool. France, XXXVIII, p. 154 (Libreville, Gaboon); 1914, Ann. Inst. Océanogr. Monaco, p. 7 (Baie du Lévrier, Dakar, Gaboon).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 194 (Cape Blanco).

Disk width little less than its length, or $5 \frac{1}{3}$ to $5 \frac{3}{4}$ in total length. Snout rather broad, end blunt, length 7 to $7 \frac{4}{5}$ in total body length. Eye $6 \frac{1}{6}$ to 7 in head measured to first gill opening. Mouth straight, width $2 \frac{3}{4}$ to 3 in head. Teeth in 95 to 116 rows above, 80 to 90 rows below. Internasal $5 \frac{3}{4}$ to $6 \frac{1}{5}$ in head; nostril $4 \frac{3}{4}$ to $5 \frac{3}{5}$; interorbital $3 \frac{2}{3}$ to $4 \frac{1}{2}$. Spiracle large, $7 \frac{1}{2}$ to 12 in snout, with 2 prominent folds. Median vertebral row of small tubercles, 2 groups on each shoulder and a row above each orbit. Dorsals small; first dorsal base $3 \frac{5}{6}$ to 5 in

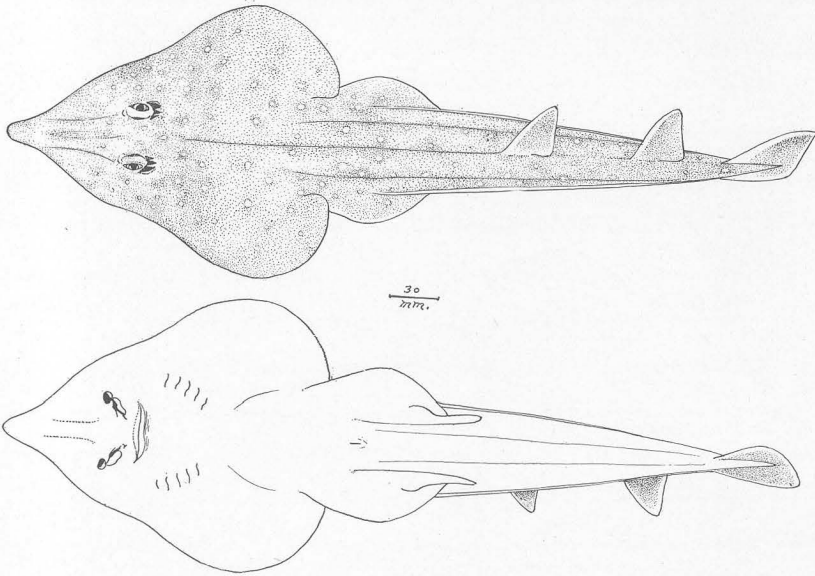


Fig. 36. *Rhinobatos rhinobatos*.

head, height $2 \frac{1}{4}$ to 3; second dorsal base $3 \frac{1}{2}$ to $4 \frac{1}{8}$, height $2 \frac{1}{2}$ to $3 \frac{2}{5}$; upper caudal lobe $1 \frac{2}{5}$ to $1 \frac{4}{5}$. Nearly uniform brownish above, paler each side of rostral cartilages. Lower surface whitish. Length 938 mm.

Eastern Atlantic, Mediterranean, and Persian Gulf. The above description from Mediterranean examples, including the types of *Rhinobatus columnae* Bonaparte.

***Rhinobatos cemiculus* Geoffroy St.-Hilaire**

Gnatj (Senegambia) Etutumé, Etutuma, Ngonga, Mungonga (Cameroons)

Figure 37

Rhinobatus cemiculus GEOFFROY ST.-HILAIRE, 1809, 'Description de l'Égypte,' Poiss., Pl. xxvii, fig. 3; 1813, p. 338. Egypt.—NORMAN, 1926, Proc. Zool. Soc. London, p. 953, Fig. 7 (head of type).

Rhinobatus halavi (not Forskål) GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 442 (West Africa, Gambia).—STEINDACHNER, 1882, Denskschr. Akad. Wiss. Wien, XLIV, p. 5 (Senegambia).—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 27 (Gambia, Casamence, Baie de Sainte-Marie, Dakar).—OSORIO, 1890 (September), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) II, p. 59 (Bahia de Lobito, Mossamedes, Benguella, Angola); 1898, *op. cit.*, (2) V, p. 201 (Angola).

Rhinobatis halavi PETERS, 1876, 1877, Monatsb. Akad. Wiss. Berlin, p. 252 (Victoria, Cameroon).—TROSCHER, 1866, Archiv Naturg., p. 238 (Cape Verde Islands).—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 28 (Dakar, Gorée).

?*Rhinobatus granulatus* (not Cuvier), OSORIO, 1898, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 201 (Cape Verde Islands).

Rhinobatus rarus GARMAN, 1908, Bull. Mus. Comp. Zoöl., LI, p. 253. Akkara, Guinea; 1913, Mem. Mus. Comp. Zoöl., XXXV, p. 270, Pl. xvii a, figs. 1-2 (type).—NORMAN, 1926, Proc. Zool. Soc. London, p. 955, Fig. 8 (head; Gambia; R. Bonny).—MONOD, 1927, 'Faune Colon. françaises,' p. 648 (Douala, Cameroons). (See Fig. 38.)

Rhinobatus columnae (part) PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 154 (Libreville).

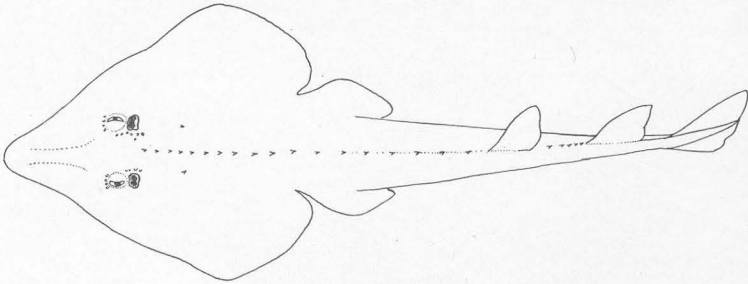


Fig. 37. *Rhinobatos cemiculus*, modified from G. St.-Hilaire.

Disk rather narrow and pointed forward. Snout moderate, blunted, length $2\frac{2}{3}$ times mouth width; rostral cartilages strong, ridges nearly parallel from fontanel, where convergence is slight; no fold above snout tip. Mouth nearly straight, width $\frac{3}{8}$ snout length. Nostrils wide, $\frac{2}{3}$ mouth width, $1\frac{1}{2}$ in internarial; front valve feeble, not extended halfway from lobe to inner nostril edge, lobe narrow, pointed; hind valve about $\frac{2}{3}$ nostril width, lobe well developed, outer and inner sections narrow. Spiracle as large as eye, outer fold prominent, inner rudimentary. Scales minute, very sharp, smoother and more closely set below disk; strong compressed and depressed tubercles in dorsal row to second dorsal, in a pair on each shoulder, outer one smaller, in a pair before each eye, in a row of smaller ones on each rostral ridge and in a pair above end of snout; the row of small tubercles above each orbit ends in a larger one above spiracle. Dorsals small, equal, pointed, concave on hind edges; base of first less than $\frac{1}{3}$ space from ventral bases, $\frac{2}{5}$ of that from second dorsal; caudal narrow elongate. Length from snout to pectoral axils about $\frac{2}{5}$ entire length. Light brownish on back, lighter each side of rostrum, lighter on lower surface. Blackish blotch beneath end of snout. (Garman.)

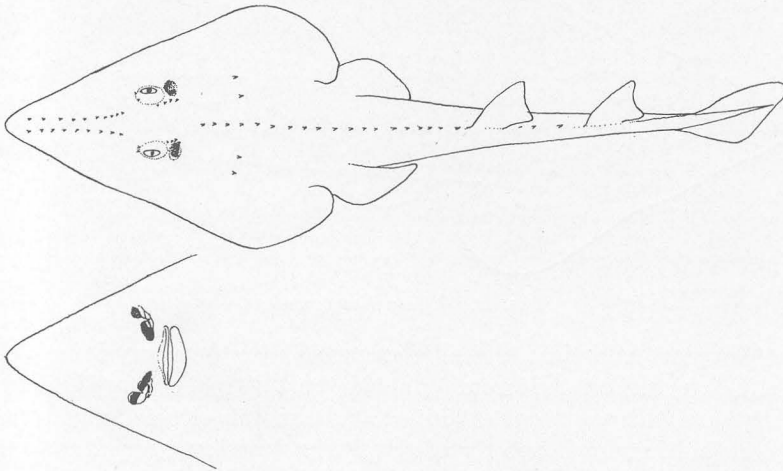


Fig. 38. *Rhinobatos cemiculus*, modified from Garman.

Coast of Ashantee. Length not given. According to Garman, it differs from *Rhinobatos percellens* and *Rhinobatos rhinobatos* in the pointed snout, narrow nasal valve, enlarged scales on middle of upper surface and especially by the rostral ridges.

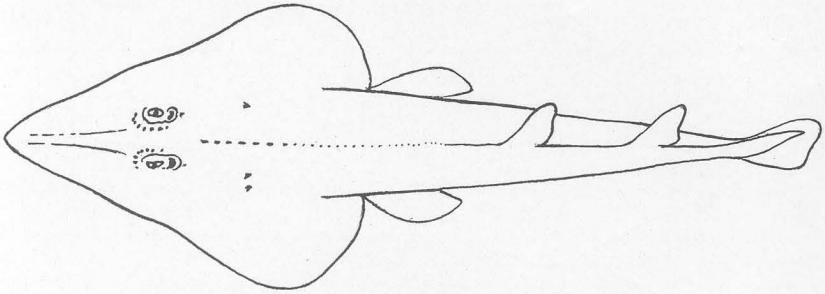
***Rhinobatos percellens* (Walbaum)**

Figure 39

Raja percellens WALBAUM, 1792, 'Artedi Pisc.,' part 3, p. 525 (on *Puraque* Marcgrave, 1648, 'Hist. Nat. Brasil.,' p. 151. Brazil).

Rhinobatus undulatus OSORIO, 1895 (March), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 253 (Dahomey).

Interorbital concave, though supraorbital ridges not prominent. Rostral cartilages rather close, only gradually converging forward or about first $2/5$ in their length. Orbit $1\ 1/2$ in firm interorbital or $4\ 7/8$ in snout. Mouth scarcely bent forward, or lower jaw slightly so, width $2\ 3/5$ in preoral length. Teeth in about 85 rows in each jaw. Nostrils large, well inclined, length about 4 in preoral or greater than posterior internarial. Spiracles large, outer larger or scarcely less than orbit, with 2 folds, of which outer larger. A few low obsolete spines before eye and on vertebral ridge. Scales minute and simple. First dorsal little nearer caudal tip than hind edge of spiracle. Second dorsal similar, subequal, inserted a little nearer first dorsal than last caudal vertebra. Caudal but slightly larger than first dorsal. Ventral about $2\ 1/2$ in disk length. Disk width $1\ 1/4$ in its length without ventrals. Pale or muddy brown above, sprinkled rather sparsely with white dots, all smaller than pupil. Under surface soiled whitish. Dorsals and caudal dusky brown. Length 545 mm.

Fig. 39. *Rhinobatos percellens*.

Tropical Atlantic. A smaller example in the Academy from Panama (Colon) and another from Trinidad (Port-of-Spain) agree in almost every way with the above, obtained at the mouth of the Congo by the American Museum Congo Expedition. The American specimens do not show the dorsals darker than the back, and they only have 38 to 60 rows of teeth in the jaws.

Discobatidae

Disk short, broad. Snout broad, blunt. Nostrils almost transverse, valves variable. Tail rather slender, with 2 dorsals far behind ventrals, dermal fold along each side and moderately elongate caudal, in which axis is not raised. Subcaudal fin without lobe nearly equaling supra-caudal. Pectorals wide, rounded, continued to end of snout.

Four genera.

ZANOBATUS Garman

Zanobatus GARMAN, 1913, Mem. Mus. Comp. Zool., XXXVI, p. 291. Type: *Platyrrhina schoenleinii* Müller and Henle. Monotypic.

Disk wider than long, subround. Snout short, blunt; rostral cartilages small, tapering gradually. Nostrils transverse, narrow, internasal space wide; front valves confluent; posterior valves with inner section large, reaching mouth. Spiracle large, without fold. Fins rounded. Dorsals small, far behind pectorals. Tail slender, nearly half total length; caudal small, rounded. Pectorals very broad, separated at snout end. Ventrals close to pectorals.

One species.

Zanobatus schoenleinii (Müller and Henle)

Raja de Altura (Cape Blanco)

Figure 40

Platyrrhina schoenleinii MÜLLER AND HENLE, 1838, 'Beschr. Plagiostomen,' p. 125, Pl. XLV. India.—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV (1), p. 50, Pl. VII (Gorée).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 195 (Cape Blanco).

Platyrrhina schonleinii ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 29 (Gorée).

Platyrrhina schoenleini PELLEGRIN, 1905, Act. Soc. Linn. Bordeaux, LX, p. 25, Fig. (Guet N'Dar); 1905, p. 137 (Cape Blaco, Cape Verde); 1914, Ann. Inst. Océanogr. Monaco, p. 8 (St. Louis).—REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 125 (Lagos).

Zanobatus schoenleini CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 231 (Cape Blanco).

Zanobatis schoenleini NORMAN, 1926, Proc. Zool. Soc. London, p. 982 (Lagos example).

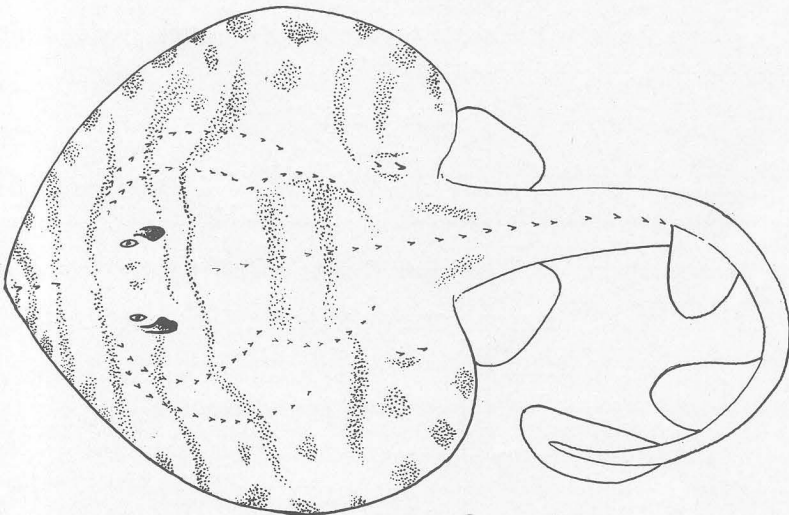


Fig. 40. *Zanobatus schoenleini*.

Disk subcircular, wider than long. Snout blunt, length little greater than space between outer nostril edges, or less than twice mouth width. Mouth nearly straight. Teeth small. Nostrils narrow, half as wide as interspace; front valves united across internarial; hind valves with an inner section as wide as both outer section and lobe and extending nearly to mouth angle. Spiracles large, without folds. Scales dissimilar, minute, larger; small tubercles in vertebral series; above rostral cartilage, on orbital ridges, above basal cartilages of pectorals and in a row of 3 on each shoulder. Dorsals small, equal, rounded; origin of first dorsal more than 3 times length of base behind ventral bases. Caudal small, rounded; subcaudal not lobed. Back brown with darker cross bands and with spots between them toward pectoral edges. Lower surfaces brownish, irregularly mottled with brown. (Garman.)

Eastern Atlantic and Indian Oceans. Reaches 473 mm. in length.

Rajidae

Skates

Body and head much depressed, united with pectorals to form rhomboid disk. Eyes and spiracles on head above. Mouth inferior. Teeth small, numerous, in pavement. Gill openings small. Oviparous, eggs deposited in large four-angled leathery cases, with 2 long tubular horns at each end. Electric organ rudimentary. Skin usually roughened with sharp spines and larger tubercles. Male with erectile spines near middle of upper side of each pectoral. Dorsals small, usually 2, behind middle of tail. Tail distinct, depressed, with rather long fold along each side.

A large family with about nine genera and numerous species in most cool seas, some in deep water.

RAJA Linné

Skates

Raja LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 231. Type: *Raja clavata* Linné. (Designated by Jordan and Gilbert, 1882, Proc. U. S. Nat. Mus., p. 36.)

Raia, *Raya* auct.

Leobatus KLEIN, 1775, 'Gesellsch. Schauplatz,' I, p. 316. Type: *Raja oxyrinchus* Linné. (Inadmissible.)

Dipturus RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 16. Type: *Raja batis* Linné. Monotypic.

Cephaloetherus RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' pp. 48, 61. Type: *Cephaloetherus maculatus* Rafinesque. Monotypic. (Monstrosity.)

Platopterus RAFINESQUE, 1815, 'Analyse de la Nature,' p. 93. Type: *Raja clavata* Linné. (*Platopterus* Rafinesque proposed to replace *Raja* Linné.)

Laevirajae NARDO, 1817, Giorn. Fis. Pavia, I, p. 11. Type: *Raja miraletus* Linné.

Laeviraja BONAPARTE, 1834, 'Fauna Ital.,' Pesci, II, vi. Type: *Raja oxyrinchus* Linné. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 2, p. 187.)

Propterygia OTTO, 1821, Nov. Act. Acad. Leop. Bonn., X, p. 112. Type: *Propterygia hyposticta* Otto. Monotypic. (Monstrosity.)

Proplegia auct.

Leviraja auct.

Rajabatis PYLAIE, 1834, Congrès Sci. France, Poitiers, p. 528. Type: *Raja mosaica* Lacépède.

Batis BONAPARTE, 1838, Nuovi Ann. Sci. Nat., Bologna, II, p. 204. Type: *Raja radula* De la Roche. Monotypic.

Hieroptera FLEMING, 1841, Philos. Jour., Edinburgh, XXXI, p. 236, Pls. iv-v. Type: *Hieroptera abredonensis* Fleming. Monotypic. (Monstrosity.)

Actinobatis AGASSIZ, 1843, 'Poiss. Foss.,' III, p. 372. Type: *Raia (Actinobatis) ornata* Agassiz. Monotypic.

Amblyraja MALM, 1877, 'Bohtia Fauna,' p. 607. Type: *Raja radiata* Donovan. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 3, p. 391.)

Leucoraja MALM, *op. cit.*, p. 609. Type: *Raja fullonica* Linné. (Designated by Jordan, *loc. cit.*)

Alpharaia LEIGH-SHARPE, 1924 (December 5), Jour. Morph., XXXIX, No. 2, pp. 567, 568. Type: *Raia circularis* Couch. Orthotypic.

Betaraia LEIGH-SHARPE, *op. cit.*, pp. 567, 568. Type: *Raja clavata* Linné. Orthotypic.

Gammaraia LEIGH-SHARPE, *op. cit.*, pp. 567, 571. Type: *Raja batis* Linné. Orthotypic.

Deltaraia LEIGH-SHARPE, *op. cit.*, pp. 567, 573. Type: *Raja radiata* Donovan. Orthotypic.

Epsilonraia LEIGH-SHARPE, *op. cit.*, pp. 568, 574. Type: *Raja platana* Günther. Orthotypic.

Zetaraia LEIGH-SHARPE, *op. cit.*, pp. 568, 575. Type: *Raja brachyura* Günther. Orthotypic.

Etaraia LEIGH-SHARPE, *op. cit.*, pp. 568, 575. Type: *Raja murrayi* Günther. Orthotypic.

Thetaraia LEIGH-SHARPE, *op. cit.*, pp. 568, 577. Type: *Raja eatoni* Günther. Orthotypic.

Iotaraia LEIGH-SHARPE, *op. cit.*, pp. 568, 577. Type: *Raja marginata* Lacépède. Orthotypic.

Body with disk partly circular or quadrangular. Snout more or less produced, pointed, with stout prolongation from skull as rostral cartilage. Eyes prominent, with fimbriate velum above pupil. Mouth transverse, nearly straight. Teeth small, tessellate, varying from flat to sharp and pointed. Nostrils with 2 valves, front one broad and reaches mouth, posterior folded in tube. Nasoral groove present. Gill openings small. Spiracles close to eye. Skin usually more or less spiny. Male usually with patch or erectile spines on each side of pectoral above. Tail very distinct from disk, with fold along each side. Two rayed dorsal fins on tail above. Caudal membranous, rudimentary or absent. Pectoral fins widely separated at snout, not confluent. Ventrals notched.

A large genus with many species, seventy or more, difficult to distinguish.

Raia bispecularis Bennett, described from the Atlantic coast of North Africa,¹ is too briefly noticed to permit positive identification. It is said to be rough above with a vertebral row of spines: differing from *Raia miraletus* Risso in the caudal spines which are uniserial and the body which is all asperous above. Its pectorals are said to be marked with spots and the color above is given as brown.

KEY TO THE SPECIES

a.—Teeth in 30 to 50 rows in jaws.

b.—Row of vertebral spines from head down back, or at least on tail to second dorsal.

¹ 1831, Proc. Zool. Soc. London, p. 147.

- c.—Front disk profile broad, more or less convex, snout not prominent.
- d.—No thorns or bucklers on lower surface.
- e.—Small brown and white spots above; oblong rounded black spot behind each shoulder. *ackleyi*.
- ee.—Streaked above with darker; no black shoulder blotch. *picta*.
- eee.—Brown, with larger subsymmetrical darker brown spots; no black shoulder blotch. *fyllae*.
- eeee.—Reddish brown, spotted rather finely with brown; sometimes large white brown-edged ocelli on pectoral and ventral basally. *punctata*.
- eeeee.—Moderate brownish or white spots, larger than eye, on middle of disk; narrow stripes near edges and somewhat parallel with front and hinder border. *microcellata*.
- dd.—Bony bucklers, armed with spines, usually in profusion both above and below; with or without numerous brown or dark-edged white spots above. *clavata*.
- cc.—Snout long, slender, produced.
- f.—Tail medium, nearly half total length.
- g.—Snout longer; upper teeth 35 to 40, lower 36 to 41. *macrorynchus*.
- gg.—Snout shorter; upper teeth 43 to 52, lower 39 to 45. *oxyrinchus*.
- ff.—Tail longer than body.
- h.—Nearly uniform brownish above. *maroccana*.
- hh.—Numerous light spots above. *maderensis*.
- bb.—Back smooth to tail.
- i.—Back with 2 or 3 spines at beginning of vertebral column; tail with 3 rows of tubercles; large, blue, yellow-edged ocellus at pectoral base above. *miraletus*.
- ii.—No spines at beginning of vertebral column; tail with median and 2 lateral series of spines; no ocelli on pectorals and ventrals, which brownish below on outer portions. *alba*.
- aa.—Teeth in 55 or more rows; no median series of vertebral spines, though sometimes irregular on front of back.
- j.—Teeth in 60 rows; no ocelli at pectoral bases above. *fullonica*.
- jj.—Teeth in 80 rows; variably dark ocelli at pectoral bases above. *quadrinaculata*.

jjj.—Teeth in 90 rows; no pectoral ocelli above, body marked with numerous small rounded dark spots.....*oculata.*

Raja ackleyi Garman

Figure 41

Raja ackleyi GARMAN, 1881, Bull. Mus. Comp. Zoöl., VIII, p. 234. Yucatan Banks.

Raia ackleyi ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 20 (Azores in 1740 in.); 1919, Rés. Camp. Sci. Monaco, LII, p. 125 (Azores in 1740 m.).

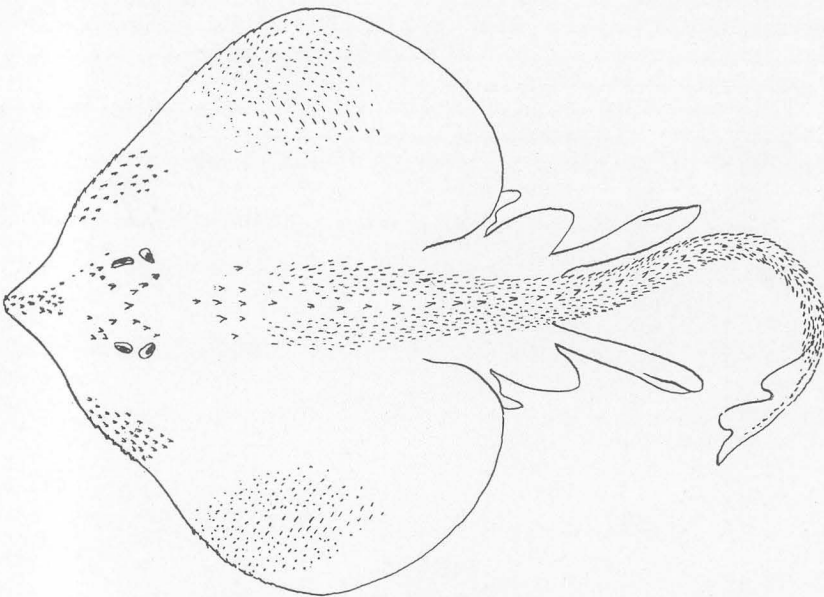


Fig. 41. *Raja ackleyi*, from Goode and Bean.

Disk, without pectorals, broader than long, nearly right-angled in front, outer and hinder angles and hinder edges rounded. Snout length less than twice interspiracular width, tip slightly blunted, rostral cartilage slender. Mouth small, width more than half space from end of snout. Teeth small, sharp, about 42 rows. Front nasal valve reaches mouth angles, joined to wide isthmus which deeply concave between them. Median series of tubercles on back and tail, 2 lateral series each side of tail, series on each orbital ridge, group above end of rostral cartilage, group on front end of each pectoral opposite eye and spiracle, shagreen below snout, and tenacula on males include nearly all of asperities, excepting these, the male is smooth. Tail moderately slender, a little longer than body, hardly extended beyond second dorsal. Ventral notch moderate, forward position of fin rather small; dorsal separated by

space with tubercles. Light yellowish-brown with small brown spots intermixed with spots of white. Oblong rounded black spot behind each shoulder, surrounded by a series of small brown spots. Lower surfaces white. Length 413 mm. (Garman.)

Gulf of Mexico and Sea of Azores, in deep water.

Raja picta Lacépède

Figure 42

Raja picta LACÉPÈDE, 1800, 'Hist. Nat. Poiss.,' IV, p. 670 (description in key).

Raja picta CHABANAUD AND MONOD, 1925, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 232 (Port Étienne).

Raja undulata GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 459 (Madeira).—BAADER, 1873-1874, Ber. Senckenberg. Naturf. Gesell., p. 182 (Mogador).—VINCI-GUERRA, 1890, Lo Spallanzani, Roma, (2) XIX, p. 484 (Las Palmas, Grand Canary); 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 301 (Grand Canary).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 195 (Rio de Oro).

Raja mosaica LACÉPÈDE, *op. cit.*, p. 675, Pl. xvi, fig. 2. France, England.—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 125 (Mazaghan, Morocco).

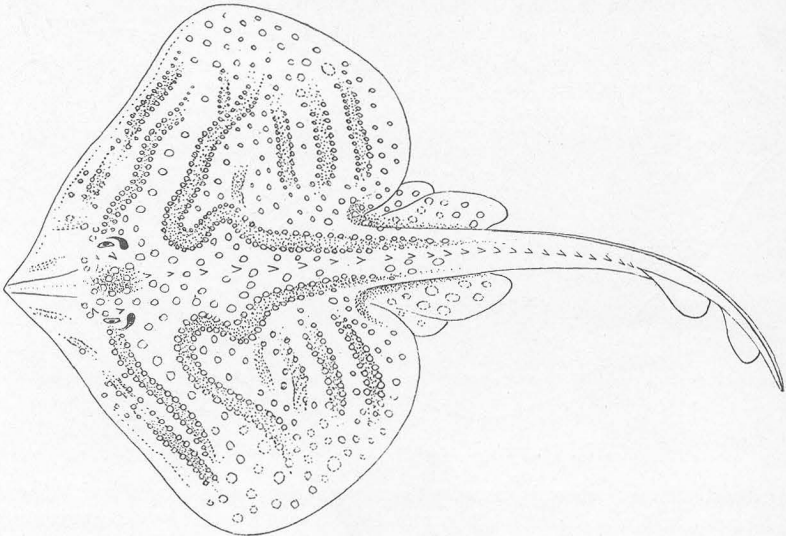


Fig. 42. *Raja picta*.

Front profile of snout very obtuse and rounded, with the tip projecting very slightly. Teeth small, obtuse, in about 60 rows in upper jaw. Space between outer edges of nostrils somewhat less than their distance from snout end. Interorbital width equals length of orbit together with spiracle. Body smooth; series of spines along median line of back and tail; series of smaller spines along side of tail; superciliary edge with spine in front and behind; spine on each side of shoulder. Brownish,

with or without transverse undulated bands and with or without round spots of light color. (Günther.)

Eastern Atlantic and Mediterranean. Günther's account is based on a young male from Madeira, which Garman thinks is possibly questionable.

***Raja fyllae* Lütken**

Raja fyllae LÜTKEN, 1898, Vidensk. Medd. Nat. Fören., Kjöbenhavn, p. 1, Pl. i. Davis Straits, Greenland, 80 fathoms.

Raja alba MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 393 (off Morocco, 2300 m.).

Disk subcircular, snout hardly produced, front edges straightened in middle, front, outer and hinder angles and hind edges broadly rounded. Orbits large, length greater than interorbital width or nearly $1\frac{1}{2}$ in preorbital length. Mouth arched, width nearly $1\frac{1}{2}$ in snout. Teeth in about 30 rows. Spiracles small. Back roughened with spinules, larger spines above snout, on orbital ridge, a pair on each shoulder, median series from head to dorsal about 37. Dorsals not separated. Tail much longer than body. Brown, with large darker brown spots, subsymmetrically arranged, on back and across tail. Length 204 mm. (Lütken.)

Eastern Atlantic. Lütken's second example, 530 mm., had the back light gray-brown.

***Raja punctata* Risso**

Raja punctata RISSO, 1810, 'Ichth. Nice,' p. 12. Nice.—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 392 (off Cape Bojador, 39 to 214 m.).

Disk broader than long, front edges nearly straight, hind edges rounded. Snout tip to mandible $1\frac{1}{4}$ to $1\frac{1}{3}$ in head, tip little produced. Orbit 1 to $1\frac{1}{3}$ in interorbital. Mouth little curved, width $2\frac{1}{4}$ to $2\frac{1}{3}$ in head. Teeth 36 to 40 above, 31 to 42 below. Vertebral row of tubercles on back and tail. Upper front part of disk, snout below and sides of tail more or less roughened. Females and young more rough than males. Dorsals separated, tail produced little behind second. Above reddish brown, spotted rather finely with brown. Sometimes a dozen or more larger white spots, bordered by brown ring, on pectoral base and several on each ventral base. Whitish below. Length 254 mm.

Eastern Atlantic and Mediterranean. Described above from Italian examples.

***Raja microcellata* Montagu**

Raja microcellata MONTAGU, 1815, Mem. Wern. Nat. Hist. Soc., Edinburgh, II, p. 430. South coast of Devonshire.

Raja microcellata MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 392 (off Cape Bojador, 39 m.).

Raja microcellata PAPPENHEIM, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 90 (Agadir and Mogador, Morocco).

Disk broader than long, rhomboid, front angle and outer angle greater than 90° ,

front edges nearly straight, hind border broadly rounded. Snout blunt, slightly produced. Eyes small, 3 in interorbital, 5 in snout. Mouth wide, width $\frac{2}{3}$ space from snout tip. Teeth in 55 rows, flattened in female, more pointed in male. Spiracles larger than eyes. Body and tail rough with small spines, or nearly smooth. Median row of small tubercles on tail, sometimes extending forward on body, with or without lateral row each side. Grayish or brownish, with brownish or white spots, larger than eye, on middle of disk; narrow stripes near edges and somewhat parallel with front and hinder border. Lower surface whitish. Reaches 763 mm. (Garman.)

Eastern Atlantic.

***Raja clavata* Linné**

Thornback Ray

Figure 43

Raja clavata LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 232. European Ocean.—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 456 (Madeira).—HILGENDORF, 1888, Archiv Naturg., LIV, p. 213 (Azores).—JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 339 (Canary Islands).—PAPPENHEIM, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 89 (Mogador, Agadir, Azamor, Morocco).

Raja clavata MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 392 (off Morocco, 141 m.; off Cape Bojador, 214 m.).—GARMAN, 1913, Mem. Mus. Comp. Zoöl., XXXVI, p. 325 (Madeira).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 125 (Melilla, Morocco).

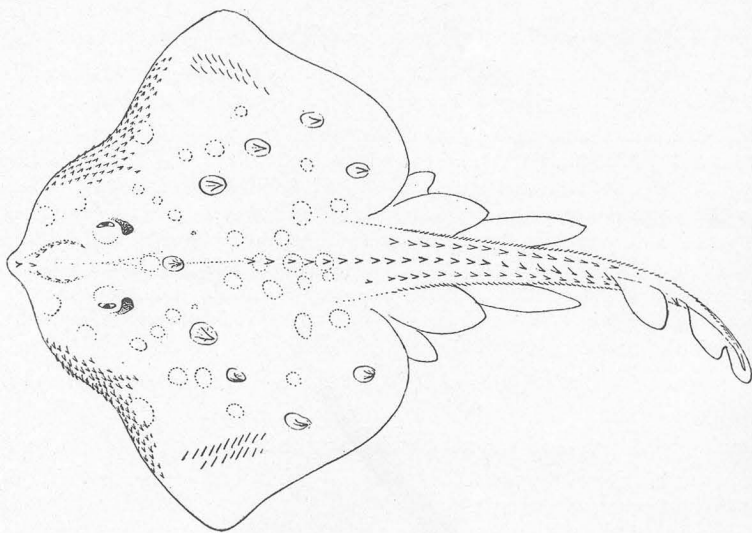


Fig. 43. *Raja clavata*.

Disk much broader than long or length about $\frac{2}{3}$ its width. Snout tip to mandible $1\frac{2}{7}$ to $1\frac{2}{3}$ (?) in head. Mouth waved, width $1\frac{3}{4}$ to $2\frac{2}{7}$ in head. Teeth

flattened, rounded, rows 32 to 44 above, 33 to 41 below. Vertebral row of large round bony bucklers, with sharp cusps to each from head to second dorsal; 2 lateral rows of bucklers each side of tail, large one on each shoulder, one before each eye, several behind each spiracle; males with few spinous bucklers above or below, quite rough; one female with 79 spinous bucklers below; spines on tail of male are developed to any extent only anteriorly, though on females they extend to the dorsal; females quite rough. Several young differ from adults in only median vertebral caudal and dorsal spines; single small spine on each side of back medianly; usually 2 spines before eye and 1 behind; also pair between spiracles. Brown, with or without numerous brown spots and irregular dark-edged white spots. Length to 762 mm.

Eastern Atlantic, north to Scandinavia, Mediterranean. Reported by Barnard as *Raia clavata* (1925, Ann. South African Mus., XXI, p. 64, Pl. iv, fig. 2) from Walfish Bay to Natal, in depths to 160 fathoms. The above description from Italian examples.

***Raja macrorhynchus* Rafinesque**

Figure 44

Raja macrorhynchus RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 15. Sicily.

Raja macrorhynchus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 468 (Madeira).

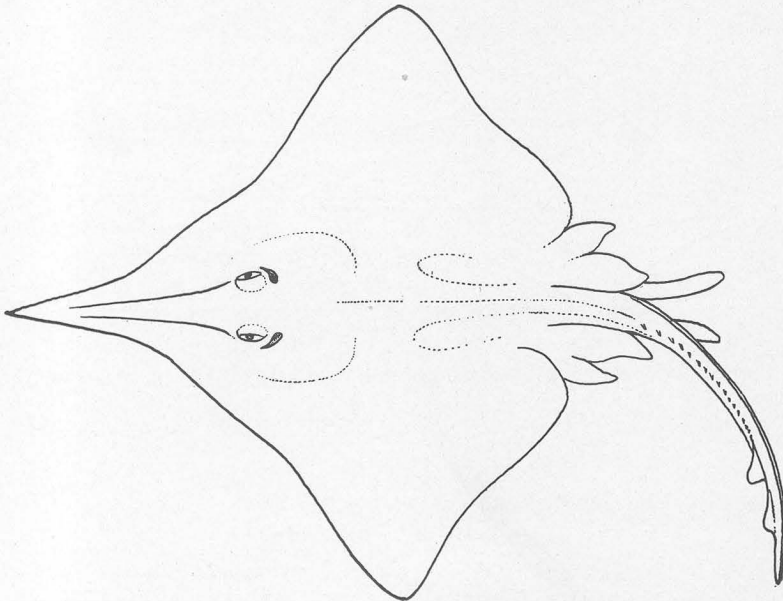


Fig. 44. *Raja macrorhynchus*.

Disk wider than long, front angle sharp, front edges deeply concave, hinder broadly round. Snout $1\frac{1}{10}$ to $1\frac{1}{6}$ in head. Mouth slightly arched, width $3\frac{2}{5}$

to $4 \frac{1}{10}$; orbital socket 1 to $1 \frac{1}{8}$ in interorbital. Teeth keeled in males, blunter in females; 35 to 40 rows above, 36 to 41 rows below. Smaller examples sometimes with front orbital spine, greater part of orbital ridge finely asperous with age; front disk edge, especially along snout edges finely asperous, snout entirely smooth; vertebral row of spines down tail above rather large and thick; sides of tail smooth in young, mostly asperous with age. Brown, sometimes with some pale or dark spots. Whitish below. Length to 426 mm.

Eastern Atlantic and Mediterranean. The above description from Italian examples.

Raja oxyrinchus Linné

Raia (Madeira)

Figure 45

Raja oxyrinchus LINNÉ, 1758, 'Syst. Nat.', 10th Ed., p. 231. Mediterranean and European Ocean.

Raja oxyrhynchus LOWE, 1843, Proc. Zool. Soc. London, XI, p. 94 (Madeira); 1839, Trans. Zool. Soc. London, III, part 1, p. 20 (Madeira).

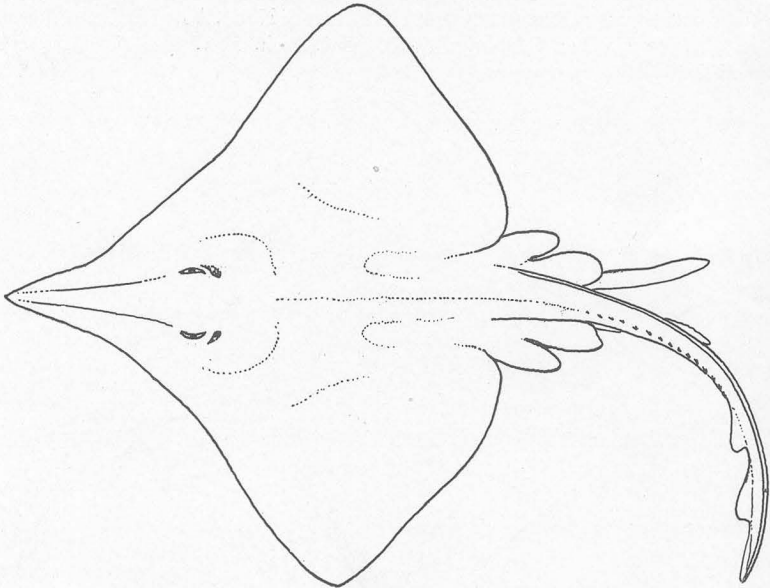


Fig. 45. *Raja oxyrinchus*.

Disk little wider than long, front edges deeply emarginate. Snout $1 \frac{1}{8}$ to $1 \frac{1}{4}$ in head. Mouth little curved, width $2 \frac{3}{5}$ to $2 \frac{4}{5}$; orbital socket 1 to $1 \frac{1}{8}$ in interorbital. Teeth larger and sharper with age; 43 to 52 rows above, 39 to 45 rows below. Smaller examples with front orbital spine; head and back with scattered asperities in young, ventral surfaces also roughened with age; front disk edges with asperities extending nearly to snout tip; vertebral row of spines down tail above, and

frequently lateral rows on sides of tail. Brown above, spotted with darker or paler, to uniform. Whitish below. Length to 328 mm.

Eastern Atlantic and Mediterranean. Described here from Italian examples.

***Raja maroccana* Schneider**

Raja maroccana SCHNEIDER, 1801, 'Syst. Ichth. Bloch,' p. 367. Morocco.—MÜLLER AND HENLE, 1838, 'Beschr. Plagiostomen,' p. 150, Pl. XLIX, fig. 2 (Atlantic Ocean).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 466 (Morocco?).

Raia maroccana GARMAN, 1913, Mem. Mus. Comp. Zool., XXXVI, p. 335 (Morocco).

Disk rhomboid. Snout long, 3 1/2 in interorbital, pointed, front edges undulated, a little indented, hinder edges and angles rounded. Teeth of male conical, pointed, 41 rows above. Skin naked, except a few minute spines on middle of back, on edges of disk and under snout, on head, also a group of larger ones on forward ends of pectorals, and tubercles in a row on orbital ridges and in 2 lateral rows and a median row, of alternating sizes, on tail. Tail longer than body, moderately slender; dorsals separated by a space. Male with claspers. Nearly uniform light brown. Length 560 mm. (Garman.)

Coasts of Morocco.

***Raja maderensis* Lowe**

Raya (Canaries), *Raia*, *Arraia* (Madeira)

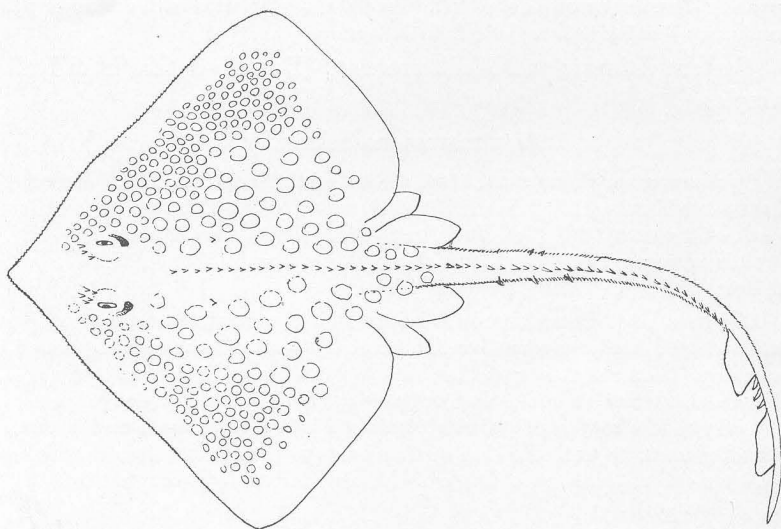
Figure 46

Raia maderensis LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 195. Madeira; 1843, Proc. Zool. Soc. London, XI, p. 94 (Madeira).—VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' part 2, p. 100, Pl. XXV (Canaries).—GARMAN, 1913, Mem. Mus. Comp. Zool., XXXVI, p. 325 (Madeira, Canaries).

Raja maderensis DUMÉRIL, 1865, 'Hist. Nat. Poiss.,' I, p. 545 (Madeira, Canaries).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 459 (Madeira).—CAPELLO, 1871, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, p. 85 (Madeira).—HILGENDORF, 1888, Archiv Naturg., LIV, p. 213 (Azores).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 301 (Canaries).—OSORIO, 1895 (March), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 253 (Dahomey); 1898, *op. cit.*, (2) V, p. 201 (Dahomey; Anno Bom).—REGAN, 1903, Ann. Mag. Nat. Hist., London, (7) XII, p. 347 (Azores).

Rhomboid, broader than long, front angle little more than 90°, little more than outer angles, front edges nearly straight. Snout elongate, produced sharp, length about twice interspiracular width. Teeth sharp, rows about 44 (39 to 44). Internasal space nearly equals preoral. Minute spines over entire body; small tubercles before and behind each orbit, 1 on each shoulder and in median series on back and tail, older examples with lateral rows more or less complete on tail. Tail slender, longer than body, produced behind second dorsal. Dorsals separated by space with tubercles. Back brown, with numerous rounded lighter spots, larger behind head above abdomen. Length 368 mm. (Garman.)

Eastern Atlantic.

Fig. 46. *Raja maderensis*.***Raja miraletus* Linné**

Raza (Cape Verde)

Raja miraletus LINNÉ, 1758, 'Syst. Nat.', 10th Ed., p. 231. Mediterranean.—PAPPENHEIM, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 95 (Atlantic coast of Morocco).—PELEGRIN, 1905, Act. Soc. Linn. Bordeaux, LX, p. 24, Fig. (Cape Blanco, Cape Verde); 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanco, Cape Verde); 1914, Ann. Inst. Océanogr. Monaco, p. 7 (Cape Blanco, Cape Verde).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 195 (Rio de Oro).

Raja miraletus MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 393 (off Cape Bojador, 214 m.).

Disk rhomboid, greatest width about midway in its length, but little greater than its length without ventrals; front edges very slightly undulate, outer angles broadly rounded. Snout tip but slightly produced. Orbit $1\frac{3}{4}$ in firm interorbital width, $4\frac{1}{5}$ in snout. Mouth curved, width about $1\frac{3}{4}$ in preoral. Teeth small, 44 rows in both jaws; each tooth with a slight cusp. Back smooth, except for a patch of asperities at ends of nasal cartilages, minute before orbits, except 3 or 4 large ones along each orbital edge anteriorly and 3 or 4 along hind edge and inner edge of spiracle; row of 3 large spines on middle of back anteriorly; vertebral row and 2 lateral rows of spines on tail; upper front pectoral edge finely asperous. Lower surface smooth, except finely asperous front snout edge. Dorsals alike, equal. Umber above, with many rather close-set darker spots, crowded toward edge of disk. At each pectoral base medianly there is a large slaty-blue round spot, narrowly bordered with orange-

brown, its diameter equal to the interorbital. Lower surfaces soiled whitish, but no dark spot on rostral cartilages. Length 530 mm.

Eastern Atlantic and Mediterranean. One example, described above, obtained at the mouth of the Congo by the American Museum Congo Expedition. Reported by Barnard as *Raia miraletus* (1925, Ann. South African Mus., XXI, p. 68) from Agulhas Bank and Natal to 36 fathoms.

***Raja alba* Lacépède**

Raja alba LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, pp. 661, 663, Pl. xx, fig. 1. Rouen.—PAPPENHEIM, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 95 (Atlantic coast of Morocco).

Raia alba MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 393 (off Cape Bojador, 39 m.).

Disk rhomboid, length less than $\frac{2}{3}$ its width, front edges deeply undulated, outer angles nearly 90° , hinder edges broadly rounded backward almost straight or slightly concave near outer angles. Snout long, narrow, acuminate, length twice mouth width or more. Mouth large, moderately curved. Teeth small, rows 40 to 46, cusps sharp, keel-like. Tubercles compressed, hooked, 1 before and 1 behind each orbit, median and 2 lateral series on tail extending to second dorsal. Back smooth, lower surface rough with small slender spines below snout and pectoral angles. Males with tenacula. Dorsals separated by space with tubercle. Tail half or less of total length, much depressed, retains width backward, pointed behind dorsals. Back light reddish-brown, more or less spotted white, darker toward outer edges. Translucent spaces at sides of rostral cartilage white. Lower parts brownish white to white anteriorly and brown below outer portions of pectorals and ventrals. Tail dark below, blackish above, brownish at sides. Length 305 mm. (Garman.)

Eastern Atlantic.

***Raja fullonica* Linné**

Figure 47

Raja fullonica LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 231. European Sea.—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 467 (Madeira).

Raia fullonica MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 393 (off Morocco, 535 m.).—GARMAN, 1913, Mem. Mus. Comp. Zoöl., XXXVI, p. 328 (Madeira).

Disk rhomboid, broader than long without ventrals, angle acute in front, front edges undulated, indented, hind edges broadly rounded. Snout nearly one-fourth of disk width, thrice interorbital, produced, sharp. Teeth sharp, slender, rows about 60. Young females covered with minute close-set spines; males with large naked spaces; claspers present on adult males. Few tubercles above end of rostral cartilages, series on each orbital ridge, short median row behind head on shoulder girdle, scattered tubercles farther back, 2 rows of larger ones on top of tail, which without median

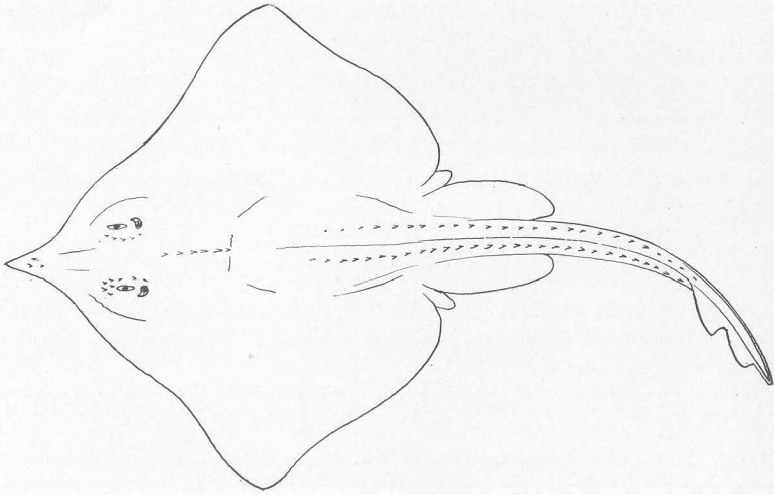


Fig. 47. *Raja fullonica*.

series, but irregular row at each side on large individuals. Tail shorter than disk. Yellowish to reddish brown. Length over 915 mm. (Garman.)

Eastern Atlantic to Scandinavia north.

***Raja quadrimaculata* Risso**

Raja quadrimaculata RISSO, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 150. Nice.—GARMAN, 1913, Mem. Mus. Comp. Zool., XXXVI, p. 323 (Madeira).

Raja circularis GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 462 (Madeira).

Raja circularis MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 395 (off Cape Bojador, 214 m.).

Angles of disk rounded and front edges waved. Teeth pointed, in about 80 rows. Interorbital width equals orbital length. Back covered with small spines; row of small tubercles around each orbital ridge; 3 to 5 rows of small tubercles in front of shoulder girdle, in middle, median row continued backward by scattered thorns; lateral series also continued on tail and interrupted more or less completely above abdomen; median line on tail nearly naked. Rusty brown, uniform or with small darker spots of white or yellow behind ends of girdle, number of ocelli varying from one to a dozen or more; many individuals, mostly young, with a rounded black spot vermiculated or marbled yellowish at each shoulder. Length to 1220 mm. (Garman.)

Eastern Atlantic and Mediterranean. Reported by Barnard as *Raja quadrimaculata* (1925, Ann. South African Mus., XX, p. 70, Pl. iv, fig. 5) off west coast of South Africa to 250 fathoms.

***Raja oculata* Risso**

Raia oculata RISSO, 1826, 'Hist. Nat. Eur. Mérid.', III, p. 149. Nice.—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 232 (Rio de Oro).

Raja asterias METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 195 (Rio de Oro).

Raja maculata PAPPENHEIM, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXXI, p. 94 (Atlantic coast of Morocco).

Disk rhomboid, little broader than long; anterior edge moderately undulated each side, front angle blunt; greatest width anterior to center in its length. Snout tip rather rounded, though it projects slightly, length $1 \frac{2}{5}$ in head; rostral cartilages narrow, basal interspace about $1 \frac{1}{3}$ eye length. Eye small, socket large, close before spiracle, about $1 \frac{1}{3}$ in interorbital. Mouth broadly transverse, slightly before or opposite front of eye; jaws nearly straight or but slightly undulated; width $1 \frac{7}{8}$ in head. Teeth pointed, median cusp well developed; 93 above, 91 below. Interorbital depressed medianly, concave, $3 \frac{1}{3}$ in head. Back covered with minute asperities almost everywhere, especially segregated and numerous down middle of disk and along edges, tail above and upper or anterior portions of dorsals; ventrals largely smooth, only few asperities along lower submarginal portions posteriorly; several enlarged denticles before eyes as slight spinous cluster; posteriorly on pectorals many denticles become somewhat elongate and rather slenderly spinescent; down vertebral ridge obscure series consists of several small spines, but opposite ventral bases become well developed on to dorsals, which are separated by spine; along each side of tail just above lateral fold there is an irregular series of few spines like median series, all curved back. Disk below largely smooth; broad area medianly with many minute asperities begins each side of mouth down between gill openings to tail base; few extend also on each ventral anteriorly, and adjacent parts of pectoral; lower surface of tail moderately asperous. Front dorsal a little higher than second. Largely dull brown, slightly darker above, obscurely marked with very numerous small rounded spots, each one about as large as the length of the large spines on tail. Below uniform pale to whitish. Length 1067 mm.

Eastern Atlantic and Mediterranean. Questionably reported by Barnard as *Raia maculata* (1925, Ann. South African Mus., XXI, p. 71) from South Africa. Described above from an example obtained in the Mediterranean.

Raia oculata Stephan¹ is the earliest available form of the present name, that of Valmont, 1768, not being consistently binomial. According to Garman, the very imperfectly described and poorly figured *Raia brachyura* Lafont, from the Gironde, is also the present species. Likewise *Raia maculata* Montagu 1811 to 1816, preoccupied by *Raja maculata* Shaw, 1803, and renamed *Raja montagui* by me in 1910. My specimen bears the name *Dasybatis fullonica* on the original label and may, in part, be what Bonaparte had in mind for that species.

¹ 1779, De Rajis scediasma primum, Lipsiae, p. 22.

Torpedinidae

Electric Rays

Head, trunk, electric organs, and pectorals form smooth depressed and partly circular disk. Large electric organ formed of many hexagonal tubes, between pectorals and head. Tail short and with wide base, and the fold each side may be present or absent. Rostrum short, more or less branched, cartilages extended before eye forward to support disk edges. Gill openings small between electric organs and head. Spiracles present. Lateral line rudimentary on lower surface of disk (remnants as vesicles of Savi). Skin smooth, soft, and naked. Dorsals 2, 1, or none. Caudal short, deep, not lobed.

Rays of moderate or large size, long noted for their power of giving electric shocks. The very young have external gills, and some writers claim that they pass through three distinct changes in development, as a sharklike, a raylike, and finally a torpedo-like stage.

Seven genera.

TORPEDO Houttuyn

Torpedo HOUTTUYN, 1764, 'Nat. Hist. Linn.,' p. 103. Atypic. Type: *Raja torpedo* Linné, virtual tautotype.

Naracacion KLEIN, 1776, 'Gesellsch. Schauplatz', II, p. 237; 1777, IV, p. 726. Type: *Raja torpedo* Linné. Monotypic. (Inadmissible.)

Narcobatus BLAINVILLE, 1816, Bull. Soc. Philom., Paris, p. 21. Type: *Raja torpedo* Linné. (Designated by Jordan and Evermann, 1917, Stanford Publications, 'Genera of Fishes,' part 1, p. 95.)

Narcobatis auct.

Tetronarce GILL, 1861, Ann. Lyc. Nat. Hist. New York, VIII, p. 387. Type: *Torpedo occidentalis* Storer. Monotypic.

Tetranarce, *Tetronarke* auct.

Gymnotorpedo FRITSCH, 1886, Arch. Anat. Physiol., Leipzig, p. 365. Type: *Torpedo occidentalis* Storer. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' part 4, p. 435.)

Fimbriatorpedo FRITSCH, *loc. cit.* Type: *Torpedo marmorata* Risso = *Raja torpedo* Linné. (Designated by Jordan, *loc. cit.*)

Eunarce FOWLER, 1910, Proc. Acad. Nat. Sci. Philadelphia, p. 472. Type: *Torpedo narke* Risso. Orthotypic.

Disk large, partly circular. Tail short, with a low keel on each side. Snout short, flexible, feeble. Mouth crescentic, with lengthwise fold at each angle. Teeth small, in pavement, bases wide, crowns with acute angles directed inward. Nostrils small, front valves united forming a wide flap before mouth, free behind and at sides. Spiracles moderate, rather close behind eyes, edges fringed or not. Rostral cartilages weak, short, reduced to a pair of slender rods. Two dorsals on tail. Caudal well developed. Ventrals separate, large, below pectorals anteriorly.

Tropical and temperate seas. About ten species.

KEY TO THE SPECIES

- a.—TORPEDO. Spiracles fringed, in young.
 b.—Marbled above with dark, or white, or both *torpedo*.
 bb.—Brown above, with as many as 5 ocellate black spots *narke*.
 aa.—TETRONARCE. Spiracles not fringed.
 c.—Pectoral edges without papillae: uniform deep brown above. *nobiliana*.
 cc.—Pectoral edges with double row of small white papillae; densely spotted white above *mackayana*.

Torpedo torpedo (Linné)

Dromideira (Madeira), Trembladora (Canaries), Tremblador, Trembladera (Cape Verde), Toih (Senegambia), Oundango (Gaboon)

Figure 48

Raja torpedo LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 231, Mediterranean Sea.

Torpedo torpedo PAPPENHEIM, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 87 (Azamor, Morocco).

Torpedo marmorata VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II, part 2, p. 101 (Canaries).—LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 195 (Madeira).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 450 (Madeira).—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV, p. 50 (Gorée).—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 29 (Guet N'Dar, Cape Blanco, Cape Mirik, Baie d'Arguin).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 301 (Grand Canary).—PELLEGRIN, 1905, Act. Soc. Linn. Bordeaux, LX, p. 23 (Cape Blanco, Cape Verde); 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanco, Cape Verde).—BOULENGER, 1903, 1905, Mem. Soc. Españ. Hist. Nat., Madrid, I, p. 187 (Spanish Guinea).—PELLEGRIN, 1913, *op. cit.*, XXXVIII, p. 154 (Libreville, Gaboon); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 8 (Cape Blanco, Cape Verde, Gaboon).

Narcacion marmoratus CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 232 (Port-Étienne).

Torpedo picta LOWE, 1843, Proc. Zool. Soc. London, XI, p. 93. Madeira.

Torpedo trepidans VALENCIENNES, *op. cit.*, Pl. XXIII. Canary Islands.—DUMÉRIL, 1865, 'Hist. Nat. Poiss.,' I, p. 511 (type of *Torpedo trepidans* Valenciennes).—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 403 (Santa Cruz, Tenerife, Canaries).

Torpedo vulgaris STEINDACHNER, *op. cit.*, p. 403 (Santa Cruz).

Torpedo torpedo forma *atlantica* PAPPENHEIM, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 88. Atlantic coast of Morocco.

Torpedo torpedo forma *mediterranea* PAPPENHEIM, *loc. cit.* Mediterranean.

Disk subcircular, little broader than long. Snout short, partly truncate, length $1\frac{3}{5}$ to 2 in head. Mouth small, crescentic, width $1\frac{4}{5}$ to $2\frac{1}{4}$ in head. Teeth small, crowns pointed; rows 15 to 30 above, 13 to 28 below. Nostrils small; internasal $2\frac{3}{5}$ to $3\frac{2}{5}$ in head. Spiracles nearly equal eyes; usually 7 papillae on each aperture, sometimes 6. Dorsals small, rounded; first dorsal origin but slightly before hind basal edge of ventrals, length of fin $4\frac{1}{2}$ to $6\frac{1}{4}$ in disk width, not twice the size of second dorsal. Tail short; upper caudal lobe $2\frac{7}{8}$ to $4\frac{1}{2}$ in disk width.

Rusty brown, spotted or mottled with darker and paler to uniform; under surface white, except brownish edges of fins and disk. Length to 264 mm.

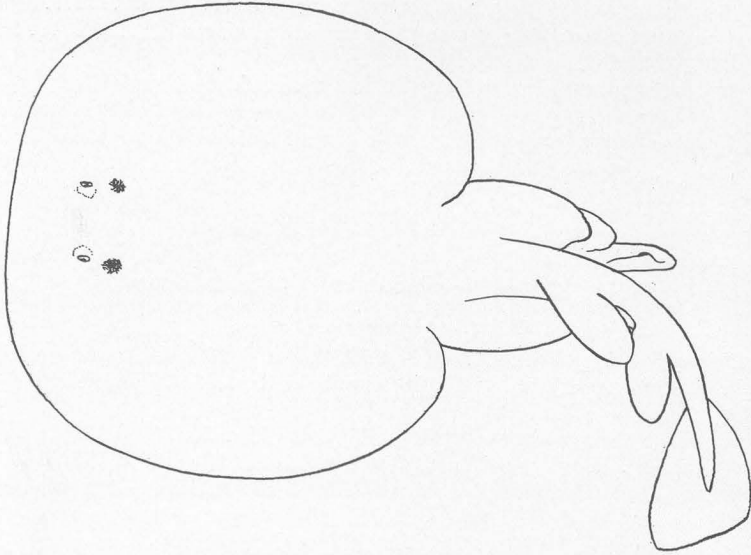


Fig. 48. *Torpedo torpedo*.

Eastern Atlantic and Mediterranean. Reported by Barnard as *Narcobatus marmoratus* (1925, Ann. South African Mus., XXI, p. 90) from False Bay to Natal and Delagoa Bay. The above description from Italian examples.

Torpedo narke Risso

Trembladera africana (Cape Blanco), *Tremblador* (Mauritania and Senegal),
Tremelga (Angola)

Figure 49

Torpedo narke RISSO, 1810, 'Ichth. Nice,' p. 10. Nice.—(Duméril) DE LA ROCHE, 1809, Ann. Mus. Paris, XIII, p. 314 (Ivica; no description).—FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 250 (Elmina, Ashantee).

Torpedo narce STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV, part 1, p. 50 (Rufisque).—OSORIO, 1898, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 201 (Ilheo das Rolas).—PELLEGRIN, 1905, Act. Soc. Linn. Bordeaux, LX, p. 23 (Cape Blanco, Cape Verde).—PAPPENHEIM, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 88 (Agadir, Morocco).—PELLEGRIN, 1907, Act. Soc. Linn. Bordeaux, LXII, p. 76 (Mauritania); 1912, Bull. Soc. Zool. France, XXXVII, p. 291 (Praya Amelia).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 196 (Cape Blanco; St. Louis).

Torpedo oculata DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 261 (Gorée).—ROCHEBRUNE, 1883, 'Faune Sénégalaise,' Poiss., p. 29 (Gorée, Rufisque).

Narcacion torpedo (not Linné) CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 232 (Port Étienne).

Disk broader than long. Snout slightly concave along front edge, length $1\frac{3}{5}$ to $1\frac{7}{8}$ in head. Eye small, less than $\frac{1}{3}$ of snout. Mouth moderate, with longitudinal fold at each angle, width $1\frac{4}{7}$ to $2\frac{1}{4}$ in head. Teeth small, pointed cusps; upper rows 18 to 33, lower rows 15 to 28. Nostrils small, wider than internasal which is $2\frac{1}{5}$ to 3 in head. Spiracles greater than eye, with as many as 7 small rudimentary

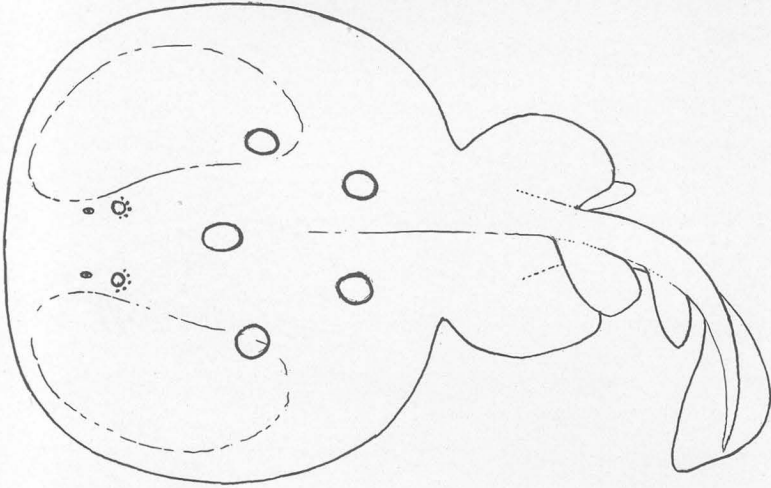


Fig. 49. *Torpedo narke*.

papillae around each edge posteriorly, rarely without any, in some cases only one; may be variable in the same individual. In smaller specimens the papillae are more elongated. Dorsals small, rounded; front dorsal length $3\frac{7}{8}$ to 6 in disk width; second dorsal base less than its length from base of first. Tail short; caudal about as deep as long, length of upper lobe $2\frac{9}{10}$ to $3\frac{2}{3}$ in disk width. Upper surface brown; usually 5 ocellated black spots, 3 in a front series and 2 behind; sometimes there is even another ocellus in the posterior row, sometimes the median ocellus of the front row is small, or the other ocelli may be lunate. Reaches length of 264 mm.

Eastern Atlantic and Mediterranean. The above description is from Italian examples.

***Torpedo nobiliana* Bonaparte**

Tromentin (Madeira), Toih (Senegambia), Trembladera (Cape Blanco), Tollo (Port-Étienne)

Figure 50

Torpedo nobiliana BONAPARTE, 1835, 'Fauna Ital.,' III, fasc. xii, Pl. figs. 1-2. Italy.

Narcacion nobilianus CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 231 (Cape Blanco).—MONOD, 1927, 'Faune Colon. françaises,' p. 650 (copied).

Torpedo hebetans LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 195. Madeira; 1842, Proc. Zool. Soc. London, XI, p. 94 (Madeira).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 449 (Madeira).—HILGENDORF, 1888, Archiv Naturg., p. 213, (Azores).—OSORIO, 1898, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 201 (Ilha de S. Thomé).—EHRENBAUM, 1914, Fischerbote, VI, p. 405 (Cameroon).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 196 (Cape Blanco).

Torpedo nigra ROCHEBRUNE, 1883, 'Faune Sénégalaise,' Poiss., p. 28 (Senegal, Lac Pagnéfoul, Cayor, Falmém).

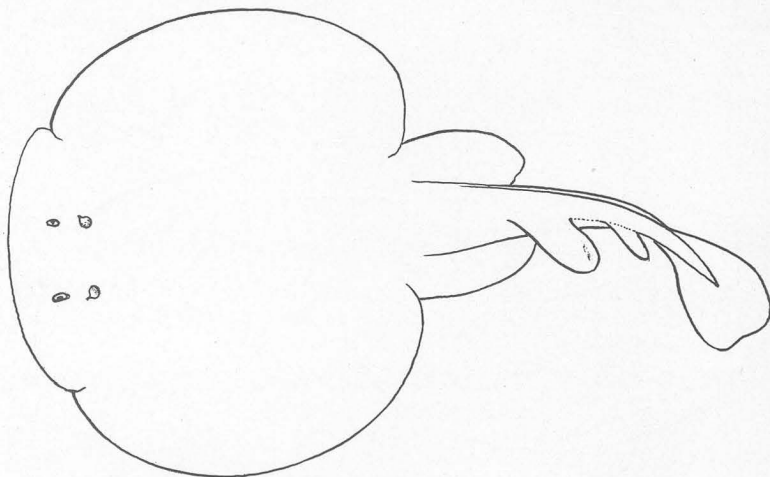


Fig. 50. *Torpedo nobiliana*.

Disk broader than long, with sides widely convex. Snout short, partly truncate, $1 \frac{3}{7}$ to $1 \frac{7}{8}$ in head measured to first gill opening. Eye small. Mouth large, crescentic, width greater than snout length or $1 \frac{2}{5}$ to 2 in head. Teeth small; upper in 17 to 23 rows in young, 30 to 36 adult; lower in 16 to 23 rows in young, 34 to 36 in adult. Nostrils small, about half width of internasal space, which is 2 to $3 \frac{2}{5}$ in head. Spiracle larger than eye, about an eye diameter back, not fringed. Dorsals small, narrow, ends rounded; first dorsal length $4 \frac{1}{3}$ to $6 \frac{7}{8}$ in disk width and about half its base above ventral bases; second dorsal less than half the size of first. Tail nearly $\frac{1}{3}$ total length, axis slightly raised, partly truncate; upper caudal lobe $2 \frac{3}{7}$ to $4 \frac{1}{10}$ in trunk width. Dark chocolate-brown to blackish on back and below on edges of disk, fins, and tail. Under surface of body otherwise white. Reaches 1525 mm.

Warmer parts of the Atlantic and Mediterranean. Reported by Barnard as *Narcobatus nobilianus* (1925, Ann. South African Mus., XXI, p. 89) from off Agulhas Bank. The above description largely from the types of *Torpedo nobiliana* Bonaparte.

Torpedo mackayana Metzelaar

Trembladera

Torpedo mackayana METZELAAR, 1919, 'Rapp. Kolonie Curaçac,' II, p. 197, Fig. 57. Coast of Senegal.

Disk length $1 \frac{2}{13}$ its width; form more or less rectangular, not subcircular; front disk edge emarginate. Teeth 37 above, 35 below. Spiracles without tubercles, half interspace. Dorsal with anterior half opposite to base of ventral. Posterior half of pectoral edge bordered by double row of small white papillae, partly spinous. Dark brownish-violet. Back densely spotted with white, spots very small on snout increase in size backward, forming rings behind spiracles; 14 rings in transverse row, also in longitudinal row between spiracles and first dorsal. Posterior border of vertical fins with broad pale margin. Length 340 mm. (Metzelaar.)

Senegal.

SUBORDER MASTICURA

Whip-tailed Rays

Disk broad or polygonal. No electric organs. Nasoral grooves infrequent. No rostral cartilages. Tail comparatively slender, dorsal fin single or wanting, and tail above usually armed with 1 or more serrated spines. Pectorals may extend to snout end or broadly angular. Copula segmented or imperfect.

Six families, of which one is extinct.

KEY TO FAMILIES

- a.*—Pectorals uninterrupted, confluent around snout, form wide disk; teeth small. DASYATIDAE.
aa.—Pectorals interrupted, one portion forming detached appendages on snout (cephalic fins), and disk polygonal.
b.—Teeth few, wide flat molars. MYLIOBATIDAE.
bb.—Teeth minute, tubercular, numerous; snout very wide, with 2 lateral lobes. MOBULIDAE.

Dasyatidae

Sting Rays

Body, head, and pectorals depressed, form a wide disk with pectorals meeting before cranium to form snout without supporting rostral cartilages. Tail various, usually whiplike, sometimes short and stout, always tapering and distinct from disk. Usually 1 or more vertical folds of skin on tail, rarely a lateral fold. Eyes superior. Mouth rather small, transverse, more or less curved. Teeth small, quincunx, tessellated. Nostrils close together and front nasal valves confluent across narrow isthmus, reaching mouth. Gill openings narrow. Spiracles large, superior, close behind eyes. Skin smooth or rough with spines and

tubercles or both, roughest in adult. Tail usually armed with large sharp retrorsely serrated spine on upper surface toward base, sometimes 2 or 3 spines present. Ventrals not emarginate, small, below pectorals. Front copula of hypobranchial cartilages segmented.

A large family in most warm seas, some forms entering fresh waters in the tropics. The large barbed spine on the strong tail is capable of causing painful and dangerous wounds.

Six genera.

KEY TO THE GENERA

- a.*—Disk circular; tail long, whiplike, without serrated spine. UROGYMNUM.
aa.—Disk quadrangular; tail long, whiplike, with one or more serrated spines. DASYATIS.
aaa.—Disk oval; tail compressed, long as, or longer than body, with serrated spine. TAENIURA.
aaaa.—Disk greatly broader than long; tail short, slender, pointed; caudal spine weak to absent. PTEROPLATEA.

UROGYMNUM Müller and Henle

Urogymnus MÜLLER AND HENLE, 1837, Archiv Naturg., p. 437. Type: *Raja asperrima* Schneider. (*Urogymnus* Müller and Henle proposed to replace *Gymnura* Müller and Henle.)

Gymnura (not Vigors and Horsfield, 1827) MÜLLER AND HENLE, 1837, Sitzs. Akad. Wiss. Berlin, p. 117. Type: *Raja asperrima* Schneider. Monotypic.

Anacanthus (not Cuvier, 1829) MÜLLER AND HENLE, *loc. cit.* Type: *Raja africana* Schneider. Monotypic.

Rhachinotus (not Gray, 1831, not Serville, 1832) CANTOR, 1850, Jour. Asiatic Soc. Bengal, 'Cat. Malay Fishes,' p. 422. Type: *Raja africana* Schneider. (*Rhachinotus* Cantor proposed to replace *Anacanthus* Müller and Henle.)

Disk orbicular or partly circular. Head rather prominent. No rostral cartilage. Mouth transverse, waved. Teeth tessellated, flattened, rhomboid. Spiracles large, close behind eyes. Scales tubercular, with broad rounded to polygonal bases, varying in shapes, sizes, and numbers with age. No dorsal fin. Tail long, slender, tapering, without spine or fins other than narrow cutaneous subcaudal at some stages. Pectorals meeting in front of disk, margins and angles rounded. Ventrals short, broad.

One species.

Urogymnus africanus (Schneider)

Golaun (Senegambia)

Raja africana SCHNEIDER, 1801, 'Syst. Ichth. Bloch,' p. 367. Guinea.

Anacanthus africanus DUMÉRILO, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 261 (Guinea).—BLÆKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, 'Poiss. Guinée,' (2) VIII, p. 6.

Urogymnus asperrimus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 471 (Africa).—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 29 (Gambia, Cape Rouge, Baie de Sainte Marie).

Disk partly oval, more pointed backward, with slight prominence of snout end. Mouth waved, palatal velum fringed, 3 to 5 papillae at bottom. Teeth broader than long, blunt, rows about 48. Anterior nasal valves confluent, fringed posteriorly. Scales tubercular, unequal, more or less striated, with rounded bases where not in contact, with polygonal bases where crowded and with cusps short to long, acute, blunt or rounded to depressed and shovel-shaped; wide area around disk edge, depressed cusps directed from either side toward median line of back, as this line is approached, the cusps turn more backward. Tail nearly twice the body length, with or without a narrow fold, according to age. Ventrals well covered by pectorals. Yellowish to whitish on tubercles; skin dark brown where exposed. (Garman.)

East Indies. Indian Ocean and eastern Atlantic. This species reaches 921 mm. in length.

DASYATIS Rafinesque

Sting Rays

Dasyatis RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 16. Type: *Dasyatis ujo* Rafinesque. Monotypic.

Dasybatus (Klein) WALBAUM, 1792, 'Artedi Pisc.,' III, p. 581. Atypic. Type: *Raja pastinaca* Linné. (Designated by Jordan, 1881, Proc. U. S. Nat. Mus., p. 35.) (Inadmissible.)

Dasibatis, *Dasibatus*, *Dasybatis* auct.

Uroxis RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' p. 48. Type: *Dasyatis ujo* Rafinesque. Monotypic.

Uroxys auct.

Trygonobatus BLAINVILLE, 1816, Bull. Soc. Philom., Paris, p. 112. Type: *Trygonobatus vulgaris* Blainville = *Raja pastinaca* LINNÉ. (Designated by Jordan and Evermann, Stanford Publications, 'Genera of Fishes,' part 1, 1917, p. 94.)

Trigonobatis, *Trygonobatis* auct.

Trygon (Adanson) CUVIER, 1817, 'Règne Animal,' II, p. 136. Type: *Raja pastinaca* Linné. (Designated by Jordan and Evermann, *op. cit.*, p. 98.)

Trygon auct.

Hypanus RAFINESQUE, 1818 (August), Amer. Month. Mag. Crit. Rev., II, p. 272. Type: *Raja say* Le Sueur. Monotypic.

Pastinacae NARDO, 1827, Giorn. Fis. Pavia, I, p. 11. Type: *Raja pastinaca* Linné. Tautotypic.

Pastinachus RÜPPELL, 1828, 'Atlas Reise Nörd. Afrika,' Fische, p. 82. Type: *Raja sephen* Forskål. (Designated by Jordan and Evermann, 1917, *loc. cit.*, p. 122.)

Pastinaca SWAINSON, 1839, 'Nat. Hist. Animals,' II, pp. 192, 319. Type: *Pastinaca olivacea* Swainson.

Hemistrygon MÜLLER AND HENLE, 1837, Ann. Mag. Nat. Hist., II, p. 90. Type: *Trygon bennetti* Müller and Henle. Monotypic.

Himantura MÜLLER AND HENLE, 1837, Archiv Naturg., p. 400. Atypic. Type: *Raja uarnak* Garman. (Designated virtually by Garman, 1913, Mem. Mus. Comp. Zool., XXX, p. 375.)

Himanturus auct.

Hellobatis MARSH, 1877, Amer. Jour. Sci. Art., (3) XIV, p. 256. Type: *Hellobatis radians* Marsh. Monotypic.

Xiphotrygon COPE, 1879, Amer. Nat., XIII, p. 333. Type: *Xiphotrygon acutidens* Cope. Monotypic.

Brachioptera GRATZIANOW, 1906, Zool. Anzeiger, p. 400. Type: *Brachioptera rhinoceros* Gratzianow. Monotypic. (Monstrosity.)

Pteroplatytrygon FOWLER, 1910, Proc. Acad. Nat. Sci. Philadelphia, p. 474. Type: *Trygon violaceum* Bonaparte. Monotypic.

Amphotistius GARMAN, 1913, Mem. Mus. Comp. Zoöl., XXXVI, p. 375 (392). Type: *Trygon sabina* Le Sueur. Orthotypic.

Disk partly quadrangular to partly circular, flat, edges rounded. Teeth small, paved. Usually a few papillae inside mouth behind lower jaw. Skin generally more or less rough with spines or tubercles, rarely smooth, or smooth in young and becoming rough with age. Tail long and whiplike, with serrated caudal spine, with or without dermal fin folds or keels behind spine, and without lateral folds on base.

Sting rays of large size, abundant in warm seas.

Forty or more species.

KEY TO THE SPECIES

- a.—Tail without keel above, fold below.
 b.—Tail more than twice disk length.....*centroura*.
 bb.—Tail 1 1/2 times disk length.....*rudis*.
 bbb.—Tail 2 1/2 times disk length.....*margarita*.
 aa.—Tail with keel above, fold below; tail 1 1/2 times disk length.....*pastinaca*.

Dasyatis centroura (Mitchill)

Guaheyam (Senegambia)

Raja centroura MITCHILL, 1915, Trans. Lit. Philos. Soc. New York, I, p. 479. Long Island coast, New York.

Hemistrygon ukpam J. A. SMITH, 1859, Proc. Roy. Phys. Soc. Edinburgh, p. 69. Old Calabar River.

Trygon ukpam GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 480 (copied).

?*Trygon spinosissima* DUMÉRIL, 1865, 'Hist. Nat. Poiss.,' I, p. 598. No locality. (Based on large thorny tail.)—ROCHEBRUNE, 1883, 'Faune Sénégalambie,' Poiss., p. 30 (Senegal, Bakel, Gambia).

Trygon thalassia GÜNTHER, 1870, *op. cit.*, p. 477 (Madeira).—ROCHEBRUNE, 1883, 'Faune Sénégalambie,' Poiss., p. 30. (Senegal, Bakel.)

Dasybatus thalassia MONOD, 1927, 'Faune Colon. françaises,' p. 652 (Souelaba, Cameroon).

Disk partly quadrangular, about 1/5 broader than long, front edges forming blunt angle at snout tip, hind edges nearly straight and hinder angles blunt. Mouth arched forward, with 5 papillae. Teeth blunt, smooth, in quincunx rows. Tail over twice the disk length, compressed distally, rounded above, with dermal fold below from base of spine backward, rough on all sides with broad-based stellate to round tubercles, each with a sharp conic cusp. Young smooth, with advancing age there are scattered tubercles on back medianly and behind, and on top and on sides of tail. In old examples the middle of back and head above and on sides are closely mailed with small flattened tubercles, with larger ones interspersed. Tail with one or more

barbed spines near base. Dark brown above, white below. Reaches 3050 mm. or more.

Atlantic and Mediterranean. The above description is from American examples (New Jersey).

***Dasyatis rudis* (Günther)**

Trygon rudis GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 479. Old Calabar.

Dasybatus rudis GARMAN, 1913, Mem. Mus. Comp. Zoöl., XXXVI, p. 384 (Old Calabar).

Disk wider than long, outer angles very distinct and front profile concave. Snout somewhat pointed. Upper parts and tail rough with minute dense asperities, no larger tubercles on body, and on middle of tail larger ones with stellate bases. Tail 1/2 longer than disk, without ridge above, with fold below. Uniform brown. Length of disk 1372 mm., tail 1830 mm. (Günther).

Old Calabar.

***Dasyatis margarita* (Günther)**

N'gothol (Senegambia), Niouma (Gaboon), Duba, Ébu (Cameroon), Raton de Altura (Cape Blanco)

Figure 51

Trygon margarita GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 479. West Africa.—PETERS, 1876, 1877, Monatsb. Akad. Wiss. Berlin, p. 252 (Victoria, Cameroon).—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV (1), p. 50

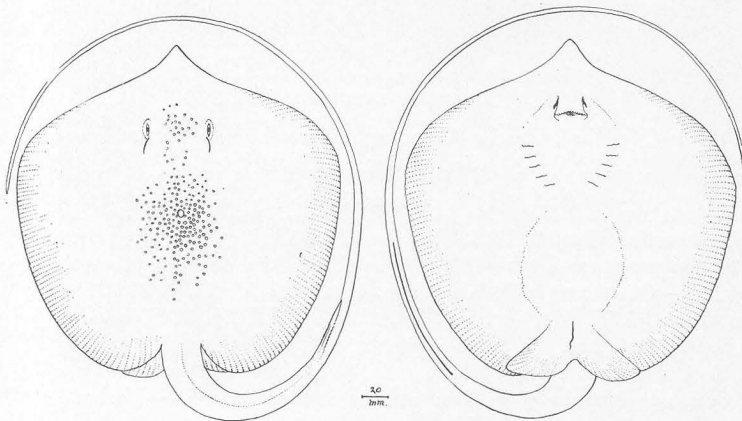


Fig. 51. *Dasyatis margarita*.

(Rufisque).—ROCHEBRUNE, 1833, 'Faune Sénégalaise,' Poiss., p. 31 (Guet N'Dar, Babagaye, Banc d'Arguin, Gorée, Dakar).—OSORIO, 1890 (September), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) II, p. 60 (Benguela, Bahio do Lobito, Angola).—STEINDACHNER, 1894, Notes Leyden Mus., XVI, p. 91 (Fisherman Lake at Buluma).—OSORIO, 1898, *op. cit.*, (2) V, p. 201 (Angola).—PELLEGRIN, 1913, Bull. Soc. Zool.

France, XXXVIII, p. 1154 (Libreville, Gaboon); 1914, Ann. Inst. Océanogr. Monaco, p. 9, Fig. 1 (Gaboon).—EHRENBAUM, 1914, Fischerbote, VI, p. 406, Fig. (Cameroon); 1915, 'Ueber Küstenfische von Westafrika,' p. 72, Fig.—REGAN, 1915, Ann. Mag. Nat. Hist., (8) XV, p. 125 (Lagos).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 199 (Cape Blanco).

Dasybatus margarita GARMAN, 1913, Mem. Mus. Comp. Zoöl., XXXVI, p. 386 (West Africa).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 232 (Port Étienne).—MONOD, 1927, 'Faune Colon. françaises,' p. 651 (Cameroon).

Trygon (Hemitrygon) bennetti (not Müller and Henle) STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LXIV (1), p. 577 (Senegal).

Disk about as long as wide, front edges forming obtuse angle with snout tip which is produced in a short point; outer edges all broadly round. Eye moderate, 4 in interorbital. Mouth with 3 long and 2 short papillae inside; width 3 in preoral; edge of buccal flap finely fringed. Skin smooth, large round tubercle in middle of back, around this and in interorbital there are segregated many small obtuse tubercles. Tail about 2 1/2 times longer than disk; few small asperities above behind spine, though no fold; lower surface with rather short low basal cutaneous fold. Above dull uniform brown, with umber tinge. Lower surfaces soiled whitish. Length 770 and 865 mm.

Eastern Atlantic shores of Africa. Two examples obtained by the Congo Expedition at the mouth of the Congo. Readily distinguished by the pearl-white tubercle in the center of the back.

Half-grown example in the U. S. National Museum labeled West Africa.

***Dasyatis pastinaca* (Linné)**

Ratão (Madeira), Chacho (Canaries), Chuco (Mauritania and Senegal),
Raton (Cape Blanco)

Figure 52

Raja pastinaca LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 232. Europe.

Trygon pastinaca LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 196 (Madeira).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 478 (Lanzarote).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 301 (Grand Canary).—PELLEGRIN, 1905, Act. Soc. Linn. Bordeaux, LX, p. 25 (Cape Blanco, Cape Verde); 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanco, Cape Verde); 1914, Ann. Inst. Océanogr. Monaco, p. 9 (Mauritania and Senegal coasts).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 198 (Cape Blanco).

Dasyatis pastinaca JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 339 (Canary Islands).—PAPPENHEIM, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 88 (Mogador, Agadir, Azamor in Morocco).

Dasybatus pastinacus CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 232 (Port Étienne).

Trygon pastinaca var. *marmorata* STEINDACHNER, 1892, Denkschr. Akad. Wiss. Wien, LIX (1) p. 381, Pl. iv, fig. 1. Gorée, Senegambia.

Disk partly quadrangular, broader than long, front edges nearly straight, forming obtuse angle beyond which the snout tip is slightly produced, outer angles blunted, hind angles rounded. Snout 1 to $1\frac{3}{5}$ in head measured to first gill opening. Mouth with 3 to 5 papillae, width $2\frac{3}{4}$ to $3\frac{9}{10}$ in head. Teeth small, 22 to 31 rows above, 24 to 31 below. Internasal $2\frac{1}{6}$ to $3\frac{9}{10}$ in head. Spiracles larger than eyes. Body smooth. Tail $1\frac{1}{2}$ times disk length, compressed behind spine, low fold above and a better developed fold below, ending in keel. Brownish, varying to gray above; white below, sometimes with brown blotches. Length of disk 320 mm., tail 300 mm.

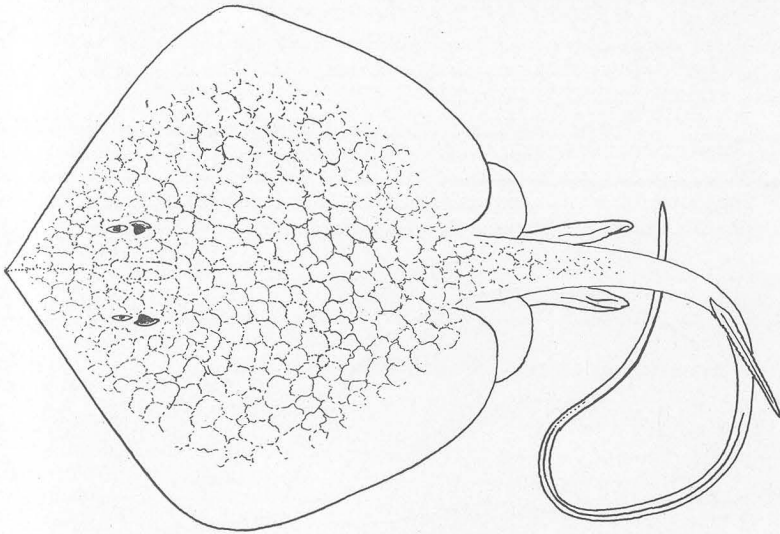


Fig. 52. *Dasyatis pastinaca*.

Eastern Atlantic and Mediterranean. Reported as *Dasybatis pastinacus* (1925, Ann. South African Mus., XXI, p. 47, Pl. iv, fig. 8) by Barnard, from Agulhas Bank and Natal. The above description from Italian and Mediterranean examples.

TAENIURA Müller and Henle

Taeniura MÜLLER AND HENLE, 1837, Sitzs. Akad. Wiss. Berlin, p. 117. Type: *Trygon ornatum* Gray = *Raja lymma* Forskål. Monotypic.

Discobatis (not Garman, 1880) MACLAY AND MACLEAY, 1886, Proc. Linn. Soc. New South Wales, X, p. 677. Type: *Discobatis marginipinnis* Maclay and Macleay. Monotypic. (Monstrosity.)

Discotrygon FOWLER, 1910, Proc. Acad. Nat. Sci. Philadelphia, LXII, p. 468. Type: *Discobatis marginipinnis* Maclay and Macleay. (*Discotrygon* Fowler proposed to replace *Discobatis* Garman.)

Taeniurops GARMAN, 1913, Mem. Mus. Comp. Zoöl., XXXVI, p. 399. Type: *Taeniura meyeri* Müller and Henle, here designated.

Disk rounded. No rostral cartilage. Mouth small, with papillae, velum fringed. Teeth small, tessellate, grooved transversely. Front nasal valves confluent, with free lateral and posterior edges, median attachment narrow. Cranium prominent, fontanel broad and rounded in front of skull, narrow between orbits. No dorsal fin. Tail longer than body, with spine above, in front of middle of length, and with rayless subcaudal fin below on terminal portion. Pectoral fins meeting in front of skull. Ventrals elongate, front rays longer than posterior.

***Taeniura grabata* (Geoffroy Saint-Hilaire)**

Figure 53

Trygon grabata GEOFFROY SAINT-HILAIRE, 1809, 'Description de l'Égypte,' Poiss., Pl. xxv, figs. 1-2; 1827, p. 218. Red Sea.

Taeniura grabata GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 484 (copied).

Taeniura grabatus OSORIO, 1898, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 201 (Cape de Verde Islands).

Taeniura grabata var. *variegata* ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 21. Tarrafal Bay, Cape Verde Islands.

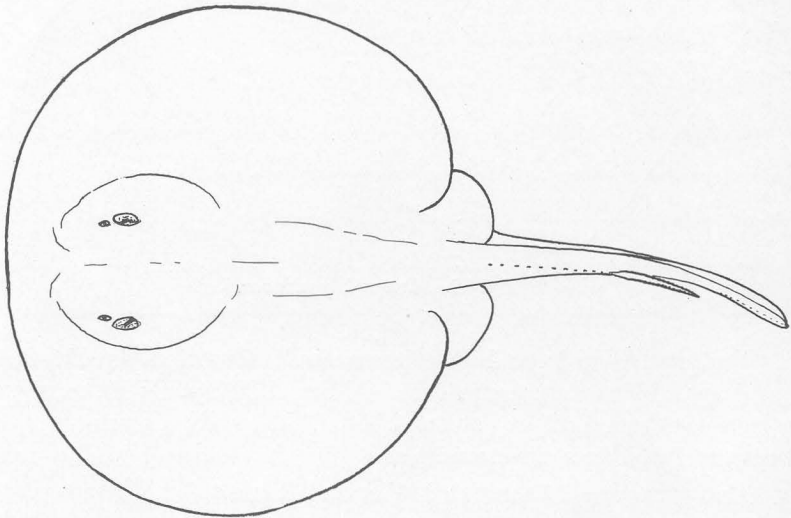


Fig. 53. *Taeniura grabata*, from Geoffroy St.-Hilaire.

Disk circular. Tail about as long as disk. Upper parts covered with minute spines with a radiated base. Reddish gray above, white below. (Günther.)

Red Sea, Mediterranean, and eastern Atlantic. The length is given as 2 meters by Duméril. Roule's variety is said to differ from the type in

that the spines are small or absent on the upper surface of the disk, the color of the upper surface is spotted irregularly and bordered brown, uniform clear yellow below, and tail slaty gray.

PTEROPLATEA Müller and Henle

Butterfly Rays

Pteroplatea MÜLLER AND HENLE, 1837, Sitzs. Akad. Wiss. Berlin, p. 117. Atypic. Type: *Raja altavela* Linné.

Planerocephalus GRATZIANOW, 1906, Zool. Anzeiger, XXX, pp. 400, 403. Type: *Planerocephalus ellioti* Gratzianow, Monotypic. (Monstrosity.)

Disk much wider than long, lozenge-shaped, angles rounded, depressed. Head little prominent. Eye prominent, small. Mouth transverse, wide, little arched, jaws slender. Teeth minute, numerous, in wide band, each tooth with broad base and with 1 to 3 sharp cusps. Nostrils wide, separated by a broad isthmus, front valves confluent and cross the isthmus as a narrow fold, and hind valves rudimentary. Spiracles large, close behind eyes. No dorsal fin. Tail short, slender, with or without narrow dermal folds behind serrated spine. Ventrals narrow, small.

Sting rays of rather large size, notable for their great width. About seven species, in most tropical seas.

KEY TO THE SPECIES

- a.—A tentacle behind spiracle. *altavela*.
 aa.—No tentacle behind spiracle.
 b.—Dermal fold on tail below weaker than upper. *micrura*.
 bb.—Dermal fold beneath low. *hirundo*.

Pteroplatea altavela (Linné)

Andorinha do mar (Madeira), Diegland (Senegambia)

Figure 54

Raja altavela LINNÉ, 1758, 'Syst. Nat.', 10th Ed., p. 232. Mediterranean.

Trygon altavela LOWE, 1839, Proc. Zool. Soc. London, p. 92 (Madeira); 1839, Trans. Zool. Soc. London, III, part 1, p. 20 (Madeira).

Pteroplatea altavela GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.', VIII, p. 486 (Madeira).—VINCIGUERRA, 1893, Atti Soc. Ital. Sci. Nat., XXXIV, p. 301 (Canaries).—PAPPENHEIM, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 96 (Mogador, Agadir, Azamor in Morocco).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 200 (Cape Blanco).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 233 (Port Étienne).

Pteroplatea canariensis VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II, part 2, p. 100, Pl. XXIII, fig. 1. Canary Islands.—DUMÉRIL, 1865, 'Hist. Nat. Poiss.,' I, p. 611, Pl. XXIII, fig. 1 (type).

Pteroplatea vaillantii ROCHEBRUNE, 1879, Bull. Soc. Philom., Paris, (7) IV, p. 159. Barre du Sénégal; 1883, 'Faune Sénégalie,' Poiss., p. 34, Pl. II, figs. 1-3 (Sénégal, Medine, Thionk, Maringouins).

Disk about twice wide as long. Snout very slightly projects, 1 1/2 in head or length about equals space between spiracles. Mouth width 1 1/2 in head. Teeth

in 50 to 100 rows, the number increasing with age. Spiracle with short filament. Front pectoral edge broadly concave at middle, outer end partly angular and hind edge broadly rounded. Tail small, slender, tapers, about $1/4$ disk length, with distinct fold above and weaker one below. Spines appear with age. Brownish olive above, finely marbled or specked with grayish. Tail whitish, with 4 or 5 distinct dusky blotches forming half rings. Length of disk 203 mm. and tail 76 mm.

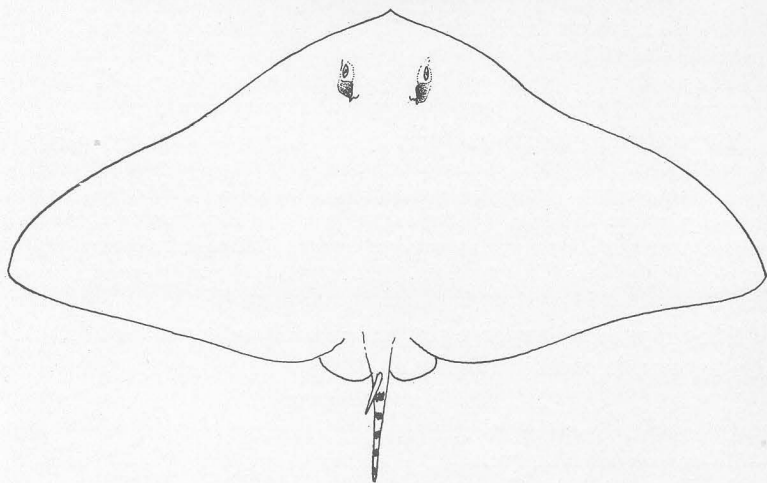


Fig. 54. *Pteroplatea altavela*, from Bonaparte.

Tropical Atlantic and Mediterranean. The above description based on American (Maryland and Virginia) and Italian examples, the largest examined 1220 mm. across.

***Pteroplatea micrura* (Schneider)**

Raia micrura SCHNEIDER, 1801, 'Syst. Ichth. Bloch,' p. 360. Surinam.

Pteroplatea micrura EHRENBAUM, 1914, Fischerbote, p. 407 (Cameroon); 1915, 'Ueber Küstenfische von Westafrika,' p. 73.—MONOD, 1927, 'Faune Colon. françaises,' p. 650 (compiled).

Disk about twice as broad as long. Snout projects very slightly, its length equals the space between the spiracles. Teeth in 66 to 100 rows. Spiracle without tentacle. Front pectoral edge broadly concave at middle, outer end partly angular and hind edge broadly rounded. Tail small, slender, tapering, about $1/4$ the length of disk, with a distinct fold above and a weaker one below. Spines appear with age. Brownish olive above, finely marbled or speckled with grayish. Tail whitish with four or five distinct dusky blotches, forming half rings. Reaches 1200 mm.

Tropical Seas. Described above from American (Middle Atlantic States) specimen. Reported as *Pteroplatea micrura* by Barnard (1925, Ann. South African Mus., XXI, p. 80) from Agulhas Bank.

Pteroplatea hirundo Lowe

Pteroplatea hirundo LOWE, 1843, Proc. Zool. Soc. London, XI, p. 94. Madeira.

Trygon altavela (not Linné) LOWE, 1839, Trans. Zool. Soc. London, III, part 1, p. 20 (Madeira).

Spiracle without tentacle. Skin smooth. Tail less than half length of disk; low dermal fold below. No dorsal fin. Caudal spine present. Uniform brown. (Garman.)

Madeira.

Myliobatidae

Eagle Rays

Body, head, and pectorals form lozenge-shaped disk. Pair of cephalic fins joined in front of snout, either separated from pectorals or united with them at side of head. Eyes lateral, prominent. Teeth angular, median row usually wider than laterals, if any. Nasoral grooves present. Nasal valves form rectangular flap with hind edge free and joined by frenum to upper jaw. Cranium prominent. Spiracles large, behind eyes, open laterally. Ovoviviparous. Skin smooth. Tail long, slender, whiplike, with a single dorsal near base, behind which usually 1 to 3 strong serrated spines. Ventrals not emarginate. Copula imperfect. Coloration usually with many pale spots above.

Large rays, feeding chiefly on mollusks, easily crushed by the large grinding teeth. Seven genera, all represented by fossils, and four living genera.

KEY TO THE GENERA

- a.—Rostral fins united in 1 lobe.
 b.—Teeth in more than 3 rows in each jaw.
 c.—Side of head not free from pectorals.....MYLIOBATIS
 cc.—Side of head free from pectorals.....PTEROMYLAEUS.
 bb.—Teeth in 1 row in each jaw.....AETOBATUS.
 aa.—Rostral fins separated as 2 lobes.....RHINOPTERA.

MYLIOBATIS Cuvier

Eagle Rays

Myliobatis (Duméril) CUVIER, 1817, 'Règne Animal,' II, p. 137. Type: *Raja aquila* Linné. (Designated by Jordan and Gilbert, 1882, Bull. U. S. Nat. Mus., 16, p. 50.)

Myliobates, *Myliobatus* auct.

?*Ictactus* RAFINESQUE, 1815, 'Analyse de la Nature,' p. 93 (*nomen nudum*).

Ptychopleurus AGASSIZ, 1838, 'Poiss. Foss.,' III, p. 67, Pl. XLV, figs. 1-3. Type: *Ptychacanthus* (*Ptychopleurus*) *faujasii* Agassiz. Monotypic.

Holorhinus GILL, 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 331. Type: *Rhinoptera vespertilio* Girard. Monotypic.

Bates PROBST, 1877, Jahresb. Ver. Vaterl. Naturk., Württemberg, p. 88. Type: *Bates spectabilis* Probst. Monotypic.

Disk wide, front angles acute. Head moderate, prominent. Jaws about equal. Teeth in seven rows, median row very wide, much wider than long in adult, proportionately narrower in young, and several series of narrower ones each side. Front nasal valves confluent in middle flap with free edge before mouth. Skin smooth or nearly so. Dorsal small, between ventrals. Tail very long, slender, with one or more serrated spines behind dorsal. Pectorals continued along side of head to snout end. Ventrals short, wide.

Large rays of all warm seas. Many fossils have been described, though there are but seven living species.

***Myliobatis aquila* (Linné)**

Dormideiro (Madeira), Whip Ray, Raton (Cape Blanco)

Figure 55

Raja aquila LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 232. Mediterranean Sea.

Myliobatis aquila LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 196 (Madeira); 1843-1860, 'Fishes of Madeira,' I, p. 99, Pl. xv (Madeira).—GÜNTHER,

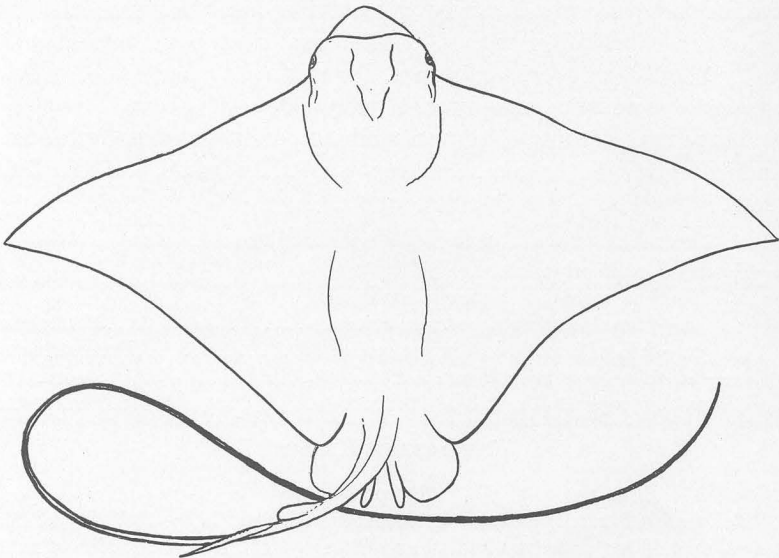


Fig. 55. *Myliobatis aquila*.

1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 489 (Madeira).—HILGENDORF, 1888, Archiv Naturg., p. 213 (Azores).—PAPPENHEIM, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 96 (Mogador, Agadir, Azamor in Morocco).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 393 (off Canaries, 10 m.).—METZELAAR, 1919,

'Rapp. Kolonie Curaçao,' II, p. 200 (Cape Blanco).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 200 (Cape Blanco).

Leiobatus aquila ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No. 243, p. 22 (Villafranca, Azores, 20 m.); 1919, Rés. Camp. Sci. Monaco, LII, p. 126 (Angra, Azores, 15 m.; Mazagan, Morocco, 11 m.; Villafranca example).

Disk width nearly half its length. Snout broad, rounded, $1\frac{4}{5}$ in head. Mouth width 3 in head; snout tip to mandible $1\frac{3}{4}$; internasal $4\frac{2}{3}$. Spiracles twice long as eyes. Body smooth. Dorsal small, length $2\frac{3}{4}$ in head. Tail twice body length. Front pectoral edge somewhat convex, posterior concave. Ventrals short, broad. Brown above, whitish below. Length of disk 290 mm., tail 292 mm.

Eastern Atlantic and Mediterranean. Reported as *Myliobatis aquila* by Barnard (1925, Ann. South African Mus., XXI, p. 82, Pl. iv, fig. 7) from Walfish Bay to Algoa Bay. Described above from an Italian example.

PTEROMYLÆUS Garman

Duck-billed Sting Rays

Pteromylaeus GARMAN, 1913, Mem. Mus. Comp. Zoöl., XXXVI, p. 437. Type: *Myliobatis asperrimus* Jordan and Evermann. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' IV, p. 548.)

Head elongate, narrowed forward and in snout. Teeth tessellate, in 7 rows as a median series of very broad teeth with 3 very narrow ones on each side. Spiracles open upward. Tail long, slender, with serrated spine behind dorsal. Pectorals rather falciform, not continuous with rostral fins at side of head. Ventrals elongate, narrow.

Three species.

Pteromylaeus bovina (Geoffroy Saint-Hilaire)

Obispo (Canaries), Dioulen (Senegambia)

Figure 56

Myliobatis bovina GEOFFROY SAINT-HILAIRE, 1809, 'Description de l'Égypte,' I, Pl. xxvi, fig. 1; 1827, p. 323. Egypt.—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 490 (Madeira).—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 33 (Cape Blanco, Cape Mirick, Baie d'Argain, Tanit).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 302 (Canaries).

Myliobates episcopus VALENCIENNES, 1836–1844, 'Hist. Nat. Canaries,' II, part 2, p. 98, Pl. xxiv. Canary Islands and Algiers.—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 403 (Santa Cruz, Teneriffe, Canaries).

Myliobatis aquila (not Linné) LOWE, 1844, 'Fishes of Madeira,' Pl. xv (Madeira).

Disk twice as wide as long. Head large. Snout produced, slender, tip blunt, $1\frac{4}{5}$ in head. Mouth width 3 in head. Teeth in 7 rows; median 6 to 8 times wider than long, outer narrow. Front nasal valves confluent; internasal $4\frac{2}{3}$ in head. Spiracle large, scarcely visible as viewed above. Dorsals small, inserted close behind ends of ventral bases, length $2\frac{3}{4}$ in head. Tail 3 times disk length, with serrated spines. Brownish above, whitish below. Length 889 mm.

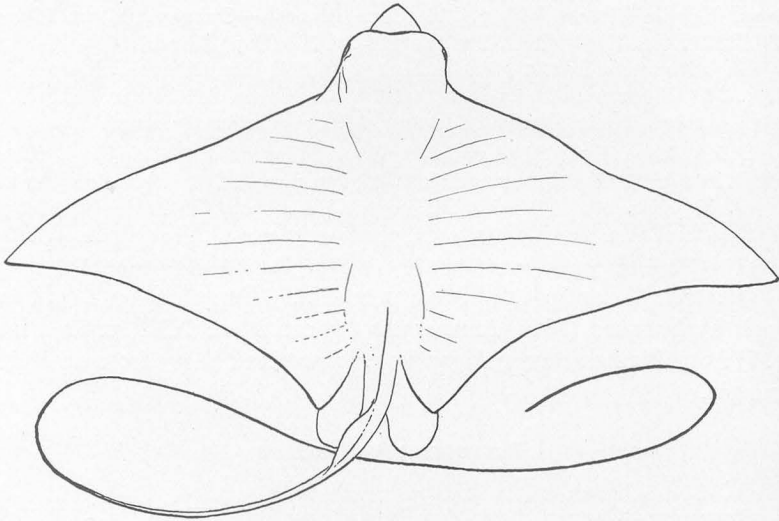


Fig. 56. *Pteromylaeus bovina*.

Eastern Atlantic and Mediterranean. Reported by Barnard as *Pteromylaeus bovinus* (1925, Ann. South African Mus., XXI, p. 83) from Agulhas Bank. The above description is from an Italian example in the Academy. The young have 7 or 8 more or less indistinct transverse whitish stripes. I have examined one 375 mm. long from the Bay of Naples, in the Princeton University collection.

AETOBATUS Blainville

Aetobatus BLAINVILLE, 1816, Bull. Soc. Philom., Paris, p. 112. Type: *Raja narinari* Euphrasen. (Designated by Jordan and Gilbert, 1882, Bull. U. S. Nat. Mus., XVI, p. 50.)

Aetobates SWAINSON, 1838, 'Nat. Hist. Animals,' I, p. 176. Type: *Raja narinari* Euphrasen.

Aetobatis auct.

Stoasodon CANTOR, 1849, Jour. Asiatic Soc. Bengal, 'Cat. Malay Fishes,' XVIII, p. 434. Type: *Raja narinari* Euphrasen. Monotypic.

Goniobatis AGASSIZ, 1858, Proc. Boston Soc. Nat. Hist., VI, p. 385. Type: *Raja flagellum* Schneider. Monotypic.

Head prominent, narrowing downward and forward on sides. Snout narrower, produced. Teeth in single row in each jaw, fused, lower pavement produced. Anterior nasal valves confluent; median notch in preoral flap. Tail long, slender, bearing dorsal fin and serrated spine above basal portion. Pectorals slightly falciform, not continuous forward to snout. Rostral fins separated from pectorals and at lower level on sides of head. Ventrals narrow, elongate.

***Aetobatus narinari* (Euphrasen)**

Dianouetz, Impogo (Senegambia), Womb'a madiba, Komb'a madiba, Komb'édo, Éombi, Ngombéa, Ngombia (Cameroons)

Figure 57

Raja narinari EUPHRASEN, 1790, K. sevenska Vet.-Akad., Nya Handl., XI, p. 217, Pl. x. St. Bartholomieu, West Indies (on *Narinari brasiliensibus* Marcgrave, 1648, 'Hist. Nat. Brasil.,' p. 175, Fig. Brazil).

Aetobatis narinari OSORIO, 1890 (September), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) II, p. 60 (Benguella, Angola); 1898, *op. cit.*, (2) V, p. 201 (Angola).

Aetobatis latirostris DUMÉRIL, 1858-1860, Arch. Mus. Hist. Nat. Paris, X, pp. 242, 261, Pl. xx, fig. 1. Gaboon coast; 1865, 'Hist. Nat. Poiss.,' I, p. 643 (type).—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 33 (Cape Roxo, Gambia, Cape Ste-Marie).—EHRENBAUM, 1914, Fischerbote, VI, p. 407 (Cameroon); 1915, 'Ueber Küstenfische von Westafrika,' pp. 73-75, Fig. p. 74.—MONOD, 1927, 'Faune Colon. françaises,' p. 650 (compiled).

Aetobatis flagellum (not Schneider) ROCHEBRUNE *loc. cit.* (Guet N'Dar, Pointe de Barbarie).

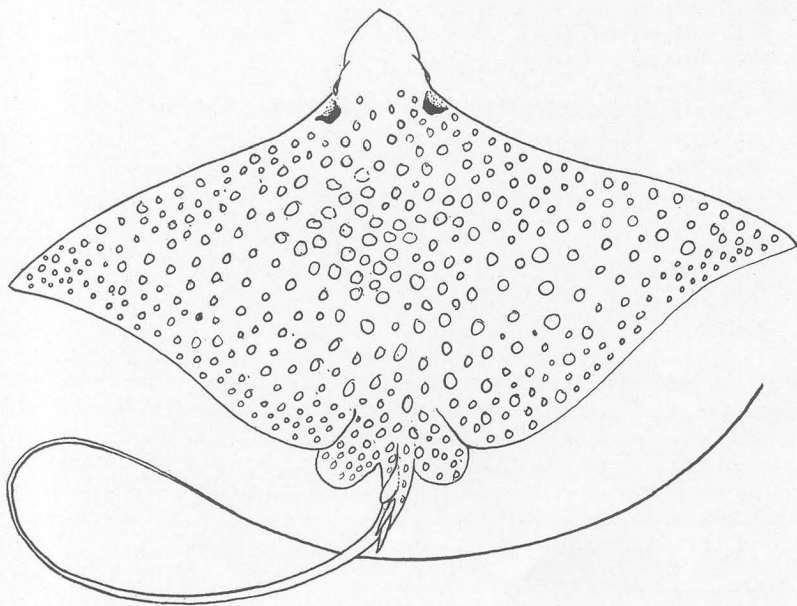


Fig. 57. *Aetobatus narinari*.

Disk width nearly twice the length, front edges convex, posterior concave. Cranium narrower toward mouth, convex across crown. Snout $1 \frac{2}{3}$ in head. Mouth width $2 \frac{1}{3}$ in head. Broad single row of teeth in each jaw, upper wider. Internasal width 5 in head. Palate papillae in 2 rows, 7 in front and 4 behind, median

pair of the latter well separated. Spiracles large, lateral, behind eyes, partly visible from above. Dorsal small, rounded above, with short free edge and angle behind base, origin above ventral bases. Tail slender, whiplike, more than 4 times length of body. Pectorals somewhat falciform, acute on outer angle. Rostral fins distinct from pectorals, joined in single pointed, depressed lobe. Above brownish gray, many ill-defined whitish spots extending to disk edges and very obscure on snout. Lower surface white. Length 1220 mm.

Tropical Atlantic and eastern Pacific. Reported by Barnard as *Aetobatis narinari* (1925, Ann. South African Mus., XXI, p. 83, Pl. v, fig. 1) from Natal. The above-described example without data, in the Academy.

RHINOPTERA Cuvier

Cow-nosed Rays

Rhinoptera (Kuhl) CUVIER, 1829, 'Règne Animal,' II, 2d Ed., p. 401. Type: *Myliobatis marginata* Geoffroy Saint-Hilaire. (Designated by Fowler, 1911, Bull. 4, Geol. Survey, New Jersey, p. 101.)

Zygobatis AGASSIZ, 1836, 'Poiss. Foss.,' III, p. 79. Type: *Myliobatis jussieui* Cuvier. Monotypic.

Zygobates auct.

Trikeras HARLESS, 1850, Abh. K.-bayer. Akad. Wiss., N. Phys. Class., V, p. 841. Atypic. Type: *Myliobatis marginata* Geoffroy Saint-Hilaire.

Mylorhina GILL, 1865, Ann. Lyc. Nat. Hist. New York, VII, p. 136. Type: *Rhinoptera lalandii* Müller and Henle. Monotypic.

Micromesus GILL, *loc. cit.* Type: *Rhinoptera adpersa* Müller and Henle. Monotypic.

Trycera (Koch) DODERLEIN, 1885, 'Manuale Ittiol. Medit.,' III, p. 242. Type: *Tryceratypica* Koch = *Myliobatis marginata* Geoffroy Saint-Hilaire (name in synonymy).

Disk broader than long, front angles acute. Eye round, pupil erect. Teeth angular, tessellated, in 5 to 20 rows, median usually enlarged. Front nasal valves confluent in wide flap, free behind and at sides, not emarginate. Skull broad to partly truncate, depressed to a rather sharp edge before each eye, deeply notched at fontanel. Tail long, slender, with dorsal fin and serrated spine above basal portion. Pectorals not continuous along sides of head to snout. Cephalic fins free, flexible lobe before each orbit.

Large rays of the tropical seas. The species, about sixteen, of which five are fossils, vary greatly in dentition.

KEY TO THE SPECIES

- a.—Teeth in 7 rows; median teeth 3 to 5 times as wide as long. *javanica*.
 aa.—Teeth in 9 rows above, 7 below.
 b.—Median row nearly 3 times and next rows 1 and 1 1/2 times as wide as long,
 second from median narrow, outer narrowest. *marginata*.
 bb.—Median 3 rows and outermost rows 2 to 3 times as wide as long. *pehi*.

Rhinoptera javanica Müller and Henle

Bindan (Senegambia)

Rhinoptera javanica MÜLLER AND HENLE, 1838, 'Besch. Plagiostomen,' p. 182, Pl. LVIII. Java.—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 261 (Gorée).—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 34 (Gorée, Dakar, Joalles, Rufisque).

Rhinoptera affinis BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, (2) XVIII, p. 19, Guinea. (Foetus.)

Disk less than twice as broad as long. Shallow notch in front of snout. Teeth in 7 rows, those in median row 3 to 5 times wide as long, those in next 2 rows about half as wide as median, and in outer 2 rows on each side as wide as long; median rows narrower on lower jaws. Skin smooth. Dorsal origin above ends of ventral bases. Tail nearly twice length of disk. Blackish green. Ventral surface white. (Garman.)

Eastern Atlantic and Indian Oceans.

Rhinoptera marginata (Geoffroy Saint-Hilaire)

Raton de tierra (Cape Blanco)

Myliobatis marginata GEOFFROY SAINT-HILAIRE, 1809, 'Description de l'Egypte,' I, Pl. XXV, figs. 3-4. Egypt; 1827, *op. cit.*, I, p. 334.

Rhinoptera marginata METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' p. 201 (Cape Blanco).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 223 (Cape Blanco).

Disk about twice as broad as long; front edge convex, nearly straight, posterior edge concave. Teeth in 9 rows; median row nearly 3 times as wide as long, next rows about half as wide, and third at each side a little broader than long, outer teeth narrowest, pentagonal. Skin smooth. Dorsal between ventrals, origin above ends of ventral bases, rounded above, with a short free margin and a slightly produced angle behind the base. Pectoral slightly falciform; outer angle blunted, hinder angle sharp. Ventrals longer than wide, angles rounded, subtruncate. Tail nearly twice disk length, with spine behind dorsal. Back brown, greenish and bronzed, lower surfaces white. In life more or less tinted red. (Garman.)

Mediterranean and Atlantic, south to Cape Blanco. Metzelaar's specimen was 460 mm. wide.

Rhinoptera peli Bleeker

Bindan (Senegambia)

Figure 58

Rhinoptera peli BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, (2) XVIII, p. 18, Pl. I. Guinea.—DUMÉRIL, 1865, 'Hist. Nat. Poiss.,' I, p. 646 (type; Gorée).—ROCHEBRUNE, 1883, 'Faune Sénégalie,' Poiss., p. 34 (Gorée, Dakar, Joalles, Rufisque).—PELLEGRIN, 1905, Act. Soc. Linn. Bordeaux, LX, p. 26 (Baie du Lévrier, Cape Blanco, Cape Verde); 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanco, Cape Verde).—GARMAN, 1913, Mem. Mus. Comp. Zoöl., XXXVI, p. 448 (West Africa).—CHABANAUD AND MONOD, 1926, Bull. Étud. Hist. Sci. Af.-Occ. française, p. 233 (Baie du Lévrier).

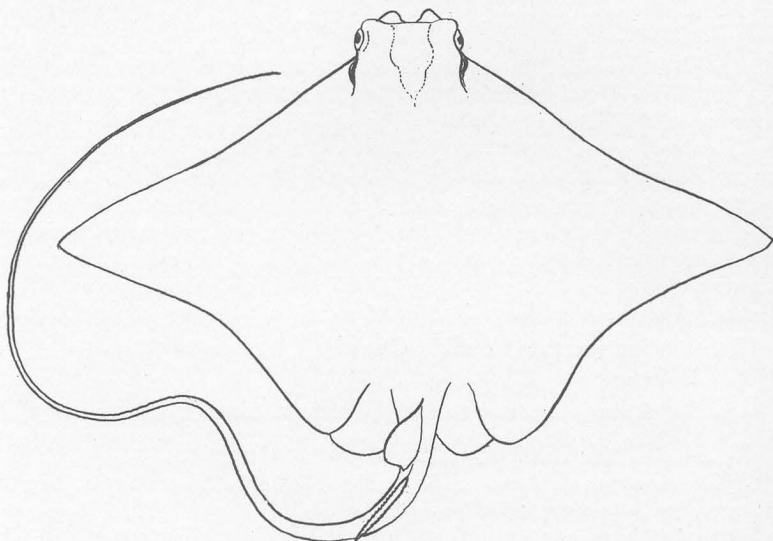


Fig. 58. *Rhinoptera peli*.

Teeth in 9 rows, hexagonal, those in middle row 3 times as wide as long; 2 rows of outer lower and 3 rows of upper as broad as long. Skin smooth. Dorsal origin hardly behind ends of ventral bases, end of fin slightly behind ends of ventral fins. Tail more than twice body length. (Garman.)

Gulf of Guinea. Reaches a length of 320 mm.

Mobulidae

Devil Fishes

Head, body, and pectorals form partly rhomboid disk, wider than long. Head wide, flat, with cephalic fin extended far forward as horn-like process from each side. Eyes lateral. Mouth wide, large, terminal or inferior. Teeth minute, in many rows, in pavement. Nostrils widely separated, valves united and form flap as wide as mouth cleft. Gill openings large. Spiracles moderate, behind orbits. Ovoviviparous. Skin more or less rough. Tail long, slender, whiplike, with single dorsal at base, also with or without serrated spine. Pectorals wide, triangular, not continued on side of head, acute-angled laterally and behind. Ventrals not emarginated. Copula imperfect.

Great rays of the tropical seas, among the largest fishes.

MOBULA Rafinesque

Mobula RAFINESQUE 1810, 'Indice Ittiol. Sicil.,' pp. 48, 61. Type: *Mobula auriculata* Rafinesque. Monotypic.

Apterurus RAFINESQUE, *op. cit.*, pp. 48, 62. Type: *Raja fabroniana* Lacépède. Monotypic.

Cephalopterus (Duméril) (not Geoffroy Saint-Hilaire, 1909) RISSO, 1810, 'Ichth. Nice,' p. 14. Type: *Raja giorna* Lacépède. (Designated by Jordan and Evermann, 1917, Stanford Publications, 'Genera of Fishes,' part 1, p. 77.)

Cephaloptera auct.

Dicerobatus BLAINVILLE, 1816, Bull. Soc. Philom., Paris, p. 116. Type: *Raja mobular* Bonnaterre. (Designated by Jordan and Evermann, *loc. cit.*, p. 95.)

Dicerobatis auct.

Pterocephala SWAINSON, 1839, Lardner's Cabinet Cyclopaedia, 'Nat. Hist. Animals,' II, p. 321. Type: *Raja giorna* Lacépède. Monotypic.

Head broad, flat, truncate. Mouth wide, inferior. Rostrum short, broad, sharp-edged anteriorly. Teeth on both jaws small, numerous, in pavement. Internarial space wide. Dorsal fin between ventrals. Rostral fins moderate, distinct from pectorals, directed forward and obliquely downward but rolled from below outward in a subcylindrical roll when not in use. Tail slender, whiplike, with or without a serrated spine.

Six species.

KEY TO THE SPECIES

- a.—Serrated caudal spine present; tail more than twice length of disk; bands of teeth reach angles of mouth.....*mobular*.
 aa.—No serrated caudal spine; tail longer than body; teeth occupy about half of jaw width.....*rochebrunei*.

Mobula mobular (Bonnaterre)

Raia mobular BONNATERRE, 1788, 'Encycl. Ichth.,' p. 5. Mediterranean.

Raja vespertilio WALBAUM, 1792, 'Artedi Pisc.,' III, p. 535 (on *Raie cornue* Duhamel, 1777, Pêches 3, Sect. 9, p. 293, Pl. xvii, figs. 1-2, Azores).

Aodon cornu LACÉPÈDE, 1798, 'Hist. Nat. Poiss.,' I, p. 300 (on Duhamel).

Cephaloptera giorna VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II, part 2, p. 97, Pl. xxii (Canaries).

Dicerabatis giornae VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 302 (Canaries).

Disk length twice or more width, angles acute. Teeth minute, pointed, median more rounded, bands extending to mouth angles, rows 150 or more. Minute scales, shagreen, on hinder portions of body. Front portion of dorsal base above ventral bases; extremities of fins about even. Pectorals falciform, convex in front, concave behind. Tail more than twice body length, with serrated spine behind dorsal, rough with scales and tubercles. Dark brown to blue-black above, white beneath. (Garman.)

Eastern Atlantic and Mediterranean. Reaches 980 mm. in length.

Mobula rochebrunei (Vaillant)

Niave (Senegambia)

Cephaloptera rochebrunei VAILLANT, 1879, Bull. Soc. Philom., Paris, (7) III, p. 187. Senegal.—ROCHEBRUNE, 1882, 'Faune Sénégalie,' Poiss., p. 35, Pl. I, figs. 1-2 (Guet N'Dar, Barbarie).

Teeth in 50 rows, occupying about half the width of jaws. Deep blue, with reddish on frontal region in longitudinal band behind head along middle of back, and on dorsal, ventrals, and tail. (Garman.)

Off Senegal. Garman says that it differs from *Mobula hypostoma* (Bancroft) in color, the latter being simply brown on the back. Its length is 1005 mm.

SUBCLASS HOLOCEPHALI

Chimaeras

Body compressed, massive. Caudal region attenuated. Upper jaws and palatal cartilages fused with skull. Teeth 6, platelike. Rostral cartilages 3, articulated to skull. Opercles rudimentary. Single external gill opening on each side. Gills 4, united with skin terminally. Spiracles absent, except in embryos. No distinct suspensorial cartilage for lower jaw. Brain with hemispheres distant from optic lobes, attached by nerve-like thread. Skeleton cartilaginous. Notochord unsegmented. Intestine without diverticular gland. Oviparous, eggs deposited in horny cases. Skin naked in adults. Series of small spines in 2 rows along back medianly and head above, aid escape from eggshell. First dorsal fin and spine erectile. Frontal and prepelvic tenacula in male.

ORDER CHIMAEROIDEI

Definition in that of the subclass *Holocephali*.

KEY TO THE FAMILIES

- a.*—Snout obtuse, prominent, soft, without proboscis; claspers of male trifold, rarely bifid. CHIMAERIDAE.
aa.—Snout produced into a long beak; claspers simple.

RHINOCHEMAERIDAE.

Chimaeridae

Chimaeras

Body robust forward, tapering behind. Head moderately pointed. Snout soft, prominent, without proboscis. Mouth inferior, small. Upper lip deeply notched. Jaws and teeth confluent into 4 bony plates above and 2 below, receive impact on edges. Tritors plated anteriorly

on edges of plates of mandibulars, palatines, and vomerines. Nostrils confluent with mouth, separated by narrow isthmus. Free gills 3, half gills 1 on each side. Gill rakers small, isthmus moderate. No spiracles. Males usually with a cartilaginous hook on snout above, prickly at tip, turned forward. Hemispheres and olfactory bulbs of brain in contact. Notochord surrounded by narrow cartilaginous rings. Skin naked, rarely somewhat prickly. Lateral line an open canal, specially modified in apertures on head. Dorsal usually divided, anteriorly short and with strong posteriorly grooved spine, erectile and near head. Second dorsal low, elongate. Anal small or indistinct. Caudal low, tapering; subcaudal low, with or without filamentary appendage, elongate, larger. Pectoral low, free. Ventral abdominal, many rayed. Trifid cartilages in each clasper of male.

Fishes of striking appearance usually living in cold seas.

CHIMAERA Linné

Chimaeras

Chimaera LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 236. Type: *Chimaera monstrosa* Linné. (Designated by Jordan and Gilbert, 1883, Bull. U. S. Nat. Mus., XIII, p. 54.)

Hydrolagus GILL, 1862, Proc. Acad. Nat. Sci. Philadelphia, XIV, p. 331. Type: *Chimaera collei* Lay and Bennett. Monotypic.

Bathyalopex COLLETT, 1901, Arch. Math. Naturv., XXXIII, p. 125. Type: *Chimaera mirabilis* Collett.

Psychichthys FOWLER, 1907, Proc. Acad. Nat. Sci. Philadelphia, p. 417. Type: *Hydrolagus waitei* Fowler. Monotypic.

Head somewhat compressed. Snout blunt, protruded, fleshy. Teeth rather strong, tritona in the form of rods. Lips thick, lower lip with frenum. Gill opening small. Males have a club-shaped cartilaginous hook on head above snout, hook curved forward and downward, armed terminally with decurved spines, tip fitting into depression before eyes; not present in females. Skin smooth. Lateral line simple, with zigzag openings on head. First dorsal triangular, preceded by strong spine, which is grooved behind and serrated on the edges. Second dorsal and caudal low, often more or less notched. Anal present. Tail extends in the line of the body axis, usually more or less produced in a terminal filament. Claspers of male trifid or bifid.

About a dozen species. Not valued as food.

Chimaera monstrosa Linné

Figure 59

Chimaera monstrosa LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 236. Atlantic.—RICHARD, 1910 (February), Bull. Inst. Océanogr. Monaco, No. 162, p. 151 (Azores, 1692 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 393 (off Morocco, 535 m.).—ROULE, 1912 (September 3), Bull. Inst. Océanogr. Monaco, No.

243, p. 23 (Azores and west of Fayal, 1165 to 1692 m.); 1919, Rés. Camp. Sci. Monaco, LII, p. 126 (Azores, 1165 m.; west of Fayal, 1962 m.).

Body compressed. Tail tapering from body cavity to a long filament terminally. Length from snout end to supracaudal origin about 5 times head length. Head compressed, subconic. Snout soft, rather blunt. Eye large, lateral. Each vomerine dental plate with 5 to 7 tritons. Lateral line in short wave on flank. First dorsal triangular, close to head, short, deep, preceded by strong erectile spine and followed by low dermal fold. Second dorsal low, 3 times as long as head, extends $2/3$ length above caudal region; not indented on upper edge, reaches above caudal origin. Anal small, rising slowly, separated by a narrow notch from subcaudal. Caudal fins low, rising slowly in front, descending very gradually backward. Pectoral large, $1\frac{1}{3}$ longer than head, reach behind ventral origin, hind edge slightly concave. Ventral far in forward half of total length; claspers of male nearly $2/3$ their length, third section slender, styliform. Brown, reddish to golden or silver above, more or less clouded and blotched with brown, irregularly scattered or in longitudinal streaks. Fins with dark outer edges. Variable, sometimes plain on back, shading to silver white or yellow below. Length 915 mm. or more. (Garman.)

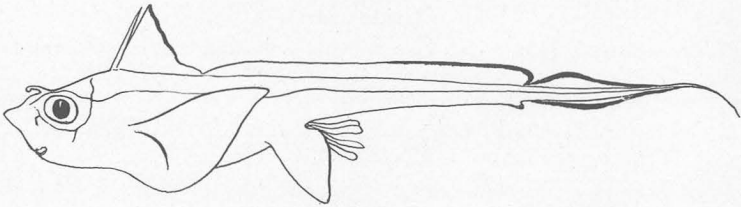


Fig. 59. *Chimaera monstrosa*, from Smitt.

Northern Atlantic, south to Cuba, Azores, and Morocco, in deep water. Reported by Barnard (1925, Ann. South African Mus., XXI, p. 94, Pl. v, fig. 5) off Cape Point and Saldanha Bay in depths to 500 fathoms.

Rhinochimaeridae

Head elongate. Snout produced in long beak. Hemispheres of brain remote from olfactory and optic lobes, connections very slender. Notochord surrounded by narrow rings, unsegmented. Lateral line an open groove, with closet-set ribs. First dorsal with strong erectile spine, fin short, close to skull. Second dorsal low. Anal not distinct from subcaudal. Subcaudal well developed, without produced lobe. Caudal tapering backward in filament. Males with frontal and 2 prepelvic tenacula. Claspers of male slender, ending in volute knob with hooked spines.

HARRIOTTA Goode and Bean

Rat Fishes

Harriotta GOODE AND BEAN, 1894, Proc. U. S. Nat. Mus., XVII, p. 471. Type: *Harriotta raleighana* Goode and Bean. Monotypic.

Antelochimaera TANAKA, 1909, Jour. Coll. Sci. Tokio, XXVII, p. 7. Type: *Antelochimaera chaetirhamphus* Tanaka. Monotypic.

Snout elongate, depressed, and somewhat flattened; forehead curving down in front to snout. Teeth with tritons and sinuous or notched cutting edges. Supra-caudal of moderate height, not armed with spines on upper edge. Frontal tenaculum of male with elongate much curved stem to comport with downward curvature of forehead.

Harriotta raleighana Goode and Bean

Figure 60

Harriotta raleighana GOODE AND BEAN, 1894, 1895, Proc. U. S. Nat. Mus., XVII, p. 472, Pl. XIX. Gulf Stream, N. lat. 36° to 39°, W. long. 70° to 74°, 707 to 1081 fathoms.

Harriotta raleighana MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 394 (Fig. 307, p. 417) (off Canaries, 2603 m.).

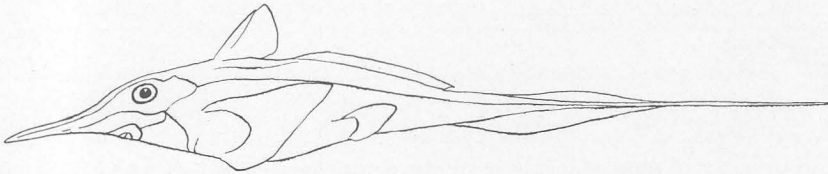


Fig. 60. *Harriotta raleighana*, from Goode and Bean.

Body and head compressed. Snout much produced, depressed, pointed. Forehead prominent, curves down from crown to snout. Each vomerine with 7 to 9 tritons (rods) on cutting edge. Palatines with 3 more or less complete longitudinal series of tritons; outer of small tritons on cutting edge, second of small ones forward, and large broad ones form pavement, backward; third irregular, composed of small and short tritons. Mandibular teeth with series of rods on cutting edge in forward half, 2 series in posterior half, inner continuous with forward series and as broad pavement-like tritons. Very young without tritons. Lateral line nearly straight along middle of length; prenasal branch passes from nasal outward in broad curve to side of snout, between suborbital and nasal, where it continues forward and curves inward to subrostral; jugular section meeting orbital behind junction of latter with suborbital and angular. Young with 2 rows of dorsal scales. First dorsal high, short, subtriangular. Second dorsal low, elongate, nearly as long as combined head and snout. No anal. Supra-caudal low, about half as wide as subcaudal, without spines on upper edge; subcaudal much wider and longer, origin near vertical from end of second dorsal. Pectorals large, reach ventral origins. Ventrals small. Brown. Length, 215 mm. (Garman.)

Atlantic Ocean.

SUBCLASS TELEOSTEI

True Fishes

Jaws and fins normally fishlike. Bones supporting fin rays greatly modified, though concealed by body integument. Usually 2 bones connect pectoral fin with shoulder girdle. Hypercoracoid flat, square, usually perforated by foramen. Below and parallel an irregular hypocoracoid. Row of bones attached called actinosts or pterygials, short, often hourglass-shaped, which actually support fin rays. Variations in coracoids occur, these sometimes imperfect or specially modified.

SERIES TELEOSTEI

Bony Fishes

Skeleton bony, firm. Air vessel present, not cellular or functional as lung, usually simple or with slender duct communicating with intestinal tract. Optic nerves crossing, not forming a solid chiasma. Arterial bulb thin, with pair of opposite valves. Intestine simple, without spiral valve. Armature, if present, usually of scales rounded in pattern. Tail homocercal.

All the great groups of existing true fishes, not comprised in the small series of ganoids, are included in the present assemblage. It is formed very largely of various heterogeneous orders, including many forms apparently dissimilar. These all agree in possessing certain characters not shared by the ganoids. As many are imperfect in definition, the following key is only provisional.

KEY TO THE ORDERS

- a.—Gill openings before pectoral.
- b.—Air vessel, when present, joined by air duct with intestinal canal, and persistent through life; spines seldom present in fins; pectorals usually on plane of abdomen; ventrals abdominal, spineless and basal segments rudimentary.
- c.—Head naked; dorsal inserted medianly or anteriorly.
- d.—Shoulder girdle attached to skull by post-temporal.
- e.—Vertebrae all more or less similar, anterior not especially modified.
- f.—Body not truly eel-like; maxillary perfect, rarely absent; precoracoid arch present.
- g.—Hypercoracoid and hypocoracoid well developed, not coalescent.
- h.—Preopercle normally connected; mesocoracoid well developed.....ISOSPONDYLI.
- hh.—Preopercle entirely detached from suspensorium, rudimentary and attached to lower jaw, its normal position replaced by subopercle; no mesocoracoid.....LYOPOMI.
- gg.—Hypercoracoid and hypocoracoid coalesced in simple lamellar imperforate plate; dorsal with many spines.....HETEROMI.
- ff.—Body eel-like; shoulder girdle not attached to skull; maxillary absent or united with palatines; no precoracoid arch.
- i.—Gill arches 4, hindmost modified as pharyngeal bones.....APODES.
- ii.—Gill arches 5 or 6, hindmost not modified as pharyngeal bones, and all as well as shoulder girdle disconnected from cranium.....LYOMERI.
- ee.—Anterior vertebrae modified, coössified and with ossicula auditus; maxillary imperfect, forming base of long barbel.....NEMATOGNATHI.
- dd.—Shoulder girdle not connected with skull in the usual way, post-temporal barely touching cranium; mostly bathypelagic.....INIOMI.
- cc.—Head scaly; lower pharyngeals separate; dorsal inserted far back.....MICROCYPINI.

bb.—Air vessel ductless with age; parietals, if present, separated by supra-occipital; pectoral arch suspended from skull; no mesocoracoid; ventral without basal segments.

j.—Fins without spines.

k.—Cranium normal.

l.—Pectoral with vertical base.

m.—Ventrals inserted far behind pectoral; lower pharyngeals fully united.

SYNENTOGNATHI.

mm.—Ventrals below or before pectorals. ANACANTHINI.

ll.—Pectoral with horizontal or subhorizontal base. ALLIOTRIOGNATHI.

kk.—Cranium twisted with age, so both eyes are on one side of head. . . . HETEROSOMATA.

jj.—Fins spinous.

n.—Ventrals thoracic.

o.—Head without laminated disk above.

p.—Ventrals close together, separated, first ray usually longest, others graduated shorter to innermost.

q.—Lower pharyngeals separated.

r.—No suborbital bony stay.

s.—Supraclavicle with spine near its hind angle, hind edge divided with 3 spines, of which 2 or 3 project through skin; gills 3 1/2, with 4 slits between them; ventral with 6 to 8 soft rays. ZEOIDEI.

ss.—Supraclavicle without protruding spines.

t.—Ventral with 3 to 13 soft rays; gills normal; scales various; spines well developed. BERYCOIDEI.

tt.—Ventrals usually absent; gills pectinated or tufted, branchial apparatus reduced; few or no dorsal spines.

u.—No preopercle; symplectic much elongated; gill filaments few, rather large, form rounded lobes.

LOPHOBRANCHII.

uu.—Peropercle and symplectic distinct, latter much elongated; gill filaments pectinated. AULOSTOMI.

ttt.—Ventral rays not more than 5; gills normal; spines typical.

PERCOMORPHI.

rr.—Suborbital with bony stay; ventrals thoracic; nostrils double.

CATAPHRACTI.

qq.—Lower pharyngeals completely united.

v.—Single nostril on each side of snout CHROMIDES.

w.—Two nostrils on each side of snout. PHARYNGOGNATHI.

pp.—Ventrals variably widely separated or close and united, inner rays of each fin longest. GOBIOIDEI.

oo.—Head above with transversely laminated disk. DISCOCEPHALI.

nn.—Ventrals jugular or mental.

w.—No ventral sucker. JUGULARES.

ww.—Ventral sucker present. XENOPTERYGII.

aa.—Gill openings in or near axil, more or less behind pectoral base.

x.—Opercular bones more or less reduced; scales osseous or as bony scutes or spines, or absent; ventrals thoracic, much reduced when present. PLECTOGNATHI.

xx.—Opercle large, hidden under skin; naked or covered with spines or bony tubercles; ventrals thoracic. PEDICULATI.

ORDER ISOSPONDYLI

Isospondylous Fishes

Bones of jaws developed. Maxillary wide, distinct from premaxillary, forms part of upper edge of mouth gape. Opercular apparatus complete, distinct. Pharyngeal bones simple above and below, lower not scythe-shaped. Gill openings wide. Gills 4, slit after fourth. Air vessel small or absent, with duct when present. Skeleton mostly firmly ossified. Symplectic present. No interclavicles. Front vertebrae simple, not modified, without auditory ossicles. Mesocoracoid arch always well developed, forms bridge from hypercoracoid to hypocoracoid. Shoulder girdle well developed, joined to cranium by bony post-temporal. Scales usually cycloid. Photophores sometimes developed. Dorsal and anal fins without true spines. Ventrals abdominal, sometimes absent.

A large order of marine fishes and with fewer fossils, though latter much better represented than most bony fishes. As some show characters like those of the higher ganoids, these have been believed to suggest possible lines of descent.

- i.*—Rayed dorsal fin always present; sometimes an adipose dorsal.
- j.*—Hyoid barbel well developed.
- k.*—Pectorals present.
 - l.*—One dorsal, opposite anal.....STOMIATIDAE.
 - ll.*—Two dorsals, first above interspace between ventral and anal, posterior adipose.
 - ASTRONESTHIDAE.
 - kk.*—No pectorals; dorsal long, with many rays, begins before ventral and ends above anal; no adipose fin.....IDIACANTHIDAE.
- jj.*—Barbel rudimentary or absent.
 - m.*—No pseudobranchiae; scales deciduous; adipose fin present.
 - n.*—Dorsal fin before ventral.....CHAULIODONTIDAE.
 - nn.*—Dorsal fin opposite anal.....GONOSTOMIDAE.
 - mm.*—Pseudobranchiae present.
 - o.*—Vertebrae and neural spines normal, not projecting from flesh in front of dorsal fin.
 - p.*—Eyes normal, moderate; mouth moderate; no scales. . MAUROLICIDAE.
 - pp.*—Eyes telescopic; mouth inconspicuous; scales large, thin, loose.
 - OPISTHOPROCTIDAE.
 - oo.*—Vertebral or neural spines projecting through skin of back in front of dorsal fin; body short, deep; mouth oblique or subvertical.
 - STERNOPTYCHIDAE.
- ii.*—No rayed dorsal present, only small adipose dorsal over last anal rays; body elongate, slender; jaws attenuated, lower projecting; fins all small. ANOPTERIDAE.

KEY TO THE FAMILIES

a.-No photophores; pectorals always present; ventrals sometimes rudimentary or absent.

b.-No adipose fin.

c.-ELOPOIDEI. Gular plate present between mandibular rami; mouth large, teeth present, all pointed.

ELOPIDAE.

cc.-No gular plate.

d.-ALBULOIDEI. Lateral line well developed; mouth small, horizontal; hind part of tongue and roof of mouth covered with coarse paved teeth.....ALBULIDAE.

dd.-CLUPEOIDEI. No lateral line.

e.-Head and body completely covered with spiny scales; mouth with barbels.....GONORHYNCHIDAE.

ee.-Scales, when present, cycloid, thin, loose, absent from head; no barbels.

f.-Dorsal inserted more or less before anal, rarely slightly behind it.

g.-Mouth moderate, terminal; maxillary of about 3 pieces.....CLUPEIDAE.

gg.-Mouth inferior, very large, below tapering piglike snout; maxillary very long...ENGRAULIDIDAE.

ff.-Dorsal posterior, opposite anal; mouth small; teeth pointed; no air vessel; blackish in color.

ALEPOCEPHALIDAE.

fff.-Dorsal occupies greater forward part of back, begins close behind pectoral base, entirely before anal origin; no supplemental maxillary; fin rays elongated.....MACRISTIIDAE.

bb.-SALMONOIDEI. Adipose fin present, oviducts none, large eggs usually falling into abdominal cavity before extrusion.

h.-Mouth larger; branchiostegals 6 or more.....ARGENTINIDAE.

hh.-Mouth small; branchiostegals 3 or 4.....MICROSTOMIDAE.

aa.-STOMIATOIDEI. Photophores usually along lower side of head, body, and tail; eggs enclosed in sacs of ovarium and excluded by oviducts; pectorals sometimes rudimentary or absent, when ventrals may be well developed or absent.

Elopidae

Tarpons

Body elongate, mostly compressed. Eye large, with adipose eyelid. Mouth large, terminal. Premaxillaries not protractile, short. Maxillaries forming lateral margins of upper jaw, composed of about 3 pieces extending backward beyond eye. An elongated gular plate between branches of lower jaw. Mouth broad, terminal, lower jaw prominent. Bands of villiform teeth in both jaws, on vomer, palatines, pterygoids, tongue, and base of skull. No large teeth. Opercular bones thin, with expanded membranaceous borders. Gill membranes entirely separate, free from isthmus. Branchiostegals 29 to 35. Gill rakers long, slender. Pseudobranchiae present or absent. Pyloric caeca numerous. Scales silvery, cycloid. Head naked, occipital collar of large thin scales. Belly not keeled or serrated, rather wide, covered with ordinary scales. Axillary scale above pectorals and ventrals. Dorsal and anal each depressible within scaly sheath. Lateral line straight. Dorsal fin inserted over or slightly behind ventrals. Anal far behind dorsal. Caudal forked. Pectorals low, fold like ventrals.

Large fishes, widely distributed in tropical seas. Their dry and bony flesh not much valued as food.

KEY TO THE GENERA

- a.—Body deep, oblong; no pseudobranchiae; scales large; anal fin larger than dorsal; last dorsal ray produced in long filament. MEGALOPS.
 aa.—Body longer; pseudobranchiae large; scales small; anal fin smaller than dorsal; last dorsal ray not produced in filament. ELOPS.

MEGALOPS Lacépède

Tarpons

Megalops LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' IV, p. 289. Type: *Megalops filamentosus* Lacépède. Monotypic.

Amia (not Gronow, Linné) BROWNE, 1789, 'Civil Nat. Hist. Jamaica,' 2d Ed., p. 442. Type: *Megalops atlanticus* Valenciennes. (Inadmissible.)

Oculeus (Commerson) LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 289. Type: *Megalops cyprinoides* Lacépède. (Inadmissible.)

Tarpon JORDAN AND EVERMANN, 1896, Bull. U. S. Nat. Mus., No. 47, part 1, p. 408. Type: *Megalops atlanticus* Valenciennes. Monotypic.

Body oblong, compressed. Belly narrow, not keeled, its edge with ordinary scales. Mouth oblique. Eye very large, with adipose eyelid. Mouth large, oblique. Mandible prominent. Maxillary wide, reaches beyond eye. Villiform teeth in jaws, on vomer, palatines, tongue, sphenoid, and pterygoids. Gill rakers long, slender. No pseudobranchiae. Branchiostegals 23 to 27. Vertebrae about 57, of which about 29 caudal. Scales large, thick, silvery, cycloid. Lateral line nearly straight, tubes radiating widely over surface of scales. Dorsal naked, caudal mostly scaly and anal

with sheath of scales. Dorsal short, high, inserted behind or above ventrals, last ray produced in long filament. Anal much longer than dorsal, falcate, its last ray produced. Pectorals and ventrals rather long.

Two species, fishes of large size in tropical seas. The young pass through a bandlike larval stage.

***Megalops atlanticus* Valenciennes**

Mell (Senegambia), M'begi (Banana), Mbèdi (Cameroon)

Figure 61

Megalops atlanticus VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XIX, p. 398. Guadeloupe, Santo Domingo, Martinique, Porto Rico.—PELLEGRIN, 1923, 'Poiss. Eaux douces Af. Occ.,' p. 44 (Senegal and Congo mouth).—MONOD, 1927, 'Faune Colon. françaises,' p. 654 (Souelaba and Kribi, Cameroon).

Megalops thrissoïdes ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 146 (Guet N'Dar, Gorée).—PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 155 (Banana, Congo); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 11 (between Dakar and Ponte San Ghomai, Banana).

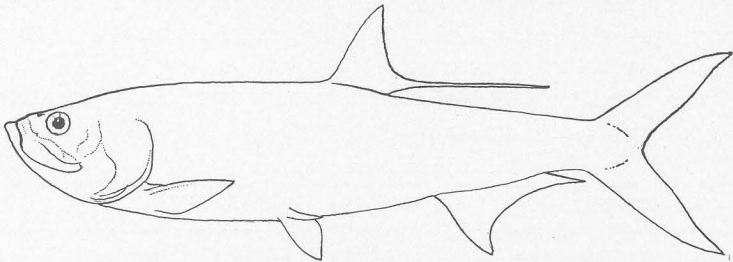


Fig. 61. *Megalops atlanticus*.

Head $3\frac{1}{4}$ to 4; depth $3\frac{2}{3}$ to $4\frac{1}{2}$; dorsal IV or V, 10 or 11; anal IV or V, 18 or 19; scales 40 to 43 in lateral line to caudal base and 2 or 3 more on latter; 5 scales above lateral line, 5 or 6 below; 20 to 23 predorsal scales; snout 4 to 5 in head measured from upper jaw tip; eye $3\frac{2}{5}$ to $4\frac{1}{2}$; maxillary $1\frac{2}{3}$ to $1\frac{3}{4}$; interorbital 5 to $5\frac{1}{2}$.

Body well compressed, edges convex. Head well compressed, sides flattened. Adipose eyelid little developed in young. Mouth moderate, lower jaw protruding. Maxillary with large supplemental bone. Teeth minute, sharp pointed. Nostrils together. Interorbital convex. Gill opening forward nearly opposite front of eye. Gill rakers about 26+39, more than half of eye. Gular plate slender, long. Scales smaller on breast, belly and bases of anal and caudal. Free-pointed pectoral and ventral scaly flaps. Lateral line complete. Dorsal inserted about midway between nostrils and caudal base, filament longer than head. Anal inserted little behind dorsal base. Caudal deeply forked, lobes pointed, about equal. Pectoral reaches ventral,

latter reaches not quite to anal. Bright silvery white, back olivaceous. Reaches 2135 mm.

Tropical Atlantic. Described above from American (Florida) examples.

ELOPS Linné

Ten Pounders

Elops LINNÉ, 1766, 'Syst. Nat.,' 12th Ed., p. 518. Type: *Elops saurus* Linné. Monotypic.

Mugilomorus LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, pp. 397, 398. Type: *Mugilomorus anna-carolina* Lacépède. Monotypic.

Trichonotus RAFINESQUE, 1815, 'Analyse de la Nature,' p. 88. Type: *Mugilomorus anna-carolina* Lacépède. (*Trichonotus* Rafinesque proposed to replace *Mugilomorus* Lacépède.)

Body elongate. Maxillaries very long. Opercular bones thin, with expanded membranaceous borders. Pseudobranchiae large. Branchiostegals numerous. Vertebrae 63 to 79, of which about 29 are caudal. Body covered with small, thin scales. Dorsal and anal both depressible in basal scaly sheaths. Lateral line straight, tubes simple. Dorsal slightly behind ventrals, last rays short. Anal similar, smaller. Pectorals and ventrals moderate, each with a long scaly flap.

Large fishes of tropical and subtropical seas, some entering tidal estuaries. All brilliant silvery in coloration. The young are bandlike, transparent creatures, undergoing a change with age similar to those of *Albula*. About seven species.

KEY TO THE SPECIES

- a.—Branchiostegals 28 to 35; scales 100 or more in lateral line. *saurus*.
aa.—Branchiostegals 24 to 26; scales less than 85 in lateral line. *lacerta*.

Elops saurus Linné

Leaktioye (Senegambia)

Elops saurus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 518. Carolina.—VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XIX, p. 264 (Senegal).—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 264 (Senegal).—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LXI (1), p. 71 (Saint Louis); 1882, Denkschr. Akad. Wiss. Wien, XLIV (1), p. 48 (Rufisque).—ROCHEBRUNE, 1883–1885, 'Faune Sénégalie,' Poiss., p. 145 (Senegal, Leybar, Dakar Bango, Thionk).—BOULENGER, 1909, 'Cat. Fresh-water Fishes of Africa,' I, p. 25 (St. Louis); 1916, *op. cit.*, IV, p. 152 (St. Louis examples).

Elops senegalensis REGAN, 1909, Ann. Mag. Nat. Hist., London, (8) III, p. 38. St. Louis, Senegal.—PELLEGRIN, 1923, 'Poiss. Eaux douces Af. Occ.,' p. 42 (Senegal).

Head $3\frac{1}{2}$ to $4\frac{1}{4}$; depth $4\frac{4}{5}$ to 7; dorsal vi, 19 or 20, anal vi, 12 or 13; scales 99 to 116 in lateral line to caudal base and 6 to 12 more on latter; 13 to 15 scales above lateral line, 11 to 14 below; 42 to 58 predorsal scales; snout 4 to $4\frac{2}{3}$ in head; eye 4 to 5; maxillary $1\frac{2}{3}$ to $1\frac{4}{5}$; interorbital 4 to $6\frac{3}{4}$.

Body slender, compressed, edges convex. Caudal peduncle well compressed, least depth $1\frac{2}{5}$ to $1\frac{2}{3}$ in its length or $2\frac{4}{5}$ to $3\frac{1}{8}$ in total head length. Head acuminate, compressed, width $2\frac{3}{4}$ to $2\frac{4}{5}$ in its length. Snout convex, as long as

wide or length $7/8$ its width. Eye large, hind edge well before center in head length; adipose lid broad, less developed in young. Mouth large, jaws equal. Bands of minute teeth in jaws, on vomer, palatines, tongue, and on maxillary edge. Maxillary broad, with large supplemental bone, reaches well beyond eye; expansion $1\frac{4}{5}$ to 2 in eye. Nostrils together, at least $1/3$ to $2/5$ in snout. Interorbital depressed concavely. Gill rakers 5 to 8 + 13 to 16, slender, long. Scales with 12 to 15 basal radiating striae; apical striae obsolete, about dozen or less; circuli coarse, not complete apically. Dorsal and anal in basal scaly sheaths; caudal base densely scaled; pectoral axil scale $1\frac{3}{4}$ to $1\frac{4}{5}$ in fin; ventral axil scale $1\frac{1}{4}$ to $1\frac{4}{5}$ in fin. Dorsal inserted about midway between eye center or front of eye and caudal base, nearer latter in large example; first branched ray $1\frac{1}{3}$ to $1\frac{9}{10}$ in head. Anal smaller, well behind depressed dorsal or inserted a little nearer caudal base than ventral origin; first branched ray 2 to $2\frac{1}{2}$ in head. Caudal $3\frac{1}{4}$ to $3\frac{2}{3}$ in combined head and trunk. Pectoral reaches 2 to $2\frac{1}{4}$ to ventral, $1\frac{7}{8}$ to $2\frac{1}{8}$ in head. Ventral inserted little before pectoral, 2 to $2\frac{1}{5}$ to anal, $1\frac{7}{8}$ to $2\frac{1}{6}$ in head.

Brilliant silvery white, back tinged brownish olive. Fins whitish, edged dusky. Reaches 915 mm.

Tropical Atlantic. Reported by Barnard as *Elops saurus* (1925, Ann. South African, Mus., XXI, p. 103, Pl. vi, fig. 1) from Port Elizabeth to Delagoa Bay. Described above from American specimens, and one, 234 mm. long, from the mouth of the Congo obtained by the Congo Expedition.

***Elops lacerta* Valenciennes**

Leak (Senegambie), Lysa (Cape Blanco), Keni (Konakry), Avo (Ivory Coast), Nianga (Libreville), Mondé, Mutanga, Unboté, Ondé, Ntanga, Mondi, Nanga, Motanga (Cameroon)

Elops lacerta VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XIX, p. 275, Pl. DCLI. Senegal.—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris., X, p. 264 (Senegal).—GÜNTHER, 1868, 'Cat. Fish. Brit. Mus.,' VII, p. 471 (copied).—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LXI (1), p. 571 (St. Louis).—PETERS, 1876, 1877, Monatsb. Akad. Wiss. Berlin, p. 251 (Cameroon).—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV (1), p. 48 (Rufisque).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 145 (Senegal, Leybar, Dakar, Bango, Thionk).—PELLEGRIN, 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Verde, Cape Blanco); 1905, Act. Soc. Linn. Bordeaux, LX, p. 29 (Cape Blanco); 1907, *op. cit.*, LXII, p. 79 (Senegal).—BOULENGER, 1909, 'Cat. Fresh-water Fishes of Africa,' I, p. 26, Fig. 18 (St. Louis, Senegal; Gambia; Benito River; Gaboon; Banana; Congo).—PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 152 (Konakry, Guinea), p. 153 (Port Bouet, Ivory Coast), p. 154 (Libreville, Gaboon); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 10 (Cape Blanco).—EHRENBAUM, 1914, Fischerbote, VI, p. 107, Fig. (Cameroon) (Konakry; Port Bouet; Libreville); 1915, 'Ueber Küstenfische von Westafrika,' p. 25, Fig.—REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 125 (Lagos).—BOULENGER, 1916, *op. cit.*, IV, p. 152 (Chiloango River at Mayili; Lagos).—PELLEGRIN, 1923, 'Poiss. Eaux douces Af. Occ.,' p. 43, Fig. 10 (Senegal and Congo).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 234,

Fig. 1 (Baie du Lévrier).—MONOD, 1927, 'Faune Cclon. françaises,' p. 652 (Souelaba, Cameroon).

Elops congicus BOULENGER, 1898 (December), Ann. Mus. Congo, I, fasc. 1, p. 21, Pl. x, fig. 1. Nanyanga, région des cataractes.

Head $3\frac{3}{5}$ to $3\frac{2}{3}$; depth $4\frac{4}{5}$ to $4\frac{7}{8}$; dorsal vi, 16, 1; anal iv, 14, 1, rarely iv, 13, 1; scales 72 to 74 in lateral line to caudal base and 5 to 7 more on latter; 9 scales above lateral line; 7 below; 35 to 40 predorsal scales; snout $3\frac{7}{8}$ to $4\frac{1}{8}$ in head measured from upper jaw tip; eye $3\frac{3}{4}$; maxillary $1\frac{3}{5}$ to $1\frac{2}{3}$; interorbital $3\frac{3}{5}$ to $3\frac{4}{5}$.

Body elongate, fusiform, well compressed, sides flattened. Caudal peduncle compressed, least depth $1\frac{1}{4}$ to $1\frac{1}{3}$ in its length or $2\frac{5}{6}$ to $2\frac{7}{8}$ in total head length. Head width $2\frac{2}{5}$ in its total length. Snout conic, length $\frac{4}{5}$ to 1 in its width. Eye with hind edge midway in head; diameter slightly longer than snout; adipose lid largely covering eye, preorbital, and cheek. Mouth large, mandible a little protruded. Maxillary extends slightly beyond eye; expansion $2\frac{1}{8}$ in eye. Teeth fine, uniform, in broad bands in jaws, on maxillaries, vomer, and palatines. Nostrils together, small, slightly nearer eye than snout tip. Interorbital broad, concavely depressed. Gill rakers 9+16, lanceolate, $\frac{1}{2}$ of eye; gill filaments $\frac{3}{4}$ of gill rakers. Scales with 22 to 24 basal radiating striae; about a dozen or less obsolete marginal radiating apical striae; circuli rather coarse, not continuous apically on scale. Scales adherent; dorsal and anal with broad basal scaly sheaths; caudal scaly basally; pectoral axillary scale $\frac{3}{5}$ to $\frac{2}{3}$ of fin; ventral axillary scale $1\frac{1}{4}$ to $1\frac{2}{5}$ in fin. Dorsal origin midway between front pupil edge or eye-center and caudal base; first branched ray $1\frac{1}{2}$ in total head length. Anal origin about opposite depressed dorsal tip, or midway between ventral origin and caudal base; first branched ray 2 to $2\frac{1}{10}$ in head. Caudal deeply forked, $3\frac{1}{5}$ to $3\frac{2}{5}$ in combined head and trunk. Pectoral reaches $1\frac{3}{4}$ to ventral, $1\frac{3}{4}$ in head. Ventral inserted well before dorsal, reaches $\frac{2}{3}$ to anal, $1\frac{2}{3}$ to $1\frac{4}{5}$ in head.

Back brown, sides paler. Length 258 to 277 mm.

Coast and rivers of West Africa. Here described from 3 examples obtained by the Congo Expedition at the mouth of the Congo. Boulenger says that the species reaches 560 mm. The color is given as silvery, blackish, or bluish on the back; dorsal, and sometimes also anal, with a blackish terminal spot.

Albulidae

Lady Fishes

Body rather elongate, little compressed, belly flattened. Snout conic, prominent, partly quadrangular. Eye median. Mouth inferior. Maxillary rather short. Lateral edge of upper jaw formed by maxillaries. Opercle moderate, firm. Preopercle with a wide flat membranous edge, extends backward, sometimes to opercle base. Gill membranes entirely separate, free from isthmus. Pseudobranchiae present. Fold of skin across isthmus in front, its hind edge crenate. Branchiostegals 14 to 16. Vertebrae about 70, of which 28 are caudal. Pyloric caeca

numerous. Scales rather small, cycloid, brilliant silvery. Head naked. Belly not keeled, flattened, covered with ordinary scales. Lateral line present, tubes simple. Dorsal moderate, before ventrals, membranes scaly. Anal small, far behind vent, near caudal. Caudal widely forked.

Large fishes in all warm seas, among living forms comprising two genera. Two fossil genera also known. As in related families, the young pass through a metamorphosis similar to that of the conger eels.

ALBULA Gronow

Lady Fishes

Albula GRONOW, 1763, 'Zoöphylac.,' p. 102. Species nonbinomial. Type: *Clupea macrocephala* Lacépède = *Esox vulpes* Linné. ("Le type est le Butirin macrocéphale (*Clupea macrocephala* Lacépède)" Demarest, 1874, 'Encycl. Hist. Nat. Rept. Poiss.,' (Chenu), p. 309.)

Vulpes CATESBY, 1771, 'Nat. Hist. Carolina,' 2d Ed., p. 1. Type: *Esox vulpes* Linné. Tautotypic. (Inadmissible.)

Butyrinus LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 45. Type: *Butyrinus bananus* Lacépède. Monotypic.

Butyrinus auct.

Glossodonta CUVIER, 1815, Mém. Mus. Hist. Nat. Paris, I, p. 232. Atypic. Type: *Argentina glossodonta* Forskål = *Esox vulpes* Linné. Tautotypic.

Pisodus (Agassiz) OWEN, 1845, 'Odontography,' p. 138. Type: *Pisodus owenii* (Agassiz) Owen. Monotypic.

Head moderate. Snout piglike, overlaps mouth. Eye large, with bony ridge above. Annular adipose eyelid almost covers eye. Mouth small, horizontal. Maxillary strong, single supplemental bone distinct, slips below membranous edge of broad preorbital. Premaxillaries short, not protractile. Both jaws, vomer and palatines, with bands of villiform teeth. Broad patches of coarse blunt paved teeth on tongue, behind sphenoid and pterygoids. Last dorsal and anal rays not produced. Pectorals low.

A single living species in all tropical seas. A remarkable anatomical character, in which this genus differs from all bony fishes, is the presence of two transverse rows of valves to the bulbus arteriosus of the heart, in place of one, though none of the ganoid fishes have less than three.

Albula vulpes (Linné)

Banane (Gorée), Ikondo (Libreville), N'kownga (Banana)

Figure 62

Esox vulpes LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 313. Bahama Islands. (On bonefish Catesby.)

Albula vulpes PELLEGRIN, 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 11 (Rufisque, Libreville, Banana).—FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 228 (Freetown, Sierra Leone).

Albula gorensis VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XIX, p. (342) 248. Gorée.—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 264 (Gorée).

Albula conorhynchus GÜNTHER, 1868, 'Cat. Fish. Brit. Mus.,' VII, p. 468 (Cape Verde Islands).—BÜTTIKOFER, 1890, 'Reis. Liberia,' II, p. 480.—PELLEGRIN, 1907, Act. Soc. Linn. Bordeaux, LXII, p. 77, Fig. 1 (Rufisque); 1913, Bull. Soc. Zool. France, XXXVIII, p. 154 (Libreville, Gaboon; Banana, Congo).

Albula conorhynchus ROCHEBRUNE, 1883-1885, 'Faune Sénégalaise,' Poiss., p. 144 (Cape Verde, Gorée).

Albula glossodonta STEINDACHNER, 1895, Notes Leyden Mus., XVI, p. 83 (Cape Mount, Liberia).

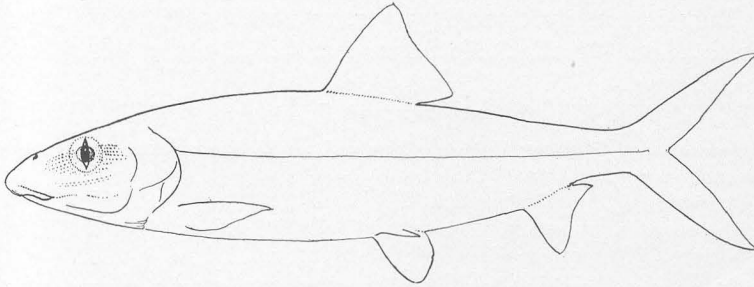


Fig. 62. *Albula vulpes*.

Head $3\frac{3}{5}$ to $3\frac{4}{5}$; depth 4 to $4\frac{2}{3}$; dorsal IV or V, 13 or 14; anal III, 6 or III, 7; scales 69 or 70 in lateral line to caudal base and 4 to 7 more on latter; 9 scales above lateral line, 6 or 7 below; 23 to 28 predorsal scales; snout $2\frac{1}{2}$ to $2\frac{2}{3}$ in head; eye $4\frac{1}{8}$ to $4\frac{4}{5}$; maxillary $2\frac{4}{5}$ to 3; interorbital $3\frac{1}{2}$ to $4\frac{1}{3}$.

Body elongate, fusiform, little compressed, deepest at dorsal origin. Caudal peduncle compressed, least depth $1\frac{1}{3}$ its length or $3\frac{3}{4}$ in head. Head pointed, compressed, width half its length. Snout conic, width $1\frac{1}{10}$ in its length. Eye high, about midway in head; diameter $1\frac{3}{4}$ in snout. Mouth not broad, inferior. Maxillary not quite reaching to eye. Teeth minute. Nostrils small, together, nearly midway in snout. Interorbital depressed. Gill rakers 8+12, short points. Scales with 2 or 3 basal radiating striae, edge lobate; circuli fine basally, parallel with striae, more or less granular with age, absent apically, and other circuli horizontal. Scales narrowly imbricate, mostly uniform on trunk; caudal basally and dorsal largely covered with small scales; broad band of elongate thin scales along middle of back; pectoral axillary scale $1\frac{1}{4}$ in fin; ventral axillary scale $1\frac{3}{5}$ in fin. Lateral line straight from shoulder to middle of caudal base. Dorsal inserted a little nearer caudal base than snout tip, midway in young; first branched ray $1\frac{2}{3}$ to $1\frac{5}{6}$ in head. Anal small, inserted nearly midway between depressed dorsal tip and caudal base; first branched ray $3\frac{1}{5}$ to $3\frac{1}{4}$ in head. Caudal well forked, lobes pointed, $1\frac{1}{10}$ to $1\frac{1}{8}$ in head. Pectoral low, reaches 2 to $2\frac{1}{8}$ to ventral, $1\frac{3}{4}$ to 2 in head. Ventral inserted about opposite middle of dorsal base, reaches 2 to $2\frac{1}{8}$ to anal, $2\frac{1}{4}$ to $2\frac{1}{3}$ in head.

Burnished brilliant silvery white, olivaceous above. Fins grayish, axils dusky. Length 200 to 400 mm.

Circumtropical. Reported by Barnard as *Albula vulpes* (1925, Ann. South African Mus., XXI, p. 106) from Natal. Described above from West Indian specimens. Reaches 915 mm.

Gonorhynchidae

Edge of upper jaw formed by premaxillary which is short and continued downward as thick lip, situated before maxillary. Mouth with barbels. Gill opening narrow. Pseudobranchiae present. Stomach simple, without blind sac. Pyloric appendages in small number. Head and body completely covered with spiny scales. Dorsal fin opposite ventrals, short, like anal. No adipose fin.

One genus.

GONORHYNCHUS Gronow

Gonorhynchus GRONOW, 1763, 'Zoöphylac.,' p. 55. Species nonbinomial. Type: *Cyprinus gonorynchus* Linné. Tautotypic.

Gonorynchus, *Gonorhinchus* auct.

Rhynchana RICHARDSON, 1844-1848, 'Voy. "Erebus" and "Terror,"' Ichth., p. 44. Type: *Rhynchana greyi* Richardson. Monotypic.

Body elongate, subcylindrical. Head pointed. Snout conic, protrudes beyond mouth. Eye large, covered by transparent skin. Mouth inferior, semicircular. Single barbel behind end of snout. Lips thick, fringed. No teeth in jaws or on palate. Two patches of obtuse teeth behind palate on pterygoids, opposed to larger patch on hyoid. Lobe of mucous membrane suspended from mouth roof, before teeth. Gill membranes joined to isthmus. Fringed gill-like organ behind fourth gill arch, half attached to arch and other half to humeral arch. Branchiostegals 4. Dorsal fin opposite ventrals, these fins approximate to vent. Caudal subtruncate.

One species in temperate southern seas of the Old World.

Gonorhynchus gonorynchus (Linné)

Figure 63

Cyprinus gonorynchus LINNÉ, 1766, 'Syst. Nat.,' 12th Ed., p. 528. Cape of Good Hope.

Gonorhynchus greyi CLARK, 1913, Proc. Roy. Phys. Soc. Edinburgh, XIX, p. 387, Fig. 1 (St. Helena).

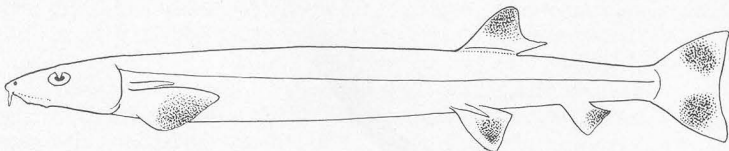


Fig. 63. *Gonorhynchus gonorynchus*.

Head 5 to 5 1/8; depth 9 to 10; dorsal v, 8, 1, sometimes v, 7, 1; anal v, 5, 1, sometimes v, 6, 1; scales in lateral line 165 to 175 to caudal base and 5 or 6 more on latter; 14 to 18 scales above lateral line, 13 or 14 below; 150 to 175 predorsal scales;

snout $2\frac{2}{3}$ to 3 in head; eye 4 to $4\frac{1}{4}$; interorbital $5\frac{1}{8}$ to 8. Body robust. Caudal peduncle compressed, depth about half its length, 4 in head. Head conic, width about $2\frac{3}{4}$ its length. Snout long, conic, width $1\frac{2}{3}$ its length. Eye high. Mouth small, jaws protractile below. Maxillary about $\frac{4}{5}$ eye. Rostral barbel little over half of eye. Nostrils together, a trifle before first third of snout. Interorbital and crown convex. Gill rakers $12+9$, hastate, tips sharp pointed, third of eye. Scales small, ctenoid, exposed edges truncate. Axillary pectoral scale $\frac{2}{3}$ of fin, ventral scale similar. Caudal and dorsal scales basally, other fins scaleless. Lateral line continuous to caudal base, sloping gently down from shoulder until midway along trunk side posteriorly. Tubes simple, of small pores. Dorsal origin at last third between hind eye edge and caudal base. Anal origin slightly behind depressed dorsal tip or about midway between caudal base and dorsal origin. Caudal emarginate. Pectoral pointed, $1\frac{1}{4}$ in head. Ventral $1\frac{5}{6}$ in head.

Gray-brown, paler below. Fins pale gray-brown. Pectoral edge whitish. Inside mouth and gill opening black. Length to 292 mm.

Southern Indian Atlantic, and Pacific Oceans. Reported by Barnard as *Gonorhynchus gonorhynchus* (1925, Ann. South African Mus., XXI, p. 125, p. 16, Fig. 4) from Port Nolloth to Natal. Described above from Australian (Victoria) examples.

Clupeidae

Herrings

Body oblong or elongate, mostly compressed. Head usually compressed. Snout never prominent. Adipose eyelid present or absent. Pre-maxillaries not protractile. Mouth rather large, terminal, superior. Jaws about equal. Maxillaries forming lateral edge of upper jaw, each of about 3 pieces. Teeth mostly small, feeble, or absent. Hind lower part of opercular region often with an angular emargination, tips of larger branchiostegals abruptly truncate. Gills 4, slit behind last. Gill rakers long, slender. Gill membranes separate, free from isthmus. Branchiostegals usually few, 6 to 15. Pseudobranchiae present. Vertebrae 40 to 56. Ovaries furnished with oviducts. Scales thin, loose, cycloid, sometimes pectinate. Belly rounded or compressed, always with bony serratures, with or without spines. Head naked. Dorsal fin median or somewhat posterior, rarely absent. Anal usually rather long. Caudal forked. Ventrals moderate or small.

A large family found in all warm seas, the species usually swimming in immense schools, their abundance proverbial. Some ascend fresh waters and some remain there permanently.

I am unable to locate *Clupea tropica* Osbeck¹ with any known clupeoid. According to Forster's translation,² it is described with the following characters:

¹ 1765, 'Reis. Ost-Ind., China,' p. 393. Ascension Island.

² 1771, 'Voy. China' (Osbeck), II, p. 103.

No distinct notch in upper jaw. Opercle without radiating striae. Vertical edge of cleithrum covered by dermal fold bearing 2 obtusely pointed projections equidistant and with shallow cavity between.

Mostly valued as food-fishes, also used for oil; found in most tropical seas. Fourteen species.

KEY TO THE SPECIES

- a.*—Ventrals with 9 branched rays; dark spot on opercle. *aurita*.
aa.—Ventrals with 8 branched rays; dark spot at front base of dorsal.
 b.—Depth 3 2/3 to 4; 60 to 95 gill rakers on lower branch of first arch. *maderensis*.
 bb.—Depth 3 1/3 to 3 2/3; 110 to 130 gill rakers on lower branch of first arch. *eba*.
 bbb.—Depth 3; 90 to 100 gill rakers on lower branch of first arch. *cameronensis*.

***Sardinella aurita* Valenciennes**

Sardina de ley (Canaries), *Yaboy* (Dakar), *Sardinha* (Angola), *Sardina machiralado* (Rio de Oro)

Figure 64

Sardinella aurita VALENCIENNES, 1847, 'Hist. Nat. Poiss.,' XX, p. 190, Pl. DXCIV. Gulf of Morée.—FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 208 (Porto Grande, Cape Verde), p. 269 (Loando, Angola).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 203 (Gorrei, Rio de Oro).—FOWLER, 1923, Proc. Acad. Nat. Sci. Philadelphia, p. 33 (Funchal Bay, Madeira).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 241, Fig. 4 (opercle) (Port Étienne).

Clupea aurita VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 331 (Grand Canary).—PELLEGRIN, 1907, Act. Soc. Linn. Bordeaux, LXII, p. 80, Fig. 2 (Dakar); 1912, Bull. Soc. Zool. France, XXXVII, p. 291 (Praya Amelia); 1913, *op. cit.*, XXXVIII, p. 116 (Mauritanian coast); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 13 (Baie du Lévrier, Dakar, Angola).

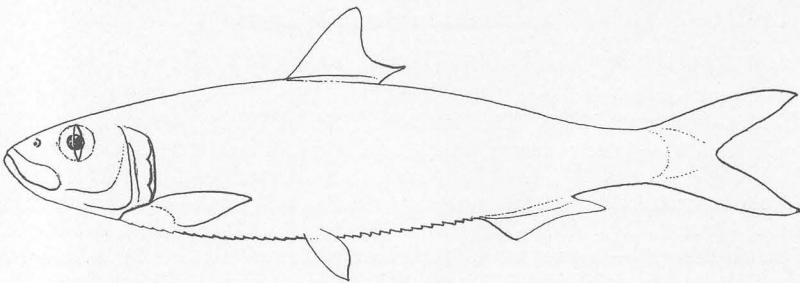


Fig. 64. *Sardinella aurita*.

Head 3 1/2 to 4; depth 4 to 5 1/8; dorsal v, 14, I, varies IV or v, 12 to 15, I; anal III, 15, I, varies III or IV, 12, I to 16, I; scales in lateral count 49, vary 45 to 48

to caudal base and mostly 4 more on latter; 12 scales between dorsal origin and ventral base; predorsal scales 14 or 15, vary 13 to 18; snout 3 to $3 \frac{2}{5}$ in head measured from upper jaw tip; eye $3 \frac{1}{4}$ to 4; maxillary $2 \frac{1}{5}$ to $2 \frac{1}{2}$; interorbital $4 \frac{1}{4}$ to 5; abdominal scutes 19 to 21 + 13 to 17.

Body fusiform, well compressed, deepest at ventral origin. Caudal peduncle compressed, least depth 1 to $1 \frac{1}{4}$ its length. Head width slightly over half its length. Snout width about $\frac{2}{3}$ to $\frac{3}{4}$ its length. Eye at first $\frac{2}{5}$ in head, high, adipose lid moderately broad. Mouth rather small, mandible well protruded, rami well elevated inside. Maxillary reaches little beyond front pupil edge or to first $\frac{2}{5}$ in eye, expansion $1 \frac{2}{3}$ to $1 \frac{3}{4}$ in eye. Teeth absent or minute. Nostrils adjoin, little before middle in snout. Interorbital slightly convex. Postorbital width $\frac{3}{5}$ to $\frac{2}{3}$ infraorbital, latter $1 \frac{1}{5}$ in eye. Infraorbital and preopercle with many arborescent external mucous tubes. Opercle with single anterior striation curving down behind toward pectoral base. Gill rakers 60 to $65 + 100$ to 120, slender, finely asperous, $\frac{4}{5}$ of eye, little longer than gill filaments. Shoulder girdle with deep notch. Scales caducous, narrowly imbricate, small and crowded along dorsal, anal, and caudal bases. Free ventral axillary flap $\frac{3}{4}$ of fin. Dorsal origin midway between mandible tip and last $\frac{2}{5}$ in anal length. Anal inserted well behind dorsal, about midway between ventral origin and caudal base. Caudal rather small, forked. Pectoral reaches about $\frac{2}{5}$ to ventral. Ventral inserted midway or at first $\frac{2}{5}$ in dorsal base, little nearer anal than pectoral origin, fin $2 \frac{1}{2}$ to $2 \frac{4}{5}$ to anal.

Silvery or golden, greenish to bluish on back. Length 267 mm.

Tropical Atlantic, Mediterranean and Black Seas, also the Indo-Australian Archipelago, China, and southern Japan. In the Indian Ocean it is represented by the allied *Sardinella longiceps* Valenciennes, which is distinguished by the greatly increased gill rakers (180 to 250 on the lower part of the first arch). The above description is based largely upon Brazilian, Adriatic, and Mediterranean examples.

The dark marginal opercular spot is not always present.

***Sardinella maderensis* Lowe**

Arenque (Madeira), Sadjí (Anno Bom), Sardina de ley (Spanish Sahara)

Clupea maderensis LOWE, 1836, Trans. Zool. Soc. London, II, part 3, p. 189. Madeira.—GÜNTHER, 1868, 'Cat. Fish. Brit. Mus.,' VII, p. 440 (Madeira, Cape Verde Islands).—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LXI (1), p. 568 (St. Louis).—BAADER, 1873-1874, Ber. Senckenberg. Naturf. Gesell., p. 182 (Mogador).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' p. 142 (part).—BÜTTIKOFER, 1890, 'Reis. Liberia,' II, p. 480.—STASSANO, 1890, Annali di Agricoltura, Roma, p. 32 (Spanish Sahara).—VINCIGUERRA, 1890, Lo Spallanzani, Roma, (2) XIX, p. 483 (Las Palmas, Grand Canary).—OSORIO, 1893 (August), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 132 (Benguella, Angola); 1895 (March), *op. cit.*, (2) III, p. 247 (Anno Bom Island); 1898, *op. cit.*, (2) V, p. 199 (St. Thomé, Anno Bom, Angola).

Clupea (Alausa) maderensis VON MARTENS, 1876, 'Preuss. Exped. Ost-Asien,' I, p. 404 (Madeira).

Clupanodon maderensis JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 340 (Canary Islands).

Sardinella maderensis REGAN, 1919, Ann. Mag. Nat. Hist., London, (8) XIX, p. 380 (Madeira, Cape Verde Islands, Mogadore).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 242 (Cape Blanco).

?*Harengula forsteri* VALENCIENNES, 1847, 'Hist. Nat. Poiss.,' XX, p. 217. St. Jago, Cape Verde Islands.

Head $3\frac{3}{4}$; depth $3\frac{2}{5}$; dorsal IV, 15, 1; anal III, 18, 1; scales 40 in median lateral series to caudal base and 4 more on latter; 11 scales transversely between dorsal origin and ventral base; 18 predorsal scales; head width $2\frac{2}{5}$ in its length; mandible $2\frac{1}{10}$; snout $3\frac{3}{5}$ in head measured from upper jaw tip; eye $3\frac{3}{5}$; maxillary $2\frac{1}{4}$; interorbital 4.

Body well compressed, thin, profiles nearly evenly convex to form fusiform contour, deepest at dorsal origin. Trenchant abdominal serrae 19+13. Caudal peduncle compressed, least depth equals its length or $2\frac{3}{4}$ in head.

Head compressed, flattened sides converge below. Snout width $\frac{3}{4}$ its length. Eye elevated, anterior, with well-developed adipose lid. Upper jaw front with slight median notch. Mouth rather small. Maxillary reaches first third in eye, expansion about half latter and lower edge behind with short series of minute teeth, no others present. Mandible deep, protrudes in front, rami well elevated inside mouth. Nostrils rather small, together, about midway in snout above. Interorbital flat. Opercle narrow, smooth. Gill opening forward about opposite front eye edge. Gill rakers 50+90, slender, thin, twice length of gill filaments, or $11\frac{1}{2}$ in eye. Pseudobranchiae one-half of eye. Scales in even longitudinal series, exposures narrowly imbricated; 4 or 5 vertical striae, most broken medianly; circuli appear as minute, fine, close-set, vertical crowded striae; apical portion nonstriate, with weak marginal crenulations. Several enlarged scales before pectoral base, depressed fin also fitting below scaly superior ridge. Ventral axillary scale $\frac{2}{3}$ of fin. Dorsal and anal depressible within scaly basal sheaths. Caudal base finely scaly. Dorsal origin much nearer snout tip than caudal base, first branched ray $1\frac{1}{2}$ in head. Anal inserted behind depressed dorsal, first branched ray $5\frac{1}{8}$ in head, little longer than last. Caudal forked; $1\frac{1}{4}$ in head. Pectoral pointed, reaches $1\frac{1}{4}$ to ventral, $1\frac{1}{3}$ in head. Ventral inserted a little behind dorsal origin or little nearer that of pectoral than anal, reaches $2\frac{1}{2}$ to anal, $2\frac{1}{4}$ in head. Back with purplish or greenish tints, sides and below silvery white. Fins all pale, dorsal with small dusky spot at bases of first 4 rays. Length 109 mm.

Eastern Atlantic and Mediterranean. Described above from the example from Beirut, Syria. I recorded it as *Sardinella granigera* Valenciennes.¹ There is little doubt that this nominal form is synonymous, as suggested by Regan.

***Sardinella eba* Valenciennes**

Machuelo, Téryit (Cape Blanco), Eba (Senegal), Awouath (Senegambia), Bampé (Konakry), Eoué (Grand Bassam), M'béré (Gaboon)

Alausa eba VALENCIENNES, 1847, 'Hist. Nat. Poiss.,' XX, p. 306. Gorée, Senegal.—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 264 (Gorée, Senegal).

¹ 1911, Proc. Acad. Nat. Sci. Philadelphia, p. 206.

Clupea eba PELLEGRIN, 1907, Act. Soc. Linn. Bordeaux, LXII, p. 81, Fig. 4 (Bel Air, Baie de Hann); 1913, Bull. Soc. Zool. France, XXXVIII, p. 116 (Mauritaine coast), p. 151 (Konakry, Guinea), p. 152 (Lagune de Grand-Bassam, Ivory Coast), p. 154 (Libreville, Gaboon); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 13 (Baie du Lévrier, Bel Air, Baie du Hann, Konakry, Grand-Bassam, Gaboon).

Sardinella eba REGAN, 1917, Ann. Mag. Nat. Hist., London, (8) XIX, p. 380 (Nigeria).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 242, Figs. 3, 10, 12 (Port Étienne).

Clupea maderensis (not Lowe) GÜNTHER, 1868, 'Cat. Fish. Brit. Mus.,' VII, p. 440 (Niger).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 142 (Gorée, Guet N'Dar, Cape Verde).

Head $3\frac{2}{3}$ to 4; depth $3\frac{1}{3}$ to $3\frac{2}{3}$; dorsal 18 to 20; anal 17 to 22; scales 44 to 46 in longitudinal row, 11 to 13 transversely; abdominal scutes 18 or 19+14. Snout as long as eye, which $3\frac{1}{3}$ to 4 in head. Maxillary to front third of eye, or a little beyond. Gill rakers 110 to 130 on lower part of first arch. Vertebrae 46. Ventral with 8 rays. Dark spot at base of front dorsal rays. Length 110 to 200 mm. (Regan.)

Eastern Atlantic and Mediterranean.

Sardinella cameronensis Regan

Figure 65

Sardinella cameronensis REGAN, 1917, Ann. Mag. Nat. Hist., London, (8) XIX, p. 380. CAMEROON.—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 204 (Rio de Oro).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 247 (remarks on Metzelaar).

Clupeonia cameronensis MONOD, 1927, 'Faune Colon. françaises,' p. 654, Figs. 2-3 (Souelaba, Cameroon).

Clupea senegalensis (not Bennett) GÜNTHER, 1868, 'Cat. Fish. Brit. Mus.,' VII, p. 441 (Cameroon).

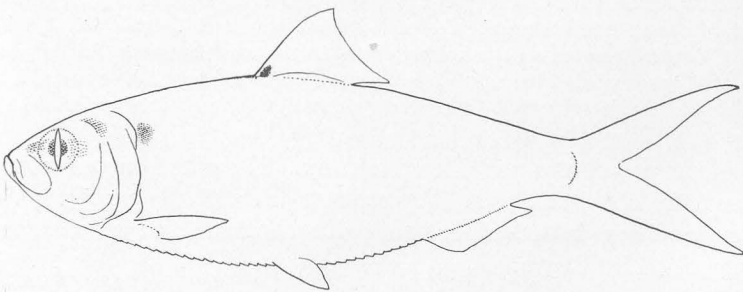


Fig. 65. *Sardinella cameronensis*.

Head 4; depth 3; dorsal 18 or 19; anal 20 or 21; scales 44 in longitudinal series, 13 transversely; abdominal scutes 18 or 19+14; eye $3\frac{2}{3}$ in head. Snout long as eye. Maxillary reaches below first third of eye. Gill rakers 90 to 100 on lower part

of first arch. Vertebrae 46. Caudal lobes long, third total length. Ventral with 8 rays, below middle of dorsal. Dark spot at base of front dorsal rays. Length 170 to 200 mm. (Regan.)

Cameroons.

SARDINA Antipa

Pilchards

Sardina ANTIPA, 1906, Denkschr. Akad. Wiss. Wien, LXXVIII, p. (39) 41 (54). Type: *Clupea pilchardus* Walbaum. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' part 4, p. 512.)

Body elongate, moderately compressed, abdomen sharp edged. Eye with well-developed adipose lids. Mouth moderate, upper jaw without or with slight median notch and lower jaw not prominent. Teeth minute or absent, none on vomer. Opercle with radiate striae. Vertebrae 50 to 53. Ventral scutes keeled, not projecting beyond edges of groove in which they lie. Dorsal and anal with scaly basal sheaths. Caudal with basal alar scales. Pectoral base scaly. Dorsal rays highest forward, advanced in total length. Anal rays low, last 2 enlarged. Caudal forked. Ventral rays 8, inserted below the middle of hind part of dorsal.

Three species.

Sardina pilchardus (Walbaum)

Sardinha (Madeira), *Sardina* (Canaries), *Sardina-lache* (Spanish Sahara)

Figure 66

Clupea pilchardus WALBAUM, 1792, 'Artedi Pisc.,' III, p. 38 (on Pennant, 1771, Brit. Zool., III, p. 353, Pl. LXVIII. Cornwall, England).—STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1), p. 738 (Teneriffe).—GÜNTHER, 1868, 'Cat. Fish. Brit. Mus.,' I, p. 439 (Madeira).—BAADER, 1873-1874, Ber. Senckenberg. Naturf. Gesell., p. 182 (Mogador).—STASSANO, 1890, Annali di Agricoltura, Roma, p. 32 (Spanish Sahara).—VINCIGUERRA, 1890, Lo Spallanzani, Roma, (2) XIX, p. 483 (Las Palmas, Grand Canary); 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 331 (Grand Canary).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 611 (off Cape Blanco, 10 m.).

Aloa pilchardus VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 129 (Povoação, São Miguel, Azores).

Sardinis pilchardus FOWLER, 1923, Proc. Acad. Nat. Sci. Philadelphia, p. 33 (Praia Formosa, west of Funchal). (Impr. err.)

Sardina pilchardus CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 247, Fig. 5 (Baie du Lévrier).

Aloa senegalensis BENNETT, 1831, Proc. Zool. Soc. London, p. 147. Atlantic coast of North Africa.

Clupea sardina VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II, part 2, p. 75 (Canaries).

Clupea sardinia LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 189 (Madeira).

Clupea pilchardus var. *sardinia* GÜNTHER, 1868, *op. cit.*, p. 440 (Madeira).—PIETSCHMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 101 (Atlantic coast of Morocco).

Sardina pilchardus sardinia REGAN, 1916, Ann. Mag. Nat. Hist., London, (8) XVIII, p. 13 (Madeira).

Clupea laticosta LOWE, 1843, Proc. Zool. Soc. London, p. 90. Madeira.

Clupea spratus POGGI, 1881, (article in 'Guidebook of Canary Isls.'). 'Guia de Santa Cruz de Teneriffe,' [p. d. 36].

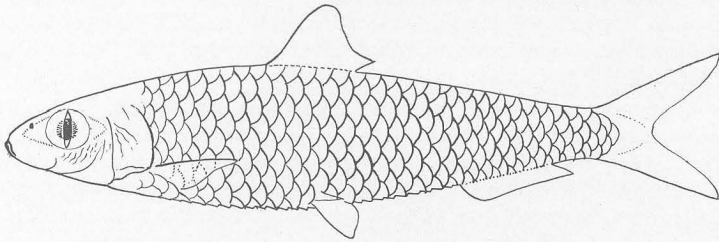


Fig. 66. *Sardina pilchardus*.

Head $3 \frac{1}{8}$ to 4; depth $4 \frac{1}{4}$ to $4 \frac{3}{4}$; dorsal III or IV, 13, 1; anal III, 15, 1 or III, 16, 1; scales 39 to 40 in median lateral series to caudal base; 8 scales transversely between dorsal and ventral origins; 14 or 15 predorsal scales; abdominal scutes 19 to 21 + 11 to 14; snout $3 \frac{1}{8}$ to $3 \frac{2}{5}$ in head measured from upper jaw tip; eye $3 \frac{1}{2}$ to 4; maxillary $2 \frac{1}{4}$ to $2 \frac{3}{5}$; interorbital $4 \frac{1}{5}$ to $5 \frac{1}{8}$.

Body elongately fusiform, deepest at dorsal origin, with slight median predorsal keel. Caudal peduncle strongly compressed, long as deep, least depth $3 \frac{1}{6}$ in total head length.

Head width $2 \frac{1}{5}$ to $2 \frac{2}{5}$ in its length. Snout conic, width $1 \frac{1}{2}$ in its length. Eye center slightly advanced from middle of head, diameter $1 \frac{1}{8}$ to $1 \frac{1}{4}$ in snout. Mandible slightly protruding. Maxillary reaches eye, not quite to pupil; expansion $1 \frac{7}{8}$ to 2 in eye. No teeth. Nostrils small, together, little nearer snout tip than eye. Interorbital with 4 or 5 radiating striae. Suborbital and humeral branches of venules well developed. Gill rakers 27 to 28 + 44 to 50, fine, slender, much longer than gill filaments or equal eye. Scales with 5 or 6 vertical striae, usually separated at median horizontal axis of scale. Dorsal origin nearer mandible tip by length of maxillary than caudal base; first branched ray $2 \frac{1}{8}$ to $2 \frac{2}{5}$ in head. Anal far behind dorsal, much nearer caudal base than dorsal origin. Caudal $1 \frac{1}{2}$ to $1 \frac{3}{5}$ in head. Pectoral low, reaches $1 \frac{3}{5}$ to $1 \frac{2}{3}$ to ventral, $1 \frac{2}{3}$ to $1 \frac{3}{4}$ in head. Ventral reaches $2 \frac{1}{8}$ to $2 \frac{2}{3}$ to anal, $2 \frac{1}{2}$ to $2 \frac{3}{4}$ in head.

Back deep blue-black, sides and below silvery white. Dorsal and caudal pale dusky, other fins pale. Length 128 to 132 mm.

Eastern Atlantic, from the Canaries and Madeira northward to the British Isles. As the scales of this fish are of unequal size, and the larger scales conceal the smaller, a small scale count or about 30 or less in a longitudinal series will be found. Preserved examples in which the scales have fallen will show a count of 50 or more pockets. Described

above from a series of Adriatic examples and 2 from Praia Formosa, Madeira.

One from Fayal, Azores, 138 mm. long, in the Museum of Comparative Zoölogy.

Clupea laticosta Lowe may be this species. It is described with: dorsal III, 15; anal II, 18; pectoral I, 15; ventral I, 7; elliptic, with broad level sides; profiles equally convex; no teeth; obsolete opercle and suborbital striae; scales lunate; lateral line obsolete or absent; dorsal central; anal partly elongate; caudal lobes gracefully pointed; pectorals low.

ALOSA Linck

Shad

Alosa LINCK, 1790, Mag. Neueste Phys. Naturges., Gotha, VI (3), p. 35. Type: *Clupea alosa* Linné. Tautotypic.

Alausa VALENCIENNES, 1847, 'Hist. Nat. Poiss.,' p. 286. Type: *Clupea alosa* Linné.

Trichis (Plumier) LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 448. Type: *Clupea alosa* Linné. Monotypic. (Inadmissible.)

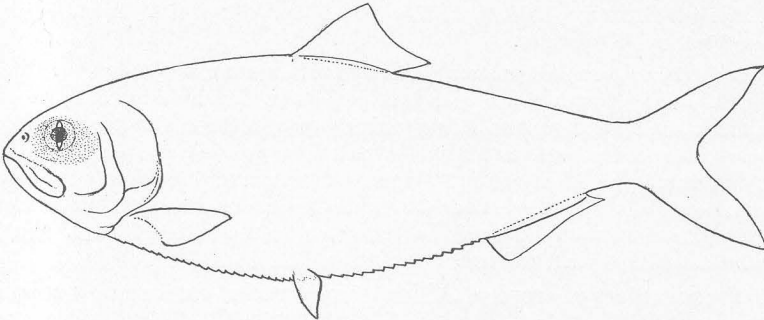


Fig. 67. *Alosa alosa*, modified from Day.

Body deep, compressed. Head deep. Upper jaw tip with a sharp deep notch as premaxillaries meet at a very acute angle. Jaws and vomer entirely toothless in adults. Free portion of cheeks deeper than long. Gill rakers long, fine. Vertebrae about 56. Fins low, last dorsal ray not produced in filament.

Among the most excellent of food fishes, with rich white flesh, a little oily, though small bones are numerous.

Alosa alosa (Linné)

Longarona (Spanish Sahara)

Figure 67

Clupea alosa LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 318. European Ocean.—BAADER, 1873-1874, Ber. Senckenberg. Naturf. Gesell., p. 182 (Mogador).—STASSANO, 1890, Annali di Agricoltura, Roma, p. 32 (Spanish Sahara).—MURRAY AND

HJORT, 1912, 'The Depths of the Ocean,' p. 611 (off Cape Blanco, N. lat. 26° 12', W. long. 14° 26', 10 m.).

Alosa alosa var. *alosa* PIETSCHMANN, 1906, Ann. k.k. Naturhist. Hofmuseums, Wien, XXI, p. 101 (Mogador, Agadir, and Azamor in Morocco.)

Head 4 to 4 1/4; depth little more than head; dorsal 19 to 21; anal 21 to 24; scales 70 in lateral series; 15 or 16 abdominal scutes behind ventral base. Maxillary nearly or quite reaches opposite hind orbit edge. No teeth on palate or tongue. Lower jaw but slightly prominent. Opercle with irregular radiating striae, descending toward subopercle. Gill rakers very fine, long, 60 to 80 on lower branch of first arch. Basal half of caudal finely scaly. Ventral inserted behind dorsal origin, which is nearer end of snout than caudal base. Large blackish blotch at scapular region, sometimes followed by a series of smaller ones. (Günther.)

Northern parts of eastern Atlantic. Reaches a length of 7 cm.

Baader also lists *Alosa finta* (Cuvier), *loc. cit.*, from Mogador, Morocco. This species does not seem to be otherwise recorded in our limits. It is known by its fewer, lower gill rakers, 20 to 23.

PELLONULA Günther

Pellonula GÜNTHER, 1868, 'Cat. Fish. Brit. Mus.,' VII, p. 452. Type: *Pellonula vorax* Günther. Monotypic.

Body oblong, compressed strongly, abdominal serrature of bony scutes. Mouth moderate or large, terminal, lower jaw little projecting. Teeth sharp, conic, uniserial, unequal in each jaw; on premaxillary rather strong, without well-marked canines; enlarged anterior teeth on mandible. Conic teeth on palatines and tongue. Minute teeth on maxillary. Maxillary in 2 pieces. Gill membranes separate, edges entire. Branchiostegals 6. Vertebrae 42 or 43. Scales moderate. No lateral line. Dorsal short, begins above ventrals. Anal moderately long, with less than 20 rays. Ventrals 8 or 9. Bluish silvery lateral band.

Fresh waters of tropical Africa, some species estuarian; according to Regan three are known.

Pellonula vorax Günther

Samba, Amoul, Karo (Senegambia), Elingène (Ivory Coast), Lolo (Gaboon), Mwanja a moto, Mulongo ma mbèdi, Samba, Hamba, Békoki, Nengélé (Cameroon)

Figure 68

Pellonula vorax GÜNTHER, 1868, 'Cat. Fish. Brit. Mus.,' VII, p. 452. River Niger, West Africa.—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LXI (9), p. 570, Pl. VII fig. 3 (Senegal, between Bakel and Podor, Dagana, St. Louis).—PETERS, 1876, Monatsb. Akad. Wiss. Berlin, p. 251 (Cameroon).—ROCHEBRUNE, 1883-1885, 'Faune Sénégal-gambie,' Poiss., p. 143 (Senegal, Sorres, Thionk, Leybar, Dakar, Bango).—PERUGIA, 1891, Ann. Mus. Civ. Storia Nat. Genova, (2) X, p. 977 (Congo).—STEINDACHNER, 1894, Notes Leyden Mus., XVI, p. 83 (Robertsport, Liberia).—BOULENGER, 1901, 'Poiss. Bass. Congo,' p. 125 (Banana, Congo); 1909, 'Cat. Fresh-water Fishes Africa,' I, p. 156, Fig. 124 (type); Niger River, Old Calabar, Cameroon, Benito River, Gaboon, Congo).—EHRENBAUM, 1913, Fischerbote, V, p. 404 (Cameroon).—PELLEGRIN, 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 13 (Lagune Ebrie, Ivory Coast);

Libreville Bay, Gaboon).—EHRENBAUM, 1915, 'Ueber Küstenfische von Westafrika,' p. 24, Fig.—REGAN, 1915, *Ann. Mag. Nat. Hist.*, London, (8) XV, p. 125 (Lagos); *idem*, (8) XIX, p. 200 (Senegal to Angola).—BOULENGER, 1916, *op. cit.*, IV, p. 171 (Angola, west of Lagos, Portuguese Guinea, Lagos, Mayili, N'Kutu, Lundo).—MONOD, 1927, 'Faune Colon. françaises,' p. 673 (Cameroon).

?*Pellonula modesta* J. G. FISCHER, 1885, *Jahrb. Hamburg. Wiss. Anst.*, II, p. 75. Eloby, West Africa.

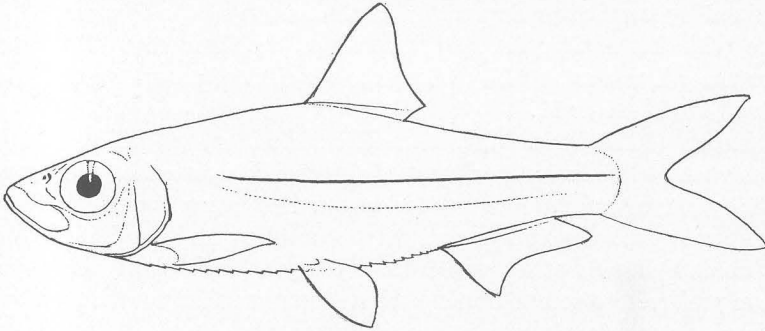


Fig. 68. *Pellonula vorax*.

Head $3 \frac{2}{5}$ to $3 \frac{3}{4}$; depth 4 to $4 \frac{4}{5}$; dorsal IV, 13; anal II, 15, or II, 16; scales 38 in median lateral series to caudal base and 3 more on latter; 13 scales transversely at dorsal origin; 16 to 20 predorsal scales; abdominal scutes 11 to 13+10 to 12; snout $3 \frac{1}{4}$ in head measured from upper jaw tip; eye 3 to $3 \frac{1}{6}$; maxillary $2 \frac{1}{10}$ to $2 \frac{1}{3}$; interorbital $4 \frac{1}{2}$ to $5 \frac{1}{2}$.

Body slender, compressed, deepest between pectoral and ventral origins, predorsal with slight median ridge. Caudal peduncle well compressed, least depth $1 \frac{1}{6}$ to $1 \frac{1}{5}$ in its length or 3 to $3 \frac{1}{2}$ in total head length.

Head well compressed, attenuated, width $2 \frac{2}{3}$ to $2 \frac{4}{5}$ in its length measured from upper jaw tip. Snout conic, width $1 \frac{1}{8}$ to $1 \frac{1}{5}$ its length. Eye large, midway in head length; adipose lid broad, covers front and hind third of eye, little developed in young. Mouth well included, mandible strongly protruding. Maxillary reaches first third in eye, expansion 2 in eye; edge finely toothed uniserially. A few strong, well-developed large teeth in front of mandible each side of symphysis; upper teeth larger, similar and larger patch each side of median line, also extending farther back within mouth. Tongue free in front, with narrow band or irregular biserial, uniformly low, close-set teeth longitudinally. Nostrils together, small, midway in snout. Interorbital narrow, slightly convex. Branch of striate venules from postocular over infraorbitals to preorbital, also humeral branch.

Gill rakers 10 or 11+21 or 22, lanceolate, slender, about half of gill filaments, which are $1 \frac{1}{2}$ in eye. Scales mostly fallen, thin, cycloid, little crowded on predorsal; circuli as all parallel vertically, close together, crowded, fine striae. Dorsal origin midway between mandible tip and caudal base, first branched ray $1 \frac{1}{2}$ to $1 \frac{2}{3}$

in total head length. Anal origin behind depressed dorsal tip, or midway between ventral origin and caudal base, much nearer ventral origin in young. Caudal well forked, lobes pointed, slender, $1 \frac{1}{5}$ to $1 \frac{1}{4}$ in head. Pectoral reaches $\frac{2}{3}$ to ventral or $1 \frac{1}{3}$ to $1 \frac{1}{2}$ in head. Ventral inserted little before dorsal origin, reaches $\frac{1}{2}$ to $\frac{3}{5}$ to anal or $1 \frac{3}{4}$ to $2 \frac{1}{6}$ in head.

Brown, with silvery lateral band, less than eye diameter in width. Fins all pale. Young dusted with dusky about end of muzzle. Length 49 to 96 mm.

Rivers of west Africa. The above description is from 5 examples obtained by the Congo Expedition at the mouth of the Congo. These agree with fresh-water Angola examples in the Academy. Boulenger gives the gill rakers as "27 to 30 on lower part of anterior arch" and scutes 13 to 15+9 or 10.

Regan (1917, Ann. Mag. Nat. Hist., London, (8) XIX, p. 200) states that *Pellonula modesta* by J. G. Fischer "is placed by Boulenger in the synonymy of *P. vorax*, but unless the description is quite incorrect [teeth in jaws minute, tongue and palate toothless, no lateral band, etc.] it is not a *Pellonula* at all, and is most likely a *Sardinella*." However, I have preferred to accept Boulenger's action until the types are studied. Fischer's description follows in modified form:

Head 5; depth 4; dorsal 17; anal 18; pectoral 15; ventral 7; 46 scales transversely; snout equals eye, $3 \frac{1}{2}$ in head. Belly strongly compressed and keeled, not serrate. Lower jaw slightly protruded. Maxillary nearly reaches opposite eye center. Teeth minute, uniserial in jaws. Vomer, palate, and tongue toothless. Gill rakers bristle-like, longer than eye. Dorsal origin before ventral origin, nearer snout tip than caudal base.

Pectorals nearly reach ventrals. Back blue-green, side and belly yellowish. No clear lateral band.

Three specimens.

CYNOTHRISSA Regan

Cynothrissa REGAN, 1917, Ann. Mag. Nat. Hist., London, (8) XIX, p. 203. Type: *Cynothrissa mento* Regan. Monotypic.

Differs from *Pellonula* in the protruding lower jaw and the premaxillaries with an inner series of 2 or 3 strong canine-like teeth on each side, also anterior lower teeth enlarged.

Cynothrissa mento Regan

Figure 69

Cynothrissa mento REGAN, 1917, Ann. Mag. Nat. Hist., London, (8) XIX, p. 204, Fig. 1 (head). Agberi, Southern Nigeria.—MONOD, 1927, 'Faune Colon. françaises,' p. 672 (Douala Bay, Cameroon).

Pellonula vorax (not Günther) BOULENGER, 1916, 'Cat. Fresh-water Fishes of Africa,' IV, p. 171 (Southern Nigeria).

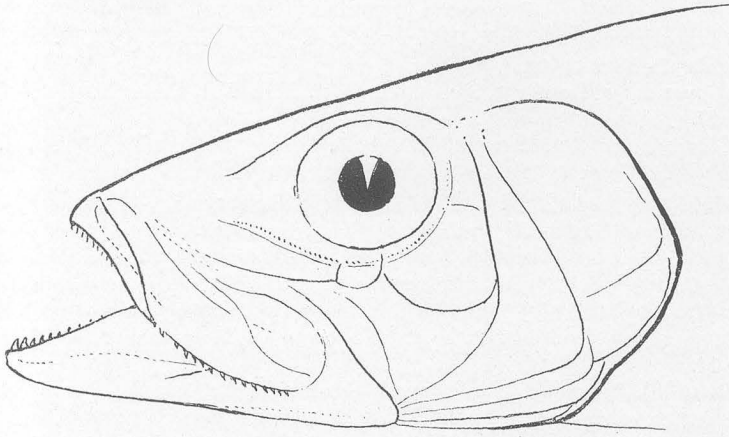


Fig. 69. *Cynothrissa mento*, from Regan.

Head $3\frac{2}{3}$ (without lower jaw); depth 4; dorsal 17; anal 21; scales about 45 in a longitudinal series; 14 scales in transverse series; snout $2\frac{3}{5}$ in head from snout tip; eye 4 according to figure (description gives $3\frac{3}{4}$), $1\frac{3}{5}$ in snout; maxillary reaches below first third of eye, expansion $1\frac{3}{4}$ in eye, length 2 in head from snout tip; 19 lower gill rakers. Abdominal scutes 15+9. Dorsal origin above bases of ventrals, equidistant between snout tip and caudal base. Caudal peduncle longer than deep. Length 130 mm. (Regan).

Southern Nigeria and Cameroon.

BREVOORTIA Gill

Menhaden

Brevoortia GILL, 1861, Proc. Acad. Nat. Sci. Philadelphia, p. 37. Type: *Clupea tyrannus* Latrobe. Monotypic.

Body elliptical, compressed, deepest in front, tapering behind. Head very large. Adipose eyelid well developed. Mouth large, notch in middle of upper jaw; lower jaw included. No teeth. Opercle striate to nearly smooth. Cheek deeper than long. Gill rakers of epibranchial of first arch fold downward, those near angle overlapping gill rakers of ceratobranchial. Intestinal canal elongate. Peritoneum silvery. Vertebrae 48. Scales deeper than long, closely imbricated, serrated in young, pectinated in adult; well-defined series of pectinated scales each side of median line from occiput to dorsal. Ventral with 7 rays.

Two species in the Atlantic. Coarse, oily, herbivorous fishes, valued chiefly for their oil and as fertilizers, the young forming the food of many other fishes. Spawn in brackish to partly fresh water in the spring.

Brevoortia tyrannus (Latrobe)

Clupea tyrannus LATROBE, 1802, Trans. Am. Philos. Soc., V, p. 77, Pl. I. Chesapeake Bay in York River, Virginia.

Alausa aurea DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 264 (West Africa?).

Clupea aurea ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 142 (Cape Verde, Gorée).

Head $2\frac{3}{4}$ to $3\frac{1}{5}$; depth $2\frac{2}{5}$ to $3\frac{1}{5}$; dorsal IV or V, 16, varies 15 to 18; anal III, 19, varies 16 to 21; scales about 50 in lateral series, vary 45 to 77 (fewer in young and often more in adult), counted to caudal base with 5 to 8 more on latter; 23 scales between dorsal and ventral origins, vary 21 to 28; 30 predorsal scales, vary 26 to 45; snout $3\frac{2}{5}$ to $4\frac{1}{4}$ in head, measured from upper jaw tip; eye $3\frac{1}{2}$ to $6\frac{1}{2}$; maxillary 2 to $2\frac{1}{4}$; interorbital $3\frac{4}{5}$ to $4\frac{1}{2}$; ventral scutes 17 to 22+11 to 14.

Body slightly ovoid, deep in front. Head width $2\frac{2}{5}$ to $2\frac{1}{2}$ in its length. Snout obtuse, convex, width $1\frac{1}{4}$ to $1\frac{1}{3}$ in its length. Eye rather small, high, near first third in head, larger in young; diameter $1\frac{1}{4}$ to $1\frac{1}{2}$ in snout; adipose lid greatly developed, scarcely evident in young. Mouth narrow, large, upper jaw deeply notched medianly; closed lower jaw entirely included, surface with longitudinal striae. Maxillary reaches little beyond eye, wide expansion $1\frac{1}{10}$ to $1\frac{1}{2}$ in eye, striate. Nostrils together, about last $\frac{2}{5}$ in snout. Interorbital slightly elevated, depressed convexly. Opercle with fine radiating striae, coarser obscure striae at angle of preopercle flange. Gill rakers 80 to 90+130 to 150, very fine, much shorter and fewer in young, slender, longer than eye. Scales with 2 or 3 transverse vertical complete striae; long apical points 30 to 36, much shorter and fewer in young; circuli as transverse close-set numerous striae, but not extending apically, enlarged gradually before dorsal fin. Fins mostly covered with minute scales; dorsal and anal depressed within basal scaly sheaths; pectoral axil scale $1\frac{1}{3}$ to $1\frac{2}{3}$ in fin; ventral axil scale $1\frac{2}{5}$ to $1\frac{2}{3}$ in fin. Dorsal inserted nearer caudal base than snout tip; first branched ray $2\frac{1}{4}$ in head. Anal inserted behind dorsal or about midway between ventral and caudal base; first branched ray 4 to $4\frac{1}{3}$ in head. Caudal well forked, 1 to $1\frac{1}{10}$ in head. Pectoral reaches $1\frac{2}{5}$ to $1\frac{3}{5}$ to ventral, $1\frac{2}{3}$ to $1\frac{9}{10}$ in head. Ventral inserted nearly opposite dorsal origin, reaches $1\frac{1}{5}$ to $2\frac{1}{3}$ to anal, $3\frac{2}{5}$ in head.

Bluish olive, otherwise entirely silvered, sides and below silvery white. Flanks sometimes brassy. A dusky scapular blotch and often a number of smaller or less distinct spots scattered behind on costal region. Fins pale. Reaches 457 mm.

Atlantic, along the western shores from Brazil to Nova Scotia, in Africa only from the Senegal region. The above description from American specimens.

ETHMALOSA Regan

Ethmalosa REGAN, 1917, Ann. Mag. Nat. Hist., London, (8) XIX, p. 302. Type: *Alausa dorsalis* Valenciennes. Monotypic.

Body deep, strongly compressed. Ventral scutes sharp keels. Adipose eyelid well developed. Upper jaw with median notch; lower included. Dentary edge not reflected outward in front of maxillary; teeth minute or absent. Opercle smooth, except groove parallel to its front edge. Cheek moderately deep, naked area below

suborbitals. Gill rakers of epibranchial of first arch not folding downward over those of ceratobranchials; on first and second arches and all following, bent or expanded, T-shaped or triangular in section. Branchiostegals 6. Scales 45 longitudinally, 16 to 19 transversely; edges crenulate in young, pectinated in adult; transverse grooves paired, not meeting in middle of scale, only most posterior groove extending right across; well-defined mid-dorsal double row of scales begins with large postoccipital pair, extends backward to dorsal fin. Dorsal rays 16 to 19, with very low basal sheath. Anal rays 20 to 23. Caudal with alar scales. Ventral rays 8, below front half of dorsal.

***Ethmalosa fimbriata* (Bowdich)**

Wouah, Hoboh (Senegambia), Yos (Mauritania), Bungu, Bongo, Élolo, Ndolo, Épa, Epara, Epaka, Paga, Bonga (Cameroon)

Figure 70

Clupea fimbriata BOWDICH, 1825, 'Excurs. Madeira,' p. 234, Fig. 44. Porto Praya, San Jago Island, Cape Verde Islands.

Harengula fimbriata VALENCIENNES, 1847, 'Hist. Nat. Poiss.,' XX, p. 217 (San Jago).

Meletta senegalensis (not Bennett) VALENCIENNES, 1847, *op. cit.*, p. 272 (Senegal).—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 264 (Senegal).

Clupea senegalensis GÜNTHER, 1868, 'Cat. Fish. Brit. Mus.,' VII, p. 441 (Cameroons).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 143 (Guet N'Dar, mouth of Senegal, Portendick, Banc d'Argain).—STEINDACHNER, 1895, Notes Leyden Mus., XVI, p. 81 (Grand Cape Mount, Liberia).—OSORIO, 1895, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) II, 133 (St. Thomé); 1898, *op. cit.*, (2) V, p. 199 (St. Thomé).—PELLEGRIN, 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanco, Cape Verde).—PELLEGRIN, 1905, Act. Soc. Linn. Bordeaux, LX, p. 29 (Cape Blanco, Dakar); 1907, *op. cit.*, LXII, p. 83, fig. 3 (Rufisque, Baie du Lévrier, Baie de Hann); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 13 (Baie de Hann, Mauritania, Dakar, Rufisque).

Alausa dorsalis VALENCIENNES, 1847, *op. cit.*, XX, p. 307. Coast of West Africa.—DUMÉRIL, 1858, *op. cit.*, p. 264.

Clupea dorsalis GÜNTHER, 1868, 'Cat. Fish. Brit. Mus.,' VII, p. 438 (Niger Expedition and West Africa).—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LXI, (1), p. 566 (St. Louis).—PETERS, 1876, 1877, Monatsb. Akad. Wiss. Berlin, p. 251 (Victoria, Cameroons).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 142 (Gorée, Dakar, Joalles, Portendick).—BOULENGER, 1903-1905, Mem. Soc. Españ. Hist. Nat. Madrid, I, p. 187 (Rio Benito, Spanish Guinea).—REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 125 (Lagos).—EHRENBAUM, 1913, Fischerbote, V, p. 400, Fig. (Cameroon); 1915, 'Ueber Küstenfische von Westafrika,' p. 20, Fig.

Brevoortia tyrannus dorsalis FOWLER, 1911, Proc. Acad. Nat. Sci. Philadelphia, p. 207 (Gaboon).

Ethmalosa dorsalis REGAN, 1917, Ann. Mag. Nat. Hist., London, (8) XIX, p. 303 (West Africa).—FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 228 (Freetown, Sierra Leone), p. 265 (Gaboon), p. 269 (Loando, Angola).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 238, Figs. 2, 7-9 (Baie du Lévrier).—MONOD, 1927, 'Faune Colon. françaises,' p. 658, Figs. 4-12 (Souelaba, Cameroon).

Alosa platycephalus BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, XVIII, No. 2, p. 123, Pl. xxvi, fig. A. Ashantee.

Clupea (Alosa) setosa STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLV (1), p. 14 (Liberia and Gaboon).

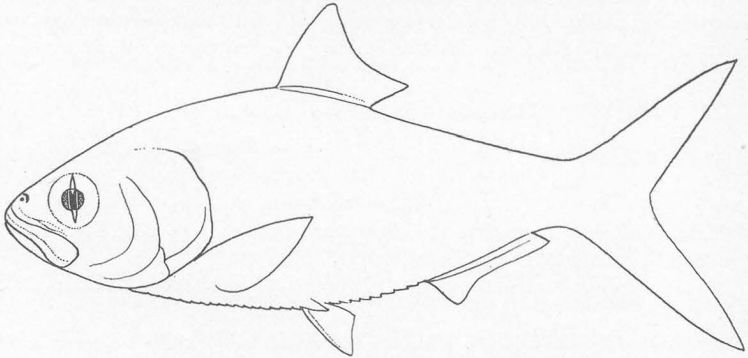


Fig. 70. *Ethmalosa fimbriata*.

Head $2\frac{3}{4}$ to $3\frac{1}{8}$; depth $2\frac{2}{5}$ to $3\frac{1}{8}$; dorsal III, 14, varies III or IV, 13 to 17; anal II, 19, I, varies II or III, 17 to 21; scales 37 to 45 in median lateral series to caudal base and 4 or 5 more on latter; 17 scales transversely, vary from 16 to 19; 20 to 22 predorsal scales; abdominal scutes 16 to 20+11 to 13; snout 4 to 5 in head; eye 3 to $5\frac{2}{5}$; maxillary $2\frac{1}{10}$ to $3\frac{1}{5}$; interorbital $3\frac{1}{5}$ to 5.

Body deeply ovoid, deepest at dorsal origin. Caudal peduncle strongly compressed, long as deep or least depth 3 to $3\frac{3}{4}$ in head.

Head deep, strongly compressed, width $2\frac{1}{5}$ to $2\frac{1}{2}$. Snout obtusely conic, length $\frac{3}{4}$ its width. Eye high, center near first third in head, about first $\frac{2}{5}$ in young. Adipose lid very broad, covers all but median third of eye; moderate in young, or extends only over about last third. Upper jaw with median notch. Mouth moderate, mandible included. Maxillary reaches opposite eye center, to first third in young, expansion 2 to $2\frac{1}{3}$ of eye. No teeth. Nostrils very small, together, slitlike; posterior twice as large, about midway in snout length. Interorbital broadly convex. Broad fringe of suborbital venules covering most of cheek, branches radiate less distinctly over broad preopercular flange; large branches over opercles above and on humeral region; lower part of opercle and subopercle very finely venulose; venules all less developed and coarser in young.

Gill rakers $64+125$, twice length of gill filaments or $1\frac{1}{8}$ in young; $35+90$ in young. Scales with 2 or 3 vertical transverse striae; apical fringe of 14 to 30 variably long points, some subdivided, others with one or more basal connections; circuli extremely fine, as vertical close-set numerous parallel striae. Narrow median naked strip from head to dorsal fin. Dorsal origin midway between snout tip and caudal base, much nearer snout tip in young; first branched ray $1\frac{4}{5}$ to $2\frac{1}{2}$ in head. Anal inserted well behind dorsal, much nearer caudal base than ventral origin; first

branched ray $3\frac{3}{4}$ to $4\frac{3}{4}$ in head. Caudal deeply forked, lower lobe little longer, as long as head. Pectoral low, reaches $1\frac{1}{6}$ to $1\frac{1}{5}$ to ventral, $1\frac{3}{5}$ in head. Ventral origin opposite dorsal origin, or opposite middle of dorsal in young, reaches $1\frac{7}{8}$ to $2\frac{1}{4}$ to anal or $2\frac{1}{4}$ to $2\frac{7}{8}$ in head.

Olive-brown above, sides pale below, with silvery white. Length 61 to 342 mm.

Coasts of West Africa. The Congo Expedition obtained 22 examples from the mouth of the Congo.

Two from Bathurst, Gambia, 285 and 390 mm., received from Government D'Arc, in Museum of Comparative Zoölogy.

Crude as the original figure and description of Bowdich may appear, I feel that they undoubtedly refer to the present species and therefore have the priority. He says: "I have given it this specific name, because every scale is fringed, which makes the fish have a very peculiar appearance. The dorsal fin has 16 rays, the ventral 19, and the pectoral 5; the back is of a brilliant azure, the sides are of a pale yellow, and the belly is silvery, the caudal and anal fins are of a deep yellow." By "ventral 19" he doubtless means the anal, and "pectoral 5" is erroneous for ventral 8. Bowdich shows the proportion of the maxillary, the anal fin entirely posterior to the depressed dorsal, and the long pectoral reaching the ventral, certainly features of *Ethmalosa* and not of *Brevoortia*. Jenyns compared his *Alosa pectinata* with *Clupea fimbriata* Bowdich, but the former is clearly a *Brevoortia*.

ILISHA Richardson

Ilisha (Gray) RICHARDSON, 1846, 'Ichth. China Japan,' Rept. British Assoc. Adv. Sci., p. 306. Type: *Ilisha abnormis* (Gray) Richardson. Monotypic.

Platygaster (not Latreille, 1809) SWAINSON, 1838, 'Nat. Hist. Animals,' I, p. 278. Type: *Clupea africana* Bloch. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 2, p. 203.)

Pellona VALENCIENNES, 1847, 'Hist. Nat. Poiss.,' XX, p. 218. Type: *Pellona orbignyana* Valenciennes. (Designated by Gill, 1861, Proc. Acad. Nat. Sci. Philadelphia, XVIII, p. 37.)

Zunasia JORDAN AND METZ, 1913, Mem. Carnegie Mus., VI, p. 7. Type: *Pristigaster chinensis* Basilewsky. Monotypic.

Body oblong, strongly compressed, with abdominal serratures of strong bony scutes. Mouth moderate, with minute teeth. Mandible prominent. Small teeth on palatines, pterygoids, and tongue, none on vomer. Maxillary in 2 or 3 pieces. Gill rakers stout, not numerous, spinulose all around. Branchiostegals 6. Vertebrae 46. Scales moderate or small, thin, deciduous. Dorsal fin short, behind ventral origin. Anal long, with more than 30 rays, $2\frac{1}{3}$ to 3 in combined head and trunk, begins below or just behind dorsal. Caudal strongly forked. Upper pectoral ray strong. Ventral very small, rays 6 to 8.

Tropical Atlantic and Indian Oceans, some species entering fresh water.

Ilisha africana (Bloch)

Machuelo (Senegal), Samba, Sambatta (Sénégal), Lati (Konakry), Osaka m'beré (Libreville), Moyo, Ño, Mweyo, Movo, (Cameroon)

Figure 71

Clupea africana BLOCH, 1795, 'Naturg. Ausl. Fische.,' IX, p. 45, Pl. ccccvii. Acara, Guinea.—SCHNEIDER, 1801, 'Syst. Ichth. Bloch,' p. 425 (Guinea).

Clupanodon africanus LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, pp. 469, 471. (Guinea).

Pellona africana BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, (2) XVIII, p. 122, Pl. xxvi, fig. 1 (Enkafran, Ashantee).—GÜNTHER, 1868, 'Cat. Fish. Brit. Mus.,' VII, p. 455 (West Africa).—GUIMARÃES, 1884, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, p. 28 (Bissau).—ROCHEBRUNE, 1883-1885, 'Faune Sénégal-gambie,' Poiss., p. 144 (Senegal, Sorres, Leybar, Casamence).—OSORIO, 1890 (September), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) II, p. 58 (Benguella, Angola); 1898, *op. cit.*, (2) V, p. 199 (Bissau, Angola).—EHRENBAUM, 1913, Fischerbote, V, p. 403 (Cameroon); 1915, 'Ueber Küstenfische von Westafrika,' p. 22, Fig.—PELLEGRIN, 1913, Bull. Soc. Zool. France, p. 152 (Konakry, Guinea), p. 154 (Libreville, Gaboon); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 14 (Konakry; Libreville).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 204 (Senegal coast).

Pelona africana OSORIO, 1894 (February), *op. cit.*, (2) III, p. 183 (Bissau).—MONOD, 1927, 'Faune Colon. françaises,' p. 670 (Cameroon).

Pellona iserti VALENCIENNES, 1847, 'Hist. Nat. Poiss.,' XX, p. 223. Coast of Guinea near Acara.

Pellona gabonica DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, pp. 264, 259, Pl. xxiii, fig. 3a. Gaboon.—ROCHEBRUNE, *loc. cit.* (Senegal, Falémé, Casamence, Gambia).

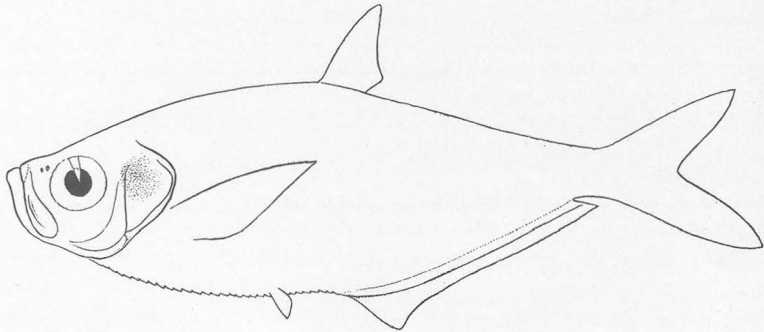


Fig. 71. *Ilisha africana*, modified from Bleeker.

Head $3\frac{1}{2}$ to $3\frac{2}{3}$; depth $2\frac{7}{8}$ to 3; dorsal III, 12, I or III, 13, I; anal II, 43, I; scales (pockets) 40 in median lateral series to caudal base, and 3 more on latter; 16 scales transversely; 23 predorsal scales; abdominal scutes 25 to 27+6 to

8; snout $3\frac{1}{2}$ to 4 in head measured from upper jaw tip; eye $2\frac{1}{2}$ to $2\frac{4}{5}$; maxillary $1\frac{3}{4}$ to $1\frac{4}{5}$.

Body thin, lower profile is more convex forward than is the upper, deepest above ventral origin, edges finely trenchant. Caudal peduncle strongly compressed, long as deep, least depth 3 to $3\frac{1}{8}$ in total head length.

Head strongly compressed, width $2\frac{7}{8}$ to 3 in its length. Snout obtuse, as long as wide, upper profile but little inclined, $\frac{2}{3}$ of eye. Eye with hind pupil edge midway in head length. Mouth superiorly terminal, upper jaw slightly notched, mandible well protruded, but little inclined from vertical. Maxillary largely ensheathed below narrow preorbital; expansion, $1\frac{4}{5}$ to 2 in eye, reaches opposite center of head. Teeth minute, uniserial in jaws and along lower maxillary edge; teeth minute or obsolete on palatines and tongue. Nostrils small, together, midway in snout. Interorbital convex, $2\frac{1}{3}$ to $2\frac{1}{2}$ in eye. Branch of venules around infraorbital from preorbital to postocular and branch on humeral region.

Gill rakers 12+28, lanceolate, twice gill filaments or $\frac{1}{2}$ of eye. Scales small, very caducous, most all fallen, narrowly imbricated; each with 3 vertical striae; circuli as very fine, numerous, close-set vertical parallel striae. Dorsal origin midway between mandible tip and caudal base, first branched ray $1\frac{1}{2}$ total head length. Anal begins about opposite first third of dorsal, fin $2\frac{2}{5}$ to $2\frac{1}{2}$ in combined head and trunk. Caudal well forked, slender lobes pointed, $1\frac{1}{8}$ to $1\frac{1}{5}$ in head. Pectoral origin but little below lower eye edge, $1\frac{1}{10}$ to $1\frac{1}{8}$ in head, not quite reaching opposite vent. Ventral inserted little nearer dorsal than pectoral origin, reaches halfway to vent, $1\frac{2}{3}$ in eye.

Brown, with obsolete silvery streak from shoulder to caudal base. Fins all pale. Length 56 to 121 mm.

West Africa. Described above from fourteen examples obtained at the mouth of the Congo by the Congo Expedition.

PRISTIGASTER Cuvier

Pristigaster CUVIER, 1829, 'Règne Animal,' II, 2d Ed., p. 321. Type: *Pristigaster cayanus* Cuvier. (Designated by Gill, 1861, Proc. Acad. Nat. Sci. Philadelphia, XIII, p. 38.)

Pristigaster CUVIER, 1817, 'Règne Animal,' II, 1st Ed., p. 176. Atypic. (Slip for *Pristigaster*.)

Abdomen greatly convex and prominent in profile, forms great depth to body. Maxillary short. Teeth all villiform, no canines. Dorsal fin inserted behind ventral, or before anal. Anal very long, rays 45 to 55. No ventrals.

Pristigaster martii Agassiz

Figure 72

Pristigaster martii AGASSIZ, 1829, 'Pisc. Brasil. Spix,' p. 55, Pl. xxiva. Mouth of the Amazon.

Pristigaster cayanus CUVIER, 1829, 'Règne Animal,' II, p. 321 (*nomen nudum*).—VALENCIENNES, 1847, 'Hist. Nat. Poiss.,' XX, p. 244, Pl. dxcvii. Cayenne, French Guiana.

Pristigaster dolloi BOULENGER, 1902, Proc. Zool. Soc. London, part 1, p. 271, Pl. xxx, fig. 3. Banana, Congo.

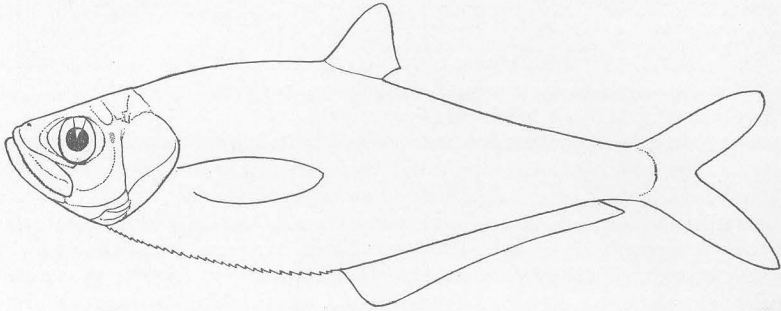


Fig. 72. *Pristigaster martii*, modified from Boulenger.

Head 4; depth 3; dorsal 16; anal 46; scales 40 in longitudinal series; abdominal scutes as 32 spinous scutes. Caudal peduncle as long as deep. Eye longer than snout, shorter than postocular part of head. Maxillary extends below center of eye. Gill rakers long, 25 on lower part of first arch. Dorsal equally distant from end of snout and caudal root. Anal begins below middle of dorsal. Caudal deeply forked. Pectoral nearly as long as head. Uniform silvery. Length 120 mm. (Boulenger.)

Tropical Atlantic, about mouths of large rivers.

Engraulididae

Anchovies

Body elongate, more or less compressed. Head compressed. Snout pointed, compressed, usually piglike and overlapping mouth. Eye large, well forward, without adipose eyelid. Preorbital narrow. Mouth extremely large, more or less oblique, gape very wide. Maxillary very long, slender, extending backward far behind eye, sometimes beyond head. Premaxillaries not protractile, very small, firmly joined to maxillaries. Teeth usually small, sometimes obsolete, usually fine and even, uniserial in jaws, canines sometimes present; small teeth on vomer, palatines, tongue, and pterygoids. Opercles thin, membranaceous. Gill membranes separate or joined, free from isthmus. Gill rakers long, slender. Pseudobranchiae present. Branchiostegals slender, 7 to 19. Body covered with thin, cycloid scales, moderate or large in size. No lateral line. Belly rounded or sharp, sometimes weakly serrate. Fins various. Dorsal usually short and median, above or before anal, which usually is long. No adipose fin. Caudal forked.

Small shore fishes, swimming in large schools on sandy shores, sometimes entering rivers. Carnivorous. About ten genera.

ENGRAULIS Cuvier

Anchovies

Engraulis CUVIER, 1817, 'Règne Animal,' II, p. 174. Type: *Clupea encrasicolus* Linné. (Designated by Jordan and Evermann, 1917, Stanford Publications, 'Genera of Fishes,' part 1, p. 98.)

Menidia BROWNE, 1789, 'Civil Nat. Hist. Jamaica,' 2d Ed., p. 441. Type: *Atherina brownii* Gmelin. Monotypic. (Inadmissible.)

Encrasicolus (Commerson) LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 458. Type: *Clupea vittargentia* Lacépède. Monotypic.

Trichosoma SWAINSON, 1839, 'Nat. Hist. Animals,' II, p. 65. Atypic; *op. cit.*, p. 292. Type: *Thrissa hamiltoni* Gray. Monotypic.

Anchovia JORDAN AND EVERMANN, 1896, Bull. U. S. Nat. Mus. No. 47, part 1, pp. 439, 449. Type: *Engraulis macrolepidotus* Kner and Steindachner. Monotypic.

Anchoviella FOWLER, 1911, Proc. Acad. Nat. Sci. Philadelphia, p. 211. Type: *Engraulis per fasciatus* Poey. Orthotypic.

Engraulites JORDAN AND GILBERT, 1925, Stanford Publications, IV, p. 12. Type: *Engraulites remifer* Jordan and Gilbert. Monotypic.

Amplova JORDAN AND SEALE, 1925, Copeia, No. 141, p. 31. Type: *Engraulis brevirostrum* Meek and Hildebrand. Monotypic.

Body oblong or elongate, compressed, belly rounded or weakly compressed. Abdominal scutes always between pectorals and anus, also mostly before pectorals. Snout conic, projects beyond large inferior mouth. Maxillary a little inclined or movable, long, slender, joined with cheek by a scarcely distensible membrane, extends back to mandible base or beyond, sometimes even reaches beyond ventrals. Teeth in jaws equally small, subequal, present at all ages; usually on vomer, palatines, pterygoids, and tongue, none as canines. Gill rakers long, slender, usually numerous. Pseudobranchiae present. Branchiostegals 9 to 14, short, membranes separate, free from and expose isthmus. Vertebrae about 40. Scales moderate or large, thin, deciduous. Pectorals and ventrals each with large axillary scale above. Dorsal inserted about midway in body, behind ventrals or before anal origin. Anal long, rays 27 to 50, and 2 2/3 to 4 in total length.

Small shore fishes, mostly silvery or marked by a very wide distinct silvery band. They are usually found swimming in large schools on the sandy shores of all warm seas, sometimes entering rivers.

KEY TO THE SPECIES

- a.—ENGRAULIS. Anal with 14 branched rays; no silvery lateral band. . . *encrasicolus*.
 aa.—ANCHOVIELLA. Anal with 15 to 22 branched rays; broad silvery-white lateral band, wide as eye. *hepsetus*.

Engraulis encrasicolus (Linné)

Lugorón (Canaries)

Figure 73

Clupea encrasicolus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 318. European Ocean.

Clupea encrasicolus VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II, part 2, p. 75 (Fortaventure).

Clupea encrasicolus POGGI, 1881, (article in 'Guidebook of Canary Isls.,' 'Guia de Santa Cruz de Tenerife,' [p. d. 35].

Engraulis encrasicolus BAADER, 1873-1874, Ber. Senckenberg. Naturf. Gesell., p. 182 (Mogador).—PELLEGRIN, 1907, Act. Soc. Linn. Bordeaux, LXII, p. 82 (Rufisque).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 611 (off Cape Blanco, 10 m.).—ROULE AND ANGEL, 1921 (August 1), Bull. Inst. Océanogr. Monaco, No. 397, p. 1 (west of Morocco).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 248, Figs. 13, 14 (Port Étienne).

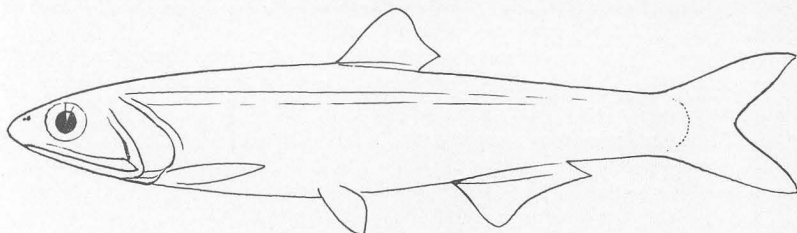


Fig. 73. *Engraulis encrasicolus*.

Head $3\frac{3}{4}$ to $4\frac{1}{8}$; depth 6 to $6\frac{2}{5}$; dorsal III, 12, 1; anal III, 14, 1; scales 42 in median lateral series to caudal base and 3 or 4 more on latter; usually 10 scales transversely; 20 predorsal scales; snout $4\frac{1}{8}$ to $4\frac{3}{4}$ in head; eye $3\frac{7}{8}$ to 4; maxillary $1\frac{1}{4}$ to $1\frac{2}{5}$; interorbital $4\frac{1}{2}$ to 5.

Body rather slender, well compressed, lower profile a little more convex, abdominal keel slight. Caudal peduncle well compressed, least depth $2\frac{1}{4}$ its length or $3\frac{1}{8}$ to $3\frac{1}{4}$ in head.

Head width $2\frac{2}{5}$ to 3 in its length. Snout as long as broad. Eye with center near first third in head; greater than snout. Mouth with mandible tip extended forward opposite nostrils. Maxillary slender, not quite reaching preopercle edge; expansion $\frac{1}{3}$ to $\frac{1}{4}$ of eye. Row of fine slender teeth in jaws, along maxillary its whole extent, and on palatines. Tongue finely granular or roughened medianly. Nostrils together, hind one larger, falls at last $\frac{2}{5}$ in snout. Interorbital broadly convex. Postocular, upper opercular, and humeral regions finely venulose.

Gill rakers $30+30$, finely lanceolate, equal to gill filaments, or slightly less than eye. Scales very thin, caducous, mostly fallen; with about 20 more or less radiating marginal striae, often only half as many present basally; other scales with only several more or less complete as transverse or vertical circuli, close-set, parallel, fine striae, often apical area with coarser striae and somewhat inclined or at angle.

Dorsal origin about midway between nostrils and caudal base, or midway between latter and eye center in half-grown examples; first branched ray $1\frac{3}{4}$ to $1\frac{4}{5}$ in head. Anal well behind dorsal origin, origin about midway between pectoral tip and caudal base; first branched ray $2\frac{5}{6}$ to 3 in head. Caudal $1\frac{3}{5}$ to $1\frac{4}{5}$ in head; pectoral $1\frac{2}{5}$ to 2 to ventral, length 2 to $3\frac{1}{2}$ in head; ventral 2 to $2\frac{4}{5}$ to anal, length $2\frac{7}{8}$ to $3\frac{1}{5}$ in head.

Back pale brown, sides and below silvery white. Iris and sides of head white. Fins all pale brown. Length 103 to 186 mm.

Eastern Atlantic and Mediterranean, south to Cape Blanco. Described above from Italian examples.

Engraulis hepsetus (Linné)

Esox hepsetus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 314. America.

Esox epsetus BONNATERRE, 1788, 'Tabl. Ichth.,' p. 175 (seas of America).

Atherina brownii GMELIN, 1789, 'Syst. Nat. Linné,' p. 1397 (on *Menidia* Browne, 1756, 'Civil Nat. Hist. Jamaica,' p. 441. Jamaica).

Engraulis brownii LAMPE, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 216 (São Vincente, Cape Verde).

Head 3 to 4; depth $4\frac{1}{4}$ to $5\frac{1}{4}$; dorsal III, 12, varies III, 11 to III, 14; anal III or IV, 20, varies III, 15, III, 22; scales 33 to 41 in median lateral series to caudal base and 3 to 5 more on latter; 8 to 10 scales transversely at dorsal; 17 to 22 predorsal scales; snout 4 to $4\frac{2}{3}$ in head; eye $3\frac{1}{5}$ to $3\frac{2}{3}$; maxillary 1 to $1\frac{1}{5}$; interorbital $3\frac{1}{5}$ to $4\frac{1}{4}$.

Body compressed, abdominal keel slight, lower profile little more convex. Head compressed, width $2\frac{2}{5}$ to $2\frac{4}{5}$ in its length. Snout moderate; length $\frac{7}{8}$ to 1 in its width or $\frac{4}{5}$ to $\frac{7}{8}$ of eye. Eye little elevated, near first third in head. Mouth narrow, mandible tip opposite nostrils. Maxillary slender, extends beyond articulation of lower jaw nearly or quite to gill opening. Small sharp teeth in maxillary and lower jaw, enlarged a little posteriorly in the maxillary. Minute teeth usually on vomer, palatines, and pterygoids. Nostrils small, together, at last $\frac{2}{5}$ in snout. Interorbital broadly convex. Gill rakers 20+22, slender, about $\frac{1}{3}$ of eye. Scales with 5 or 6 vertical striae apically; often 5 or 6 short basal marginal striae; circuli fine. Scales narrowly imbricated, edges rather even, loose. Scaly basal dorsal and anal sheaths well developed, also pectoral and ventral axillary flaps. Caudal base scaly. Dorsal inserted about midway between front eye edge and caudal base, little nearer the caudal base in young; first branched ray $1\frac{3}{5}$ to $1\frac{3}{4}$ in head. Anal inserted opposite last fifth in dorsal base; first branched ray 2 to $2\frac{1}{5}$ in head. Caudal forked, lobes sharp pointed, $1\frac{1}{5}$ to $1\frac{1}{4}$ in head. Pectoral reaches $1\frac{1}{8}$ to $1\frac{1}{4}$ to ventral, $1\frac{2}{3}$ to $1\frac{3}{4}$ in head. Ventral inserted a little nearer snout tip than caudal base, reaches $1\frac{1}{2}$ to $1\frac{3}{4}$ to anal, $2\frac{3}{5}$ to $2\frac{3}{4}$ in head.

Translucent sandy brown. Broad silvery white lateral band, expanded behind until as wide as eye. Iris silvery white. Fins translucent, caudal and anal base dusted pale dusky. Length to 154 mm.

Tropical Atlantic. Recorded from Cape Verde. Described above from American (New Jersey) examples.

Alepocephalidae

Body oblong, compressed. Head moderate. Mouth moderate or large. No barbels. Edge of upper jaw formed by premaxillaries and maxillaries, the former placed along upper front edge of latter. Teeth feeble on premaxillaries, sometimes on maxillaries, palatines, and mandible. No gular plate. Opercular apparatus complete, thin. Gill

openings very wide, membranes free from isthmus and overlapping. Gill rakers long, numerous. Pseudobranchiae present. No air vessel. Stomach curved, without blind sac. Pyloric caeca in moderate number. Photophores absent or rudimentary, placed in nodules of naked skin. Scales thin, cycloid or keeled, sometimes absent. Head naked. Lateral line present or absent. Dorsal fin long, low, posterior, inserted nearly opposite anal. No adipose fin. Pectorals short, rather high. Ventrals usually well back, sometimes absent. Vent behind middle in body.

Fishes of the deep seas.

KEY TO THE GENERA

- a.*—Scales well developed, cycloid; teeth small; lateral line present.
b.—Ventral fins well developed.
c.—Body rather deep; mouth small; maxillary with teeth.
d.—Opercle moderate; teeth in each jaw; gill membranes entirely separate. **ALEPOCEPHALUS.**
dd.—Opercle prolonged as membranous lobe overlapping pectoral base; no upper teeth; gill membranes largely united. **ASQUAMICEPS.**
cc.—Body more elongate; mouth rather large or moderate.
e.—Palatine teeth present; anal not longer than dorsal.
f.—No predorsal adipose ridge. **BATHYTROCTES.**
ff.—Adipose predorsal ridge, from dorsal fin forward to occiput. **ANOMALOPTERUS.**
ee.—No palatine teeth; anal twice as long as dorsal. **CONOCARA.**
bb.—Ventral fins absent; body short, compressed; maxillary toothed; scales keeled. **PLATYTROCTES.**
aa.—Scales absent, skin thick, rugose, with nodules; eyes large; teeth minute; no lateral line; ventrals present.
g.—Body moderately long; mouth moderate; dorsal and anal moderate. **XENODERMICHTHYS.**
gg.—Body greatly elongated, gradually becoming smaller behind until it is filiform; mouth small; dorsal and anal elongate, anal much larger. **LEPTODERMA.**

ALEPOCEPHALUS Risso

Alepocephalus Risso, 1820, Mem. Accad. Sci. Nat. Torino, XXV, p. 270. Type: *Alepocephalus rostratus* Risso. Monotypic.

Mitchillina JORDAN AND EVERMANN, 1896, Bull. U. S. Nat. Mus., No. 47, part 1, pp. 452, 453. Type: *Alepocephalus bairdii* Goode and Bean. Monotypic.

Body oblong, compressed. Snout somewhat long. Eyes large. Jaws nearly equal in front. Mouth rather small. Series of small teeth in each jaw, on vomer and palatines. Opercular flaps long or moderate. Gill membranes entirely separate. Branchiostegals 6. Scales rather large, thin, cycloid, deciduous. Bases of all fins with small scales. Scales of lateral line tubular. No photophores. Dorsal fin low

rays 15 to 25, subequal with anal and opposite. Caudal emarginate. Pectorals and ventrals moderate. Color violet-black.

Deep-sea fishes, in various seas.

***Alepocephalus rostratus* Risso**

Trista-linda (Madeira)

Figure 74

Alepocephalus rostratus Risso, 1826, 'Hist. Nat. Eur. Mérid.', III, p. 449, Pl. XI, fig. 28. Nice.—JOHNSON, 1862, Ann. Mag. Nat. Hist., London, (3) X, p. 285 (Madeira).—VAILLANT, 1888, 'Epéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 148, Pl. XI, fig. 1, *a-d*; Pl. XII, fig. 5 (off Morocco, Canaries, Soudan, Banc d'Arguin, Cape Verde, Azores, 830 to 3655 m.).

Bathytroctes attritus VAILLANT, 1888, *op. cit.*, p. 158, Pl. XII, fig. 2, *a-c* (structure). Banc d'Arguin, 1550 m., Cape Verde, 3655 m., Azores, 1442 m.; 1919, Rés. Camp. Sci. Monaco, LII, p. 129 (southeast of Azores N. lat. 37° 28' 30", W. long. 25° 31' 45", in 1732 m.).

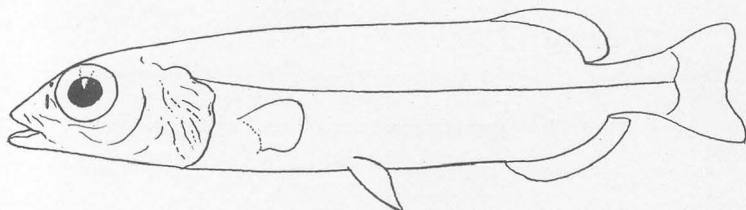


Fig. 74. *Alepocephalus rostratus*, from Valenciennes.

Head little over 3; depth about 4; dorsal 16 to 18; anal 19 to 22; scales 52 to 60 in lateral line; snout 5 in head; eye 5. Body compressed, profiles nearly parallel until they converge at hind dorsal and anal regions. Head compressed, flat above. Snout broad, rounded, projecting, with depression in profile between tip and eyes. Eyes large, nearly round, lateral, elevated, diameter apart. Mouth wide, cleft to eye. Jaws equal. Premaxillary with row of very small, conic, acute, slightly curved teeth; lower teeth similar, few forward rather larger; row of small teeth on palatine, none on vomer. A few radiating ridges below eye. Two oblique ridges on opercle project at edge as flexible spines. Scales loosely adherent. Lateral line decurved gently from vertical of pectoral, then straight to caudal base. Dorsal placed far back, base scaly, longest rays equal eye. Anal base longer than dorsal. Caudal scaly basally, lobes equal in length. Pectoral bases scaly, twice as long as eye, inserted about half an eye diameter behind opercle edge. Ventral shorter than pectoral, median in trunk without caudal. Brown, skin upon scales purplish blue or violet. Fins bluish black. Head dark indigo. Length 675 mm. (Johnson.)

Eastern Atlantic and Mediterranean. *Bathytroctes attritus* Vaillant, based on four mutilated specimens, is very likely the present species. Its scales are given as 40 to 50 rows and the dorsal 9, anal 11.

ASQUAMICEPS Zugmayer

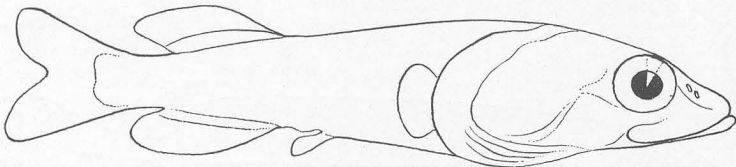
Asquamiceps ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 2. Type: *Asquamiceps velaris* Zugmayer. Monotypic.

Opercle large, prolonged as membranous lobe, overlapping pectoral base. No teeth above and mandible with microscopic teeth. Gill membranes largely connected. Branchiostegals 5. Scales small, crowded, irregular, cycloid. Head naked. Pectoral rather long, longer than ventral. Color black.

Asquamiceps velaris Zugmayer

Figure 75

Asquamiceps velaris ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 2. N. lat. 36° 6', W. long. 0°, 3660 m., off Portugal; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 10, Pl. I, fig. 4 (type).

Fig. 75. *Asquamiceps velaris*, from Zugmayer.

Head (without opercular flap) 2 1/2 to caudal base; depth 4 1/2; dorsal 15; anal 17; pectoral 14; ventral 15; scales 75 in lateral series. Body moderately long. Head very large, with opercular flap but slightly less than halfway to caudal base. Eye large, equals snout, 4 in head without opercular flap. Maxillary reaches middle of eye. Mandible projects slightly. Gill opening very large. Gills 4. Lateral line not distinct. Dorsal and anal opposite, begin about last 2/5 in total length. Least depth of caudal peduncle little less than eye. Caudal emarginate. Pectoral large, rounded. Ventral small, inserted little behind middle in total length, passes vent. Violet-black, fins brown. Length 175 mm. (Zugmayer.)

Eastern Atlantic.

BATHYTROCTES Günther

Bathytroctes GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 249. Type: *Bathytroctes microlepis* Günther. (Designated by Goode and Bean, 1895, 'Ocean. Ichth.,' p. 40.)

Talismania GOODE AND BEAN, 1895, 'Ocean. Ichth.,' p. 43. Type: *Bathytroctes homopterus* Vaillant. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' part 4, p. 467.)

Body rather elongate, compressed. Eye very large. Mouth cleft rather wide. Maxillary reaches opposite middle of eye. Premaxillary and maxillary armed with series of minute teeth, also mandible and palatines, those on latter often weak and deciduous. Vomerine teeth present or absent. No teeth on tongue. Gill rakers long, lanceolate. Gills very narrow. Pseudobranchiae present. Branchiostegals 7.

Pyloric appendages in moderate number. Ova rather small. Scales moderate, cycloid, deciduous. Dorsal and anal moderate or short, former behind ventrals. No adipose fin. Caudal forked.

KEY TO THE SPECIES

- a.*—Body shorter, depth about 5.
b.—Dorsal rays 20, scales 100..... *rostratus*.
bb.—Dorsal rays 13 or 14.
c.—Scales 105..... *melanocephalus*.
cc.—Scales 75..... *grimaldii*.
aa.—Body longer, depth $9 \frac{3}{5}$ *mollis*.

***Bathytroctes rostratus* Günther**

Figure 76

Bathytroctes rostratus GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 250. Off Pernambuco, Brazil, 675 fathoms.—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 5 (between Portugal and Azores, N. lat. $43^{\circ} 4'$, W. long. $19^{\circ} 42'$, in 1500 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 394 (off Morocco; Azores, 3239 m.).

Bathytroctes homopterus VAILLANT, 1888, 'Expéd. Sci. "Travailleur," et du "Talisman,"' Poiss., p. 153, Pl. XII, figs. 1, *a-b*. Banc d'Arguin, 1113 m.

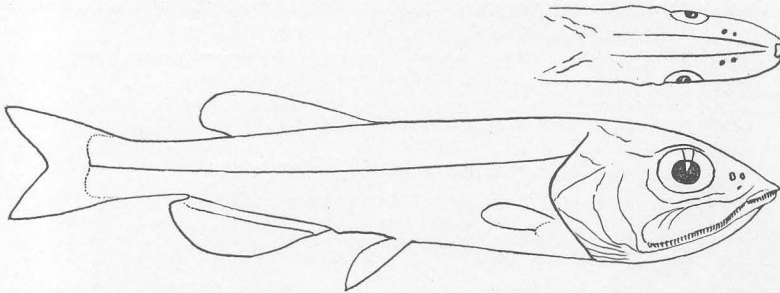


Fig. 76. *Bathytroctes rostratus*, from Günther.

Head 3; depth nearly 5; dorsal 20; anal 17; pectoral 9; ventral 16; lateral line about 100; 12 scales above lateral line, 12 below; eye $3 \frac{2}{3}$ in head. Head compressed, moderately deep. Snout wedge-shaped, with pair of short, flat projections in front, each formed by premaxillary and toothed at its end. Eye large, little longer than deep, equals snout. Mouth cleft wide. Maxillary reaches hind edge of eye. Dentition feeble, teeth minute and uniserial. Premaxillary and maxillary toothed throughout. Mandibular teeth especially minute, series interrupted close to symphysis, symphyseal portion external to lateral portion, which is implanted on upper edge of bone. Vomerine teeth reduced, small pair median on bone. Palatine teeth none, or single toothlike projection. Crown longitudinally concave, interorbital 2 in eye. Suborbitals narrow. Gill rakers $20+7$, long, lanceolate, and closely

set. Scales simple, cycloid. Lateral line simple, from upper end of gill opening along middle of side, tubes rather small. Dorsal origin somewhat before vent, fin longer than high. Anal origin below front half of dorsal, fin similar in shape. Caudal deeply emarginate. Pectoral low, rather short and broad, as long as eye. Ventral broad, reaches vent, origin nearer caudal base than snout tip. Uniform black. Length 165 mm. (Günther.)

Deep water of the Atlantic and Indian Oceans. Reported by Barnard (1925, Ann. South African Mus., XXI, p. 122) off Cape Point in 700 fathoms.

Bathytroctes melanocephalus Vaillant

Bathytroctes melanocephalus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 155, Pl. XI, figs. 2-*b*, 3. Middle eastern Atlantic, off Morocco, Soudan, Banc d'Arguin, 1435 to 2500 m.

Head 2 5/6; depth 5; dorsal 14; anal 11; scales 105 in lateral line, 13 above to dorsal origin; snout 3 in head; eye 5 1/2; maxillary 1 4/5. Front profile somewhat oblique. Eye very large. Maxillary reaches slightly beyond eye. Premaxillary teeth elongate, fine, conic, uniserial, each one separated by spaces scarcely equal to their own thickness. Opercle with many radiating ridges downward and backward. Scales with fine circuli. Lateral line nearly median along side, only decurved little from shoulder anteriorly, scales nearly twice as large as others or about 64 in course. Dorsal above interspace between ventrals and anal, latter shorter, both low. Caudal slightly emarginate. Pectoral and ventral short, the former with 13 rays. Grayish green. Head deep blackish blue. Fins bister. Eye with blue-gray iris and black pupil. Length 108 mm. (Vaillant.)

Deep waters of the eastern Atlantic.

Bathytroctes grimaldii Zugmayer

Bathytroctes grimaldii ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 1. N. lat. 37° 38', W. long. 10° 53', in 4900 m., off Portugal; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 6, Pl. I, fig. 2 (type).

Head 3 1/4; depth 5; dorsal 13; anal 11; pectoral 11; ventral 7; scales 75 in lateral series, 8 above and 8 below. Body moderately long. Snout 3/4 of eye. Eye 2 2/3 in head. Mouth large. Maxillary large, reaches 2/3 in eye. Dentition feeble, teeth extremely small, uniserial, present on premaxillaries, maxillaries, and dentary. Small group of minute teeth anteriorly on palatines. Dorsal begins behind middle in body length. Anal 2/3 size of dorsal, begins opposite first third in dorsal length. Least depth of caudal peduncle slightly greater than eye. Caudal forked. Pectoral well developed, reaches ventral. Black, head violet-black. Length 165 mm. (Zugmayer.)

Eastern Atlantic.

Bathytroctes mollis Koehler

Figure 77

Bathytroctes mollis KOEHLER, 1896, Ann. Univ. Lyon, p. 517, Pl. XXVI, fig. 2. Gulf of Gascony, 1700 m.

Talismania mollis ROULE, 1916 (May 20), Bull. Inst. Océanogr. Monaco, No. 320, p. 11 (Terceira de Azores in 1805 m.); 1919, Rés. Camp. Sci. Monaco, LII, p. 6 (30 miles east of Terceira, Azores, in 1805 m.).

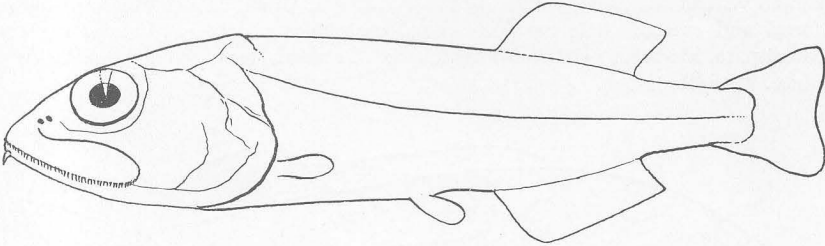


Fig. 77. *Bathytroctes mollis*, from Koehler.

Head 3; depth $9 \frac{3}{5}$; dorsal 18; anal 19; pectoral 7; scales 50 in lateral line; vertebrae 48. Body massive forward, tapering backward. Head large, with distinct ridges on jaws, nape, and opercles. Snout $3 \frac{1}{4}$ in head. Eye 5. Jaws about even. Mouth cleft reaches opposite hind edge of orbit. Maxillary extends slightly beyond eye, expansion about equals eye. Nostrils together, midway in snout. Opercle with broad membranous edge. Scales fallen. Lateral line begins high, above gill opening, slopes to caudal base medianly. Dorsal and anal opposite, alike. Least depth of caudal peduncle equals orbit. Caudal emarginate. Pectoral very small, low, reaches about halfway to ventral. Ventral inserted slightly before middle in body, about as long as pectoral or halfway to anal. Violet-black, with coppery reflections. Length 370 mm. (Roule.)

Eastern Atlantic.

ANOMALOPTERUS Vaillant

Anomalopterus VAILLANT, 1886, Compt. Rend. Acad. Sci. Paris, CIII, p. 1239.

Type: *Anomalopterus pinguis* Vaillant. Monotypic.

Body oblong, short. Head very large. Premaxillaries, mandible, and palatines with teeth. Gill opening broad, large. No scales. Soft dorsal and anal posterior, alike or subequal, former preceded by median predorsal adipose fold or ridge to occiput.

Small fishes, characterized by the median adipose predorsal fold or ridge.

Anomalopterus pinguis Vaillant

Figure 78

Anomalopterus pinguis VAILLANT, 1886, Compt. Rend. Acad. Sci., Paris, CIII, p. 1239. "Talisman" dredgings; 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 160, Pl. XI, fig. 4-a (off Morocco, 1400 m.).

Head nearly 2; depth $3 \frac{3}{5}$; dorsal 17; anal 14; pectoral 9; ventral 9; snout 3 in head; eye 20. Eye surrounded by cutaneous fold. Maxillary extends beyond

hind eye edge. Mouth very wide, jaws about even. Upper jaw and mandible with small teeth. Stronger teeth on palatines. Vomerine teeth? Opercle covered by membranous tegument. Gill opening wide. Skin naked. Lateral line begins at upper angle of gill opening, then median to caudal base. Rayed dorsal begins little behind ventral base, though little before anal origin. Anal little shorter than rayed dorsal and extends little more backward on caudal peduncle. Caudal slightly emarginate, about one-sixth of total length. Pectorals very short. Bluish. Iris white. Length 60 mm. (Vaillant.)

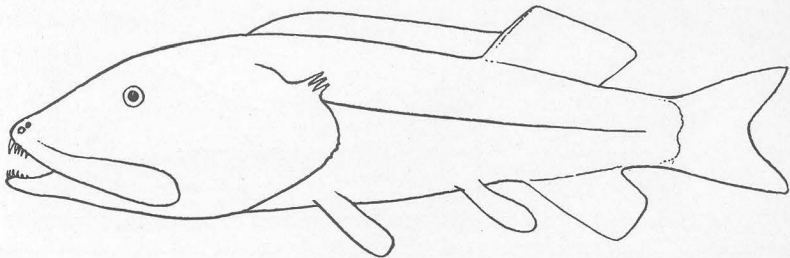


Fig. 78. *Anomalopterus pinguis*, from Vaillant.

Deep water of the eastern Atlantic.

CONOCARA Goode and Bean

Conocara GOODE AND BEAN, 1895, 'Ocean. Ichth.,' p. 39. Type: *Conocara macdonaldi* Goode and Bean. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' part 4, p. 467.)

Benthosphyraena COCKERELL, 1918 (1919), Bull. U. S. Geol. Survey, p. 172. Type: *Alepocephalus macropterus* Vaillant. Monotypic.

Body elongate, compressed. Snout long. Eye large. Mouth moderate, jaws strong, powerful, lower slightly included. Teeth in jaws acicular, rather numerous, very small on vomer, and absent from palatines. Opercular bones thin. Gill rakers rather short, stout, about 15 below angle. Branchiostegals 6, left membrane folded conspicuously over origin of right. Scales minute, deciduous. Dorsal moderate in length. Anal very long, nearly twice dorsal. Pectoral and ventral small. Caudal strongly forked.

Conocara macroptera (Vaillant)

Figure 79

Alepocephalus macropterus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 150, Pl. XI, figs. 2, a-c. Off Morocco, Soudan, Canaries, Banc d'Arguin, 863 to 2115 m.

Conocara macroptera MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 394 (off Morocco, 2300 m.).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 5 (south of Pico, 1550 m.).

Head $3 \frac{1}{3}$; depth $6 \frac{1}{4}$; dorsal 21; anal 40; scales 225 in lateral series, 20

above lateral line and 36 below; snout 3 in head; eye $5 \frac{1}{3}$; maxillary $3 \frac{1}{10}$; interorbital $5 \frac{1}{2}$. Body long. Head elongate, attenuated in profile. Snout compressed, tip obtuse. Eye large, anterior. Mouth moderate, upper jaw slightly longer. Maxillary scarcely reaches opposite eye. Premaxillaries, maxillaries, vomer, and palatines with conic, elongate, rather small teeth, uniserial in each jaw. Nostrils wide, together, front 1 behind middle in snout length. Opercle mostly membranous. Gill openings wide. Scales very small, simple. Lateral line from gill opening midway along side. Dorsal inserted little nearer ventral origin than caudal base, highest at last $\frac{2}{3}$. Anal inserted little nearer gill opening than caudal base, more than twice length of dorsal, gradually higher posteriorly. Caudal slightly emarginate, length slightly less than half of head. Pectoral low, small. Ventral very short, inserted little nearer caudal base than snout tip. Reddish brown, head azure blue. Fins sepia. Iris black, pupil azure blue. Length 310 mm. (Vaillant.)

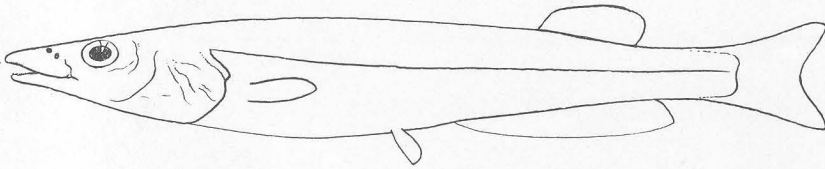


Fig. 79. *Conocara macroptera*, from Vaillant.

Deep waters of the warmer Atlantic.

PLATYTROCTES Günther

Platytrectes GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 249.
Type: *Platytrectes apus* Günther. Monotypic.

Body rather abbreviated, much compressed. Eye rather large. Mouth moderately wide. Maxillary, premaxillary, and mandible armed with uniserial teeth. Palate nearly smooth. Gill opening wide. Gill rakers long, lanceolate. Gills very narrow. Pseudobranchiae present. Branchiostegals 6. Pyloric appendages rudimentary. Each clavicle ends below in long, projecting, acute spine, 2 spines coalescent. Body covered with small, keeled scales. Dorsal and anal opposite, on tail, moderately long. Adipose fin absent. Caudal forked. Pectoral small. Ventrals none.

Platytrectes apus Günther

Figure 80

Platytrectes apus GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 249. Mid-Atlantic, 1500 fathoms.—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 8 (N. lat. $37^{\circ} 38'$, W. long. $10^{\circ} 53'$, in 4900 m.).—ROULE, 1916, (May 20), Bull. Inst. Océanogr. Monaco, No. 320, p. 12 (Canaries, in 1786 m.); 1919, Rés. Camp. Sci. Monaco, LII, p. 14, Pl. I, figs. 4, a-c (1 $\frac{1}{2}$ miles off Hierro, Canaries, 1786 m.).

Platytrectes procerus BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 23, Fig. 3. Cape Verde Islands, N. lat. $14^{\circ} 39' 5''$, W. long. $51^{\circ} 8'$, 2500 m.

Head 3; depth 4 to 4 $\frac{2}{3}$; dorsal 17 or 18; anal 17 or 18; scales 110 to 120 in lateral line; 25 to 28 scales above lateral line, 25 to 28 below; snout 3 $\frac{1}{3}$ in head; eye 2 $\frac{3}{4}$ to 3; maxillary 2 $\frac{1}{10}$; interorbital 2; vertebrae 43. Snout conic. Eye large, a little longer than snout. Mouth with gape reaching a point opposite the eye center. Lower jaw slightly protruding. Maxillary reaches opposite center of eye, expansion slightly less than half of eye. Row of small teeth in each jaw. Nostril near end of snout. Scales fallen. Caudal peduncle with 4 pigmented plates above, 3 below. Lateral line distinct. Soft, pointed papilla at shoulder above pectoral. Dorsal and anal alike and opposite. Caudal emarginate, rudimentary rays numerous. Pectoral very small, short, about $\frac{2}{3}$ of eye. Body translucent, with clear gray-violet tints. Head reddish gray or brownish. Fins grayish blue. Length 33 to 108 mm. (Brauer.)

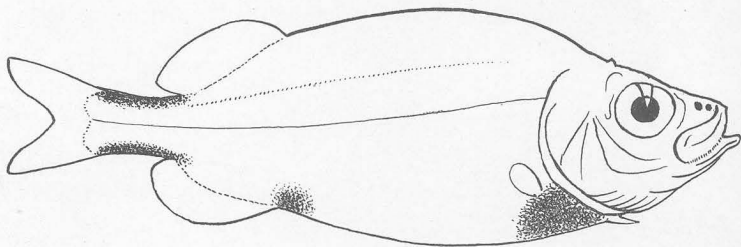


Fig. 80. *Platytroctes apus*, from Günther.

Deep water of Atlantic near Cape Verde Islands.

XENODERMICHTHYS Günther

Xenodermichthys GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 250.

Type: *Xenodermichthys nodulosus* Günther. Monotypic.

Aleposomus GILL, 1884, Amer. Nat., XVIII, p. 433. Type: *Aleposomus copei* Gill. Monotypic.

Body elongate, rather slender. Mouth moderate or small. Jaws feeble. Teeth minute or small in mandible and on premaxillaries, palatines, tongue, and pharyngeals probably toothless. Gill openings wide. Branchiostegals 6 or 7. Body scaleless. No lateral line. Skin thick, finely rugose, with small irregular papillae upon belly, sometimes also on sides and lower part of head. Dorsal and anal fins opposite, alike in form and equal in length. Caudal probably forked. Ventrals about midway in body. Vent behind middle of body.

Xenodermichthys socialis Vaillant

Figure 81

Xenodermichthys socialis VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 162, Pl. XIII, figs. 1 *a-b*. Coasts of Morocco, Soudan, Banc d'Arguin, 717 to 1350 m.—MONACO, 1905 (June), Bull. Inst. Océanogr. Monaco, No. 45, p. 105, Fig. 93 (off Azores, in 700 m.).—RICHARD, 1910 (February), Bull. Inst. Océanogr. Monaco, No. 162, p. 151, Fig. 108 (upper) (Azores in 696 m.).

Head $3\frac{3}{4}$ to 4; depth $4\frac{1}{4}$ to 6; dorsal 27 to 29; anal 27. Snout 4 to 5 in head; eye $2\frac{1}{2}$ to $2\frac{3}{4}$; interorbital 6; vertebrae 52. Body strongly compressed, upper and lower profiles parallel their greater length. Head short, obtuse. Eye well



Fig. 81. *Xenodermichthys socialis*, from Vaillant.

protruded in upper profile. Mandible well protruded, nearly half length of head. Maxillary nearly reaches opposite eye center. Gill opening large, low. Skin slimy. Dorsal slightly elevated posteriorly. Anal like dorsal, opposite. Caudal deeply forked, with well-developed rudimentary rays. Pectoral short, rays 16. Ventral small. Deep violet-black, fins translucent and lighter. Traces of black spots upon anal membrane, under eye upon cheek, opercular flap and on belly. Fins gray-blue or gray-purple. Iris violet, pupil opaline. Length 141 to 147 mm. (Vaillant, Roule.)

Deep waters of the eastern Atlantic. Noticed by Barnard (1925, *Ann. South African Mus.*, XXI, p. 123) off East London in depths to 400 fathoms.

LEPTODERMA VAILLANT

Leptoderma VAILLANT, 1886, *Compt. Rend. Acad. Sci. Paris*, CIII, p. 1239. Type: *Leptoderma macrops* Vaillant. Monotypic.

Body elongate, gradually becoming smaller behind until filiform. Head moderate. Eyes very large. Mouth small. Teeth upon premaxillaries and dentaries. Supplemental maxillary distinct. Gill opening wide, not very high. No scales. Dorsal and anal elongate, extended upon caudal peduncle and ending slightly before its end. Anal much longer than dorsal.

Leptoderma macrops Vaillant

Figure 82

Leptoderma macrops VAILLANT, 1886, *Compt. Rend. Acad. Sci. Paris*, CIII, p. 1239. Talisman dredgings; 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' *Poiss.*, p. 166, Pl. XIII, figs. 2, a-g (coasts of Morocco, Soudan, Banc d'Arguin, 1139 to 2330 m.).



Fig. 82. *Leptoderma macrops*, from Vaillant.

Head $5\frac{1}{2}$; depth $10\frac{3}{4}$; dorsal 48; anal 71; pectoral 15; ventral 5; snout $3\frac{4}{5}$ in head; eye 2; maxillary $3\frac{3}{4}$. Body slightly thinner medianly, compression greater posteriorly. Snout obtuse, short. Iris greatly developed, protruding. Maxil-

lary not quite reaching eye, toothless. Each premaxillary with row of 14 conic teeth. Minute mandibular teeth, like those on premaxillary. No palatine teeth. Dorsal and anal low, origin of first opposite twenty-second ray of second, both end at same vertical, close to caudal. Caudal small. Pectoral lanceolate. Ventral small, inserted near first third in total length. Black, velvety, fins bister. Iris gray, pupil opaline. Length 164 mm. (Vaillant.)

Deep waters of the eastern Atlantic and Indian Oceans.

Macristiidae

Body elongate, compressed. Head rather small. Snout conic. Eye small. Mouth moderate. Premaxillaries and maxillaries (?) probably form gape. Gill membranes free from isthmus. No scales. Dorsal large, occupies greater forward part of back, begins close behind pectoral. Anal begins behind dorsal base. Caudal rather broad, emarginate behind. Pectoral long. Ventral inserted opposite dorsal origin, reaches at least to caudal base.

One genus.

MACRISTIUM Regan

Macristium REGAN, 1903, Ann. Mag. Nat. Hist., London, (7) XII, p. 345. Type *Macristium chavesi* Regan. Monotypic.

Mouth only moderately wide. Maxillary dilated behind. Dentition weak. Branchiostegals rather long, slender, curved, 8 each side. Gills 4. No pseudo-branchiae. Fin rays much prolonged. Ventrals anterior.

Macristium chavesi Regan

Figure 83

Macristium chavesi REGAN, 1903, Ann. Mag. Nat. Hist., London, (7) XII, p. 345. Azores; 1911, *op. cit.*, VII, p. 204, Fig. (type).

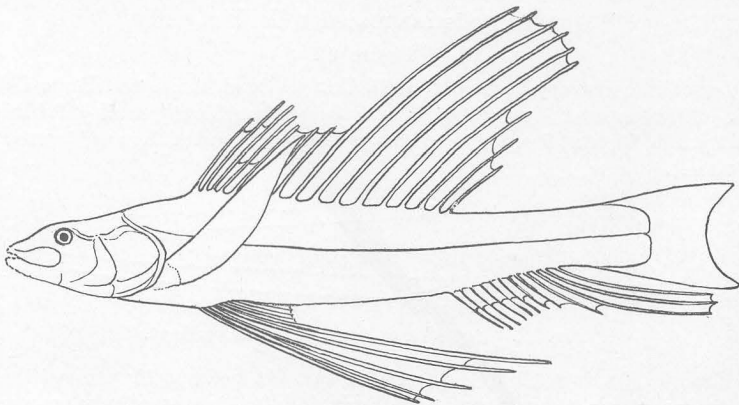


Fig. 83. *Macristium chavesi*, from Regan.

Head $4\frac{1}{4}$; depth $5\frac{1}{2}$; dorsal 18; anal 12; pectoral 16; ventral 8; caudal 19; snout 3 in head; eye $6\frac{1}{2}$; maxillary $2\frac{3}{4}$. Body long, abdomen apparently very distensible. Small acutely pointed teeth in lower jaw, on vomer, palatines, and tongue. Maxillary broad, rounded behind, without supplemental bone. Two nostrils each side, superior, rather lateral near end of snout before front end of supraorbital. Crown flattish above, frontals slightly raised above each eye. Post-temporals approach each other rather closely in occipital region. Myotomes about 62. Dorsal, anal, and ventrals with very elongate unbranched rays, though branched (?) distally. Length 110 mm. to base of caudal. (Regan.)

Described from a damaged specimen apparently washed ashore in the sea of the Azores.

Argentinidae

Smelts

Body elongate, abdomen rounded. Mouth terminal, small or large. Maxillary forms lateral edge of upper jaw, with supplemental bone. Premaxillaries not protractile. Teeth various, sharp pointed. Pterygoids toothed. No barbels. Gill membranes separate from isthmus. Gills 4, slit after fourth. Branchiostegals 5 to 10. Stomach blind sac, with few or no appendages. Air vessel single, large. Ova large, fall into abdominal cavity before exclusion. Scales moderate or small, usually cycloid. Head naked. Lateral line present. No photophores. Dorsal short, nearly median. Adipose fin always present. Anal moderate. Caudal forked. Pectoral low. Ventral moderate, nearly median.

Small marine fishes, many ascending streams in the spawning season. Reduced salmonoids, smaller and weaker than trout, from which they differ mainly in the structure of the stomach. Most are excellent food fishes.

ARGENTINA Linné

Argentines

Argentina (Artedi) LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 315. Type: *Argentina sphyraena* Linné. Monotypic.

Argentine FORSTER, 1772, 'Cat. Animals North America,' p. 22. Type: *Argentina sphyraena* Linné. (Apparently variant of *Argentina*.)

Silus REINHARDT, 1833, 'Bemerk. Skandinav. Icthyth.,' p. 11. Type: *Salmo silus* Ascanius. Tautotypic.

Acantholepis KRÖYER, 1846-1849, 'Danmarks Fiske,' III, p. 97. Type: *Salmo silus* Ascanius. Monotypic.

Body oblong. Eye large. Mouth small. Maxillary not reaching eye. Jaws toothless; arched series of minute teeth across head of vomer and on fore part of palatines; tongue with series of small curved teeth each side. Branchiostegals 6. Pseudobranchiae well developed. Pyloric caeca in moderate number. Eggs small. Scales large, cycloid, more or less rough with spinous points. Dorsal short, before ventrals. Caudal deeply forked.

Marine fishes of cold deep seas, not entering fresh waters.

Argentina silus (Ascanius)

Figure 84

Salmo silus ASCANIUS, 1775, 'Icon. rer. nat.,' III, p. 3, Pl. XXIII. Bergen, Norway.

Argentina silus MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 394 (off Cape Blanco, N. lat. 26° 3', W. long. 15°, 214 m.).

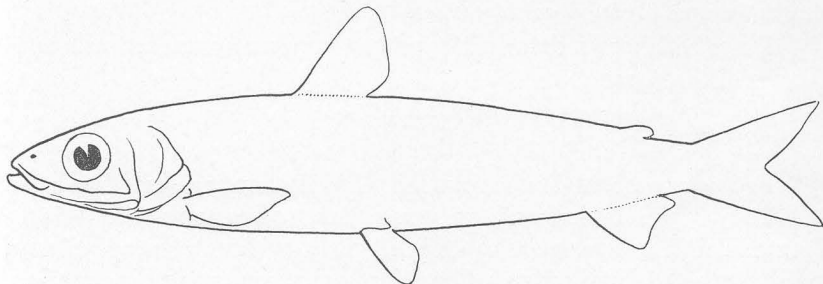


Fig. 84. *Argentina silus*, from Goode and Bean.

Head 4 to 4 1/2 with caudal; depth 5 1/2; dorsal 11; anal 14; pectoral 17; ventral 12; scales 66 in lateral line, 4 above and 4 below. Eye 3 in head, a little more than snout. Scales spiny, points of spines directed backward. Length 407 mm. (Günther.)

North Atlantic. The color is said to be olivaceous on the back and the sides silvery.

Microstomidae

Body elongate, subterete. Head moderate. Mouth very small, terminal. Teeth small, chiefly in lower jaw and on vomer. Gill membranes separate. Branchiostegals reduced to 3 or 4. Dorsal fin short, posterior. Adipose fin present. Ventrals behind middle of body.

About three genera.

MICROSTOMA Cuvier

Microstoma CUVIER, 1817, 'Règne Animal,' p. 184. Type: *Serpe microstoma* Risso. Monotypic.

Body cylindrical. Eye very large. Mouth cleft very small. Premaxillaries very small. Maxillaries very short, broad. Narrow series of very small teeth in lower jaw and across head of vomer. No other teeth. Pseudobranchiae well developed. Air vessel large. Mucous membrane of stomach with numerous large papillae. No pyloric appendages. Body covered with large, thin, silvery scales. Scales extend over central caudal rays. Dorsal fin short, inserted behind ventrals, before anal. Adipose fin present in most young examples, frequently absent in adults; small, narrow, end fringed or lacerated. Caudal forked.

Marine fishes of the deeper Atlantic and Mediterranean.

Microstoma microstoma (Risso)

Figure 85

Serpe microstoma Risso, 1910, 'Ichth. Nice,' p. 356. Nice.

Microstoma microstoma BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 1, Fig. 10 (enteron) (Gulf of Guinea in N. lat. $3^{\circ} 31'$, E. long. $7^{\circ} 25' 6''$, in 600 m.).

Head 3 to $3 \frac{1}{4}$; depth $5 \frac{3}{4}$ to 7; dorsal II, 9 or II, 10; anal II, 5 or II, 6; scales in lateral line about 44 to caudal base; snout 4 to $4 \frac{1}{4}$ in head measured from upper jaw tip; eye $2 \frac{3}{4}$ to $3 \frac{1}{2}$; maxillary $3 \frac{1}{4}$ to $4 \frac{3}{4}$; interorbital $3 \frac{2}{3}$ to 4.

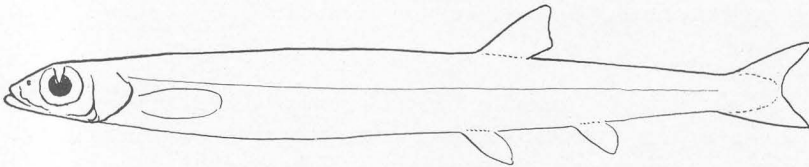


Fig. 85. *Microstoma microstoma*, from Valenciennes.

Body deepest at dorsal origin. Caudal peduncle compressed slightly, as long as deep, least depth $3 \frac{1}{8}$ in head. Head large, profiles alike, nearly straight. Snout somewhat depressed, as broad as long. Eye close to upper profile and little advanced from center of head. Mouth small, cleft horizontal, jaws firm. Maxillary short, slips largely below wide preorbital, reaches about to eye, expansion about $2 \frac{1}{4}$ in eye. Teeth moderate, in jaws only, in mandible, uniserial, conic, uniform, erect. Row of small teeth across front of mouth roof as crescent, uniform, conic, erect. Tongue free, rounded in front, with patch of small, short conic teeth. Mandible protruding well beyond snout tip. Nostrils together, about midway in snout. Interorbital slightly concave. Gill rakers $4+10?$, shorter than gill filaments, slender, pointed. Pseudo-branchiae little shorter than filaments. Scales thin, caducous, all well exposed. Along dorsal edge of back each side longitudinal keel formed down center of row of scales, and similar one in course of lateral line. Lateral line complete, little high at first, median posteriorly, tubes simple, large. Dorsal origin about midway between hind pupil edge and caudal base. Anal inserted nearly midway between last dorsal ray base and that of caudal, fin little higher forward. Pectoral low. Ventral inserted just before dorsal origin. Vent close before anal. Silvery. Length 25 to 37 mm.

Deep waters of the eastern Atlantic and Mediterranean. Described above from Italian examples.

Schmidt¹ says, "Brauer's fish cannot be any true *Microstoma*; certainly not *M. argenteum* Val., if his statement (*loc. cit.*, p. 11) that the dorsal is situated in the middle of the back, be correct. There is, however, a discrepancy between this statement and the measurements for

¹1918 (March 15), Rept. Danish Oceanogr. Exped. Medit., II, A.5, p. 24.

positions of the fins are given by Brauer himself on the page next following in his quoted work. Judging from these last, the dorsal appears situated behind the middle, as is in reality the case with the Mediterranean *Micro. argenteum*. As the formula given by Brauer (*loc. cit.*) agrees fairly well with those of this species, I must presume that his specimen really was a true *Microstoma*, nearly related to, or identical with, this; and that his statement as to the dorsal being situated in the middle of the back is incorrect. Unfortunately, Brauer does not state whether any adipose fin is present. This would have sufficed at once to decide the question, which cannot now be solved save by examination of Brauer's specimen."

Stomiatidae

Body elongate, tapering. Head oblong. Snout short, rounded. Eyes large, far forward. Mouth enormous, with deep lateral cleft. Lateral edge of upper jaw formed by maxillary, toothed. Teeth usually strong, unequal, some often fanglike or barbed. Long barbel at throat. Opercles imperfect. Gill membranes not united, free from isthmus. No pseudobranchiae. Branchiostegals 12 to 17. Skeleton feebly ossified. Stomach caecal. No pyloric appendages. Eggs excluded through oviducts. Body naked or covered with thin deciduous scales. Sides with photophores. Dorsal fin short, median or posterior, spineless. Anal free, far behind, small. Caudal distinct. Pectorals low on scapular arch, narrow. Ventrals inserted far backward.

Very voracious deep-sea fishes. Genera about fifteen or more.

KEY TO THE GENERA

- a.*—STOMIATINÆ. Body with fine scales, placed in subhexagonal depressions of skin.
b.—Ventrals normal, short. STOMIAS.
bb.—Ventrals very long, filiform. MACROSTOMIAS.
aa.—EUSTOMIATINÆ. Body naked.
c.—Ventrals inserted far apart, high on body; barbel and paired fin rays long and filiform. BATHOPHILUS.
cc.—Ventrals inserted close to ventral outline of body.
d.—Mouth very long, straight, entirely without floor between the limbs of the lower jaw, or with only a narrow transverse membranous bridge close behind the symphysis.
e.—No pectoral; ventrals greatly produced, inserted before mid-body length; vertical fins not covered by black skin. PHOTOSTOMIAS.
ee.—Pectoral rays present; ventrals short, inserted well behind mid-body in length; vertical fins covered by thick black skin and connective tissue. MALACOSTEUS.

dd.—Mouth comparatively moderate or long and curved, always with complete floor between limbs of lower jaw.

f.—Anal origin well before considerably shorter dorsal fin.

EUSTOMIAS.

ff.—Dorsal and anal origins opposite.

g.—Pectoral without isolated or produced ray.

MELANOSTOMIAS.

gg.—Pectoral with an isolated and produced ray.

ECHIOSTOMA.

STOMIAS Oken

Stomias OKEN, 1817, *Isis*, p. 1182 (on Cuvier, 'Règne Animal,' 1817, II, p. 184).

Type: *Esox boa* Risso. Monotypic.

Body elongate, compressed. Head compressed. Snout very short. Eye moderate. Mouth cleft extremely large, oblique, lower jaw projecting. Large fleshy hyoid barbel. Teeth pointed, unequal, very large on premaxillaries and mandible, fine on maxillaries. Vomer with pair of fangs. Palatines and tongue with smaller pointed teeth. Opercular region short. Gill openings very wide. No pyloric appendages. Body covered with exceedingly fine deciduous scales, scarcely imbricated, lie in subhexagonal depressions in skin. Lower side of body, head, and tail with series of photophores. Dorsal rather long, far back, opposite anal. Caudal moderate. Pectorals and ventrals rather small, short, latter far back.

KEY TO THE SPECIES

a.—Ventral row of photophores between pectoral and ventral fins 39 to 41, between ventral and anal 8 to 10; scales 65 to 67.....*colubrinus*.

aa.—Ventral row of photophores between pectoral and ventral fins 43 to 46, between ventral and anal 5 or 6; scales 67 to 70.....*affinis*.

aaa.—Ventral row of photophores between pectoral and ventral fins 47, between ventral and anal 11; scales 72 to 76.....*ferox*.

Stomias colubrinus Garman

Figure 86

Stomias colubrinus GARMAN, 1899, *Mem. Mus. Comp. Zoöl.*, XXIV, p. 275, Pl. LVII, fig. 1. N. lat. 6° 17', W. long. 82° 5', in 1672 fathoms—BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 47, Fig. 10 (Atlantic Ocean and West Africa in N. lat. 1° to 14°, W. long. 2° to 21°; N. lat. 0° to 1°, E. long. 7° to 0°; S. lat. 3° to 11°, E. long. 7° to 10°; in 1500 to 3500 m.).—EGE, 1918 (February 28), 'Rept. Danish Oceanogr. Exped. Medit.,' No. 4, (A.4), p. 24 (N. lat. 3° 44', W. long. 24° 25', in 188 m.).

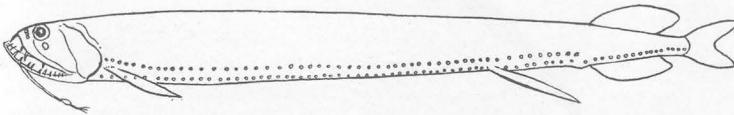


Fig. 86. *Stomias colubrinus*, from Garman.

Head 8 to 8 2/5; depth 10; dorsal 18 or 19; anal 21 or 22; pectoral 6; ventral 5; scales 65 to 67 in lateral series; eye 3 2/5 to 5 1/2 in head. Snout as long as, or longer, than eye. Double luminous organ below front of eye as black blotch; large suborbital organ below eye posteriorly; 2 luminous bodies on gill covers; many small luminous points about eye, on cheek, upper jaws and gill openings; 16 photophores between branchiostegal rays. Small photophores, one on each scale, along 3 dorsal rows of scales; fourth row from back with 3 or 4 photophores on each scale; fifth row from back mostly with 6 on each scale; sixth row from back with 6 or 7 on each scale. Subventral row of larger photophores from gill opening to ventral fin 39 to 40, from ventral to anal 8 or 9 (rarely 10). Ventral row of larger photophores from isthmus to pectoral 10 (seldom 11), from pectoral to ventral 40 (rarely 39 to 41), from ventral to anal 9 (rarely 8 to 10), from anal to caudal 17 (rarely 10). Dorsal lies in last fifth of body, somewhat posterior to anal. Ventrals at last third in body, nearly reach anal. Black with metallic sheen. Length 214 mm. (Brauer.)

Atlantic and eastern Pacific in deep seas.

***Stomias affinis* Günther**

Stomias affinis GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 205, Pl. LIV, fig. A. South of Sombrero Island, in 450 fathoms.—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 169 (southwest of Liberia in N. lat. 0° 29', W. long. 18° 57', in 10 m.; N. lat. 0° 12', W. long. 16° 39', in 10 m.).

Stomias valdiviae BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 48, Pl. III, fig. 1, text figs. 11 to 13. Atlantic Ocean, West Africa, Gulf of Guinea. (N. lat. 1° to 3°, E. long. 0° to 5°; S. lat. 1°, E. long. 7°; in 600 to 2200 m.).—EGE, 1918, (February 28), 'Rept. Danish Oceanogr. Exped. Medit.,' No. 4 (A).4, p. 23 (N. lat. 15° 30', W. long. 23° 52', in 133 m.).

Head 9 to 10; depth 12; dorsal 18 or 19; anal 21 or 22; pectoral 6; ventral 5; scales 67 to 70 in lateral series; snout equals or greater than eye. Photophores distinct, 17 on branchiostegals; 5 upper rows of scales along side of body each with single small photophore; subventral row between gill opening and ventral fin 42 to 45, between ventral and anal 5 or 6; ventral row 10 or 11 between isthmus and pectoral, between pectoral and ventral 43 to 46, between ventral and anal 5 or 6, between anal and caudal 16 or 17. Dorsal begins somewhat behind anal origin. Caudal lobes equally developed. Ventral reaches somewhat past anal origin. Black, scales with metallic sheen. Length 210 mm. (Brauer.)

Bathypelagic in Atlantic and Indian Oceans. Though Günther says that *Stomias affinis* is scaleless, hexagonal divisions of skin distinct, it doubtless had scales in life. From his description I can find little to distinguish it from *Stomias valdiviae* Brauer.

***Stomias ferox* Reinhardt**

Stomias ferox REINHARDT, 1842, Overs. K. danske Vidensk. Selsk. Forhn., Kjøbenhavn, X, p. 77. Greenland.—EGE, 1918 (February 28), 'Rept. Danish Oceanogr. Exped. Medit.,' No. 4 (A).4, p. 1 (Azores to Faeroes).

Stomias boa (not Risso) VAILLANT, 1888, 'Exped. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 115 (off Morocco, Banc d'Arguin, Cape Verde Islands, 405

to 1617 m.).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 71, Pl. IV, fig. 1 (N. lat. 39° 44', W. long. 28° 25', in 1500 m., off Azores).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 611, Fig. 453 (off Morocco, Canaries, Azores, 2170 to 3886 m.).

Head 10; depth 13; dorsal 18; anal 21; pectoral 6; ventral 5; scales 76 to 78 in lateral series. Photophores in subventral row between gill opening and ventral fins 46, posterior to latter 14. Ventral row of photophores between isthmus and pectorals 10, between pectorals and ventrals 47, between ventrals and anal 11 or 12, between anal and caudal 17. Length 270 mm. (Brauer.)

According to Ege, *Stomia boa* Risso, the Mediterranean analogue, has been taken only in the Gulf of Cadiz. The two forms are said to be distinguished as follows:

	<i>S. ferox</i>	<i>S. boa</i>
Anal rays.....	19 to 23	19 to 21
Subventral photophores.....	59 to 64	58 to 59
Ventral photophores.....	86 to 91	84 to 86
Vertebrae.....	79 to 82	76 to 77

MACROSTOMIAS Brauer

Macrostomias BRAUER, 1902, Zool. Anzeiger, XXV, p. 283. Type: *Macrostomias longibarbatu*s Brauer. Monotypic.

Body greatly elongated. Mandibular barbel very long. Vomer and palatines toothed. Gill openings broad. Gill rakers very short. Gills 4. No pseudobranchiae. Body covered with scales. Dorsal and anal inserted at about last eighth in trunk. Pectoral small. Ventral inserted nearly midway in total length, filamentous.

*Macrostomias longibarbatu*s Brauer

Figure 87

*Macrostomias longibarbatu*s BRAUER, 1902, Zool. Anzeiger, XXV, p. 283. Gulf of Guinea, 1800 m.; 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 52, Pl. III, fig. 2 (Gulf of Guinea in N. lat. 3° 11' 1", E. long. 5° 34' 9", in 1800 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (off Morocco, 1215 m.; south of Azores).

Head 17 to 20; depth 33; dorsal 13 to 15; anal 17 or 18; pectoral 6; ventral 4; snout 5 3/5 in head; eye 5 3/5; interorbital 1 1/3; eye 1 in snout. Body very long, thin, strongly compressed. Mouth cleft long. Lower jaw strongly protruded, with long barbel 2 3/5 in body length, with terminal luminous organ and ends in short filaments. Both jaws with 5 large teeth, gradually smaller posteriorly. Vomer with pair of canines. Palatines with 1 to 3 pairs of canines. Scales hexagonal, in 6 transverse rows. Luminous body below eye posteriorly. Photophores 18 on branchiostegals; lateral row between gill opening and ventral 79, between ventral and anal 67 or 68; lower row from isthmus to ventral 93, between ventral and anal 65 to 67, from anal to caudal 21 or 22. Dorsal and anal opposite, close before caudal. Pectoral shorter than head. Ventral with long filamentous rays, each with small terminal organ. Back and belly dark, scales pearly. Lower jaw gray. Eye bluish. Fins clear gray. Length 295 mm. (Brauer.)

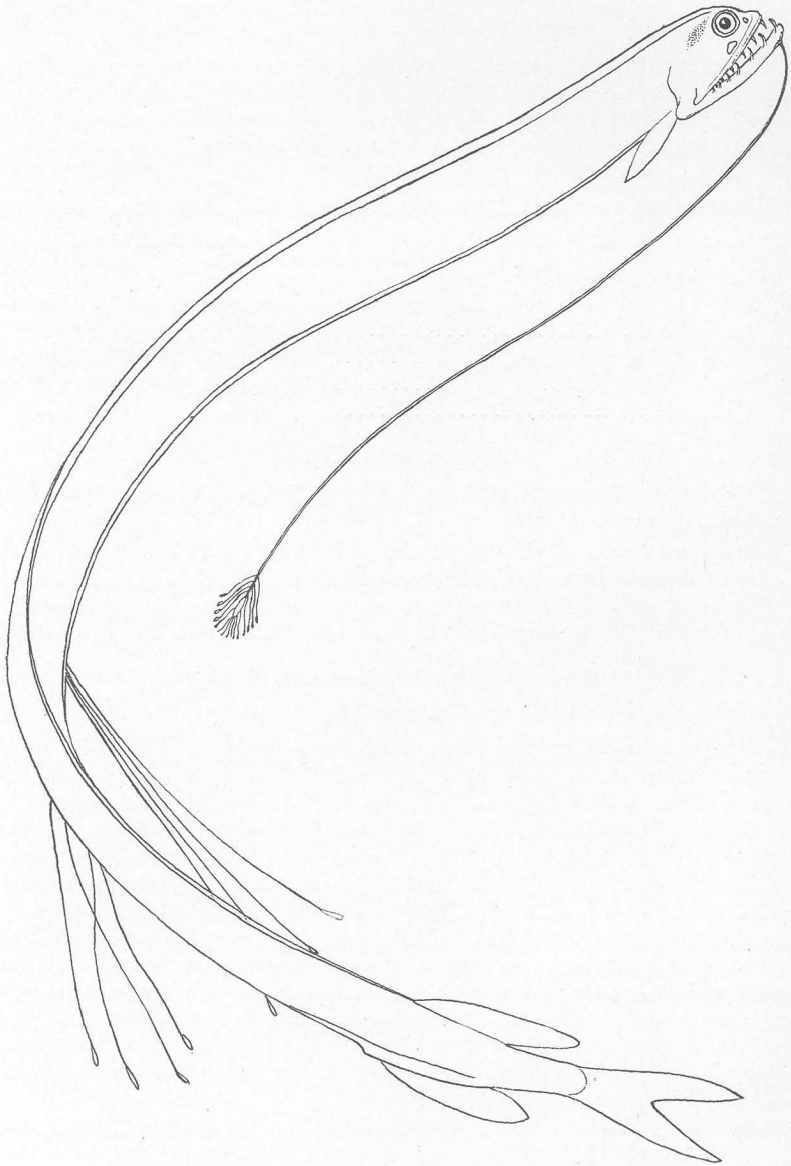


Fig. 87. *Macrostomias longibarbatus*, from Brauer.

Atlantic and Indian Oceans, in deep seas.

BATHOPHILUS Giglioli

Bathophilus GIGLIOLI, 1883, *Nature*, p. 199. Type: *Bathophilus nigerrimus* Giglioli. Monotypic.

Dactylostomias GARMAN, 1899, *Mem. Mus. Comp. Zool.*, XXIV, p. 279. Type: *Dactylostomias filifer* Garman. Monotypic.

Trichostomias ZUGMAYER, 1911 (January 20), *Bull. Inst. Océanogr. Monaco*, CXIII, p. 6. Type: *Trichostomias vaillanti* Zugmayer. Monotypic.

Gnathostomias PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 171. Type: *Gnathostomias longifilis* Pappenheim. Monotypic.

Body slender, moderately compressed. Head elongated. Eye moderately large. Mouth cleft very deep. Teeth strong, close set, uniserial. Maxillary slender, clearly toothed. No vomerine or palatine teeth. Barbel long, filamentous. Gill openings wide. Branchiostegals 8. No scales. Large postorbital luminous body present. Dorsal and anal opposite, with short bases, rays rather long. Caudal lobate. Pectoral and ventral rays in small number, very long and filamentous, without membranes. Vent close before anal.

KEY TO THE SPECIES

- a.—Ventral rays 11; last pectoral ray not apart from others.
 b.—Eye about 6; head $4\frac{1}{3}$ *longipinnis*.
 bb.—Eye 7 to 12; head $5\frac{1}{2}$ *longifilis*.
 aa.—Ventral rays 5; last pectoral ray somewhat apart from others. *vaillanti*.

Bathophilus longipinnis (Pappenheim)

Figure 88

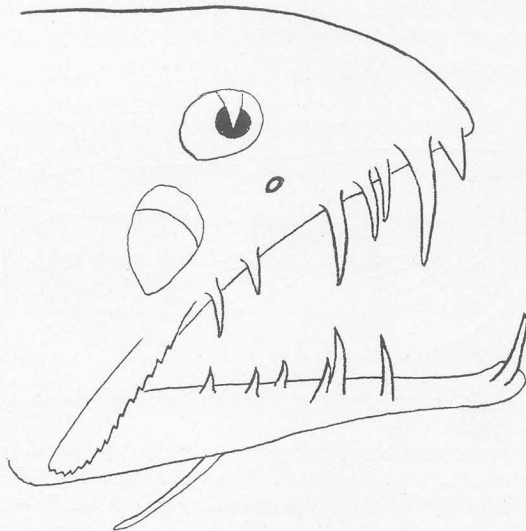


Fig. 88. *Bathophilus longipinnis*, from Pappenheim.

Melanostomias longipinnis PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 170, Text Fig. 1. Southwest of Canaries, N. lat. 24° 41', W. long. 32° 21', in 20 m.

Head $4\frac{1}{3}$; depth $7\frac{1}{2}$; dorsal 14; anal 15; pectoral 6; ventral 11; snout $2\frac{2}{5}$ in head; eye $2\frac{2}{5}$ in snout, 6 in head; interorbital 2 in head. Teeth strong; premaxillaries with 7 teeth, of which second largest, fifth little shorter; maxillary edge finely toothed; mandibular teeth 7 each side, first at symphysis largest. Barbel about half of head. Two infraorbital luminous bodies, front one very small, just below eye and posterior large, little larger than eye. Dorsal and anal in last fourth of body. Pectoral slightly greater than head. Ventral little longer than pectoral, reaches anal. Brownish black, fins white, barbel yellowish white. Length 26 mm. (without caudal). (Pappenheim.)

Off Canaries.

Bathophilus longifilis (Pappenheim)

Gnathostomias longifilis PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 172. Southwest of Cape Verde Islands, N. lat. 24° 41', W. long. 32° 21', in 20 m.

Head $5\frac{1}{2}$; depth 11; dorsal 14, anal 16; pectoral 5; ventral 11. Snout equals half of head. Eye 12 in head. Interorbital 3 in head. Premaxillary and mandibular teeth very large, long, conic canines; each premaxillary with 8 teeth, of which second longest; mandibulars each side 9; maxillary with 40 small teeth. Barbel about 4 times longer than head. Length 50 mm. (without caudal). (Pappenheim.)

Bathophilus vaillanti (Zugmayer)

Figure 89

Trichostomias vaillanti ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 6. N. lat. 37° 37', W. long. 10° 53', in 4900 m., off Portugal; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 78, Pl. III, fig. 4 (type).

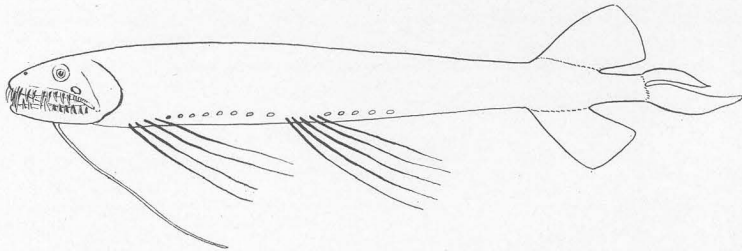


Fig. 89. *Bathophilus vaillanti*, from Zugmayer.

Head $4\frac{4}{5}$, deeper than body, feebly compressed; depth 9; dorsal 11; anal 12; pectoral 2+1; ventral 5. Body long, low. Snout 4 in head. Eye $\frac{3}{4}$ of snout. Jaws equal. Teeth moderately long; front premaxillary pair of small teeth form kind of triangle followed by 2 medium teeth; first maxillary tooth very long, passes below lower jaw, followed by 7 small irregular teeth; mandibular symphysis with triangle of

2 teeth, like those of premaxillary, followed by medium tooth and 10 smaller ones. Barbel about third of combined head and trunk. Ventral row of photophores about 15, body divided into corresponding transverse sections. Suborbital luminous body less than eye, little posterior to same close to maxillary. Eye encircled with chain of minute photophores. Dorsal and anal at last fourth in total length, latter begins slightly behind dorsal origin, both reaching caudal. Isolated pectoral ray divided, 1/4 of body, passes ventral bases. Ventral begins a little before middle in body, rays 1/3 of body, not reaching anal. Black, fins transparent, whitish. Photophores yellowish white. Suborbital luminous body pale reddish. Length 80 mm. (Zugmayer.)

Eastern Atlantic.

PHOTOSTOMIAS Collett

Photostomias COLLETT, 1889, Bull. Soc. Zool. France, XIV, p. 291. Type: *Photostomias guerni* Collett. Monotypic.

Thaumastomias ALCOCK, 1890, Ann. Mag. Nat. Hist., London, (6) VI, p. 220. Type: *Thaumastomias atrox* Alcock. Monotypic.

Body compressed. Short lingual barbel present. Series of long, curved teeth in premaxillary. Vomer and palatines smooth. Tongue and pharyngeals toothed. Opercle rudimentary. Skin naked. Two postorbital luminous bodies. Photophores 2 rows ventrally on each side, and groups of excessively small ones on rest of body. No adipose or pectoral fins. Ventral nearly median.

One genus.

Photostomias guerni Collett

Figure 90

Photostomias guerni COLLETT, 1889, Bull. Soc. Zool. France, XIV, p. 291. N. lat. 38° 34' 30'', W. long. 30° 43' 30'', in 1138 m. (Azores.)

Photostomias guernei LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 280, Fig. (type).—MONACO, ALBERT I (PRINCE OF), 1905 (June), Bull. Inst. Océanogr. Monaco, No. 45, p. (105), 106, Fig. 93 (off Azores in 1138 m.). —ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 65, Pl. III, figs. 1–1a (southeast of Azores, in 3465 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 611, Fig. 455 (off Canaries, Azores, 1235 to 3886 m.).

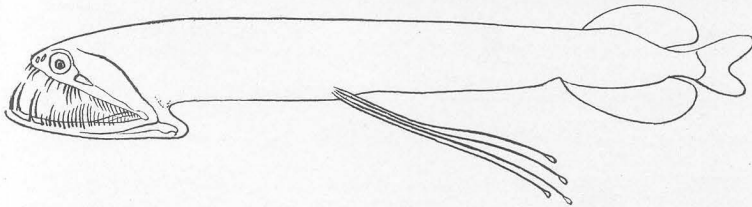


Fig. 90. *Photostomias guerni*, from Zugmayer.

Head 5 1/2; depth 8; dorsal 24; anal 27; ventral 1, 5; caudal 22; eye 5 1/2 in head. Body deepest behind ventrals. Mouth oblique, very large. Premaxillary teeth 8, those of upper jaw excessively small and serrated. Rudimentary triangular

luminous body above maxillary. Photophores of upper or subventral row 51, of lower or ventral row 46. Branchiostegals with photophores. Dorsal and anal very far back, opposite. Caudal forked, lower lobe slightly longer. Ventral elongate, filiform, reaches anal, inserted midway between eye and vent. Black. Length 118 mm. (Collett.)

Azores. Lütken figures an example 350 mm. long, with three greatly enlarged mandibular canines, much larger than any of the upper teeth.

MALACOSTEUS Ayres

Malacosteus AYRES, 1851, Proc. Boston Soc. Nat. Hist., III, p. 69. Type: *Malacosteus niger* Ayres. Monotypic.

Body compressed. Head rather compressed. Snout blunt. Eye far forward, at front end of snout. Mouth cleft extremely wide, jawbones and preopercle greatly prolonged to form an enormous gape, sufficiently large for swallowing fishes greater than its own bulk. Teeth uniserial in jaws and on tongue. Gills 4. Gill filaments very short. Branchiostegals 8, extremely short, rodlike, cartilaginous. Two infra-orbital luminous organs, anterior larger and pear-shaped, with narrow end forward. Sides of body with luminous spots.

Malacosteus niger Ayres

Figure 91

Malacosteus niger AYRES, *op. cit.*, Gulf Stream, N. lat. 42°, W. long. 60°; 1849 (1850-1857), Jour. Boston Soc. Nat. Hist., VI, p. 53 (type).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (N. lat. 31° 20', W. long. 35° 7', 3886 m., south of Azores).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 26 (southeast of Pico, Azores, 1748 m.).

Malacosteus indicus GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 181. Pacific Ocean [Philippines] 500 fathoms.—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (N. lat. 28° 54', W. long. 24° 14', west of Canaries).

Malacosteus choristodactylus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 108, Pl. VIII, fig. 4. Coast of Morocco, Azores, 1400 to 2220 m.—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612.

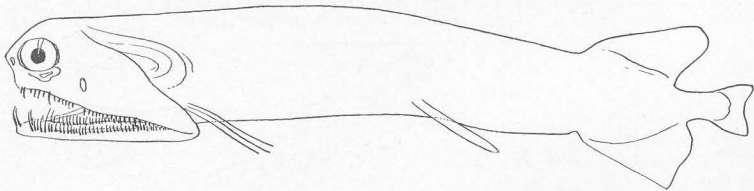


Fig. 91. *Malacosteus niger*, from Zugmayer.

Head $3 \frac{2}{5}$; depth $7 \frac{1}{2}$; dorsal 19; anal 20; pectoral 3 (?); ventral 5. Eye about 7 in head. Mandible with series of slender curved unequal teeth, 4 larger ones anteriorly with few smaller irregular ones between, and end armed with large curved tooth, but shorter than large lateral ones; fangs all less than eye diameter. Infra-

orbital luminous organ almost crescentic, length greater than eye. Dorsal and anal about opposite, falcate, strong. Caudal peduncle slender behind, length about $\frac{2}{3}$ of dorsal fin base. Base of ventral midway between caudal and hind luminous organ, fin less than dorsal base. Black, with numerous light dots over entire body. Reaches 216 mm. (Günther, Goode, and Bean.)

Atlantic Ocean.

EUSTOMIAS Vaillant

Eustomias VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 112. Type: *Eustomias obscurus* Vaillant. Monotypic.

Neostomias GILCHRIST, 1908, Marine Invest. South Africa, IV, p. 168. Type: *Neostomias filiferum* Gilchrist. Monotypic.

Body elongate, compressed. Barbel very long, furnished with filaments and luminous spots. Jaws with uniserial teeth. Palate toothless. Tongue often toothed. Photophores small, numerous. Dorsal and anal far back, former varying from about half the length of anal to nearly subequal. Pectoral rays usually few. Ventral behind middle in body.

KEY TO THE SPECIES

- a.—Barbel simple, unbranched, without filaments before bulb.
 b.—Pectoral rays 3 or less.
 c.—Anal rays about 60.....*macrorhynchus*.
 cc.—Anal rays less than 50.....*obscurus*.
 bb.—Pectoral rays 10; anal rays 36.....*braueri*.
 aa.—Barbel with main stem ending in luminous bulb and with 1 to 3 unequal branches, inserted well apart from terminal bulb on basal $\frac{2}{3}$ of stem; pectoral rays 1 or 2.....*fissibarbis*.

Eustomias macrorhynchus Pappenheim

Figure 92

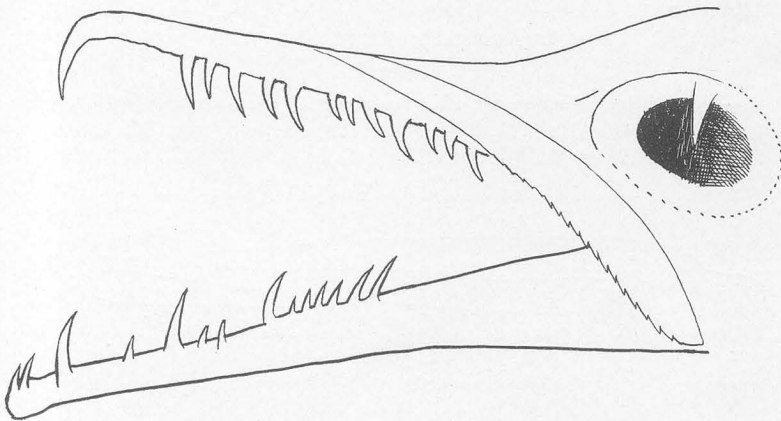


Fig. 92. *Eustomias macrorhynchus*, after Pappenheim.

Eustomias macrorhynchus PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 173, Text Fig. 2. Northwest of Cape Verde, N. lat. $24^{\circ} 41'$, W. long. $32^{\circ} 21'$, 20 m.

Head 7; depth 30; dorsal 28; anal 60; pectoral 3; ventral 7, rays as 2 short lateral and 5 long median. Snout $3/5$ of head. Eye 6 in head. Jaws strongly toothed. Premaxillary each side with canine in front, group of 5 smaller canines, then group of 7 teeth, of which only the third and fourth are about as long as the canines of first group. Maxillary with about 20 fine teeth along edge, reaches $2/3$ in eye. Mandible projects, with about 4 canines each side and 9 smaller teeth. Hyoid strongly toothed. Barbel about twice the length of head, subterminal swelling with black pigment ring and slender terminal end with a longitudinal streak of dark pigment. Length 42 to 105 mm. (Pappenheim.)

Eastern Atlantic.

Eustomias obscurus Vaillant

Eustomias obscurus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 113, Pl. VIII, fig. 3a. Azores, 2792 m.—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 611 (N. lat. $35^{\circ} 10'$, W. long. $7^{\circ} 55'$, off Morocco).

Head 7; depth 20; dorsal 21; anal 35; pectoral 3; ventral 3+4. Body very elongate. Head conic, compressed. Mouth large. Lower jaw protrudes. Barbel reaches at least halfway to anal, ends in 7 short filaments. Maxillary extends slightly beyond eye. Premaxillary with 2 long canines, then 12 lower developed teeth, of which the first and fifth are more canine-like and longer. Lower teeth 14, of which the first two, the sixth, tenth, and eleventh are longest. Nostrils close above and before eye. Dorsal and anal end close to caudal, former inserted about opposite middle of anal. Anal begins at about the last third in body. Caudal very short. Pectoral short. Ventral inserted well behind middle in length, lower long rays 4 times length of upper or not quite twice pectoral length. Velvet black. Iris silvery white. Length 165 mm. (Vaillant.)

Azores.

Eustomias braueri Zugmayer

Figure 93

Eustomias braueri ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 5. N. lat. $36^{\circ} 14'$, W. long. 8° , in 1400 m., off Portugal; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 72, Pl. III, fig. 3 (type).

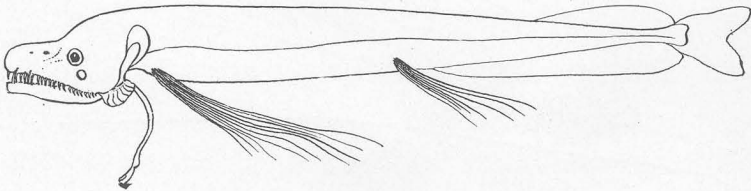


Fig. 93. *Eustomias braueri*, from Zugmayer.

Head $6\frac{1}{2}$; depth 13; dorsal 22; anal 36; ventral 8; pectoral 10. Body very long, compressed. Head elongate, deep. Snout transparent, 2 in head. Eye 6 in head. Barbel nearly long as head, ends in oblong swelling ending in leaf-like organ of touch. Dentition very strong; premaxillary with pair of canines; long tooth on maxillary followed by interval armed with 2 small teeth, serving also to permit large corresponding mandibular tooth to pass; then 2 large teeth, 2 small, 2 large, 2 small, finally row of small recurved teeth to end of maxillary. Mandible with small symphyseal tooth each side, followed by very long tooth passing in profile of upper jaw; following group of small teeth after large one 2 small and 3 small. Tongue with 4 pairs of teeth. No teeth on vomer or palatines. Photophores very numerous. Sub-orbital luminous body small. On head 15 small photophores around eye; 17 on hyoid arch; 20 each side of lower jaw; rest of snout and head covered with irregular bands of photophores; behind isthmus there is a double row of photophores, with lower row interrupted at ventral and continued to anal base, as 8 pectorals, 19 ventrals, 10 anals; upper lateral series with 79. Dorsal and anal at last third of body, former begins but slightly before middle of latter, both reaching caudal. Caudal forked. Pectoral and ventral very long, rays divided to bases, former reaches latter, which inserted about midway between head and caudal base. Velvet black. Length 80 mm. (Zugmayer.)

Eastern Atlantic.

***Eustomias fissibarbis* (Pappenheim)**

Figure 94

Neostomias fissibarbis PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 175, Text Figs. 4-5. Northwest of Cape Verde Islands, N. lat. $24^{\circ} 41'$, W. long. $32^{\circ} 21'$, in 20 m.

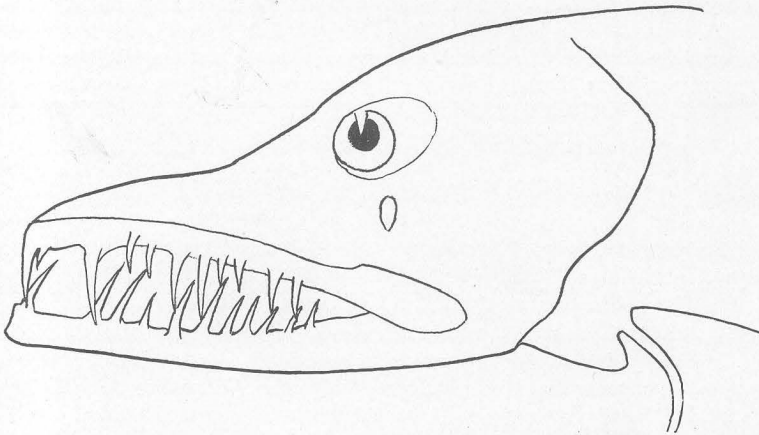


Fig. 94. *Eustomias fissibarbis*, from Pappenheim.

Head $6\frac{1}{2}$; depth at ventrals 13; dorsal 25; anal 39; pectoral 2; ventral 7. Body moderately elongate. Head compressed, moderately long. Snout conic. Mouth cleft, deep. Jaws and maxillary strongly toothed; teeth canine-like, of which

upper first, third, and seventh are longest, in lower jaw, first to third and fifth and seventh are longest. Maxillary extends slightly beyond orbit. Mandible protrudes. Barbel little longer than head, ends in 2 short branches; one enlarged club-shaped luminous body, with dark pigmented basal cusp surmounted by 7 short filaments; other branch with 3 groups of longer terminal filaments, of which 2 in turn end in 2 more slender filaments each terminated by a narrow, slender, double, spindle-like, colorless organ; median group ends in a slender, spindle-shaped, small, luminous organ, though this is larger than any of the double, spindle-like ones, and with a dark pigmented basal cusp also terminated by a group of 3 small, slender, double, spindle-like, colorless organs. Suborbital luminous organ about size of pupil. Photophores as 3 branchiostegals each side; in ventral row 8 pectoral, 2 ventral, 11 anal, 26 supra-anals; upper or lateral row, ventral 26, anal 12, supra-anal 26 and many smaller obsolete ones. Length about (?) 99 mm. (Pappenheim.)

Cape Verde Islands.

MELANOSTOMIAS Brauer

Melanostomius BRAUER, 1902, Zool. Anzeiger, XXV, p. 284. Type: *Melanostomias melanops* Brauer. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' part 4, p. 497.)

Leptostomias GILBERT, 1903, 1905, Bull. U. S. Fish Comm., XXIII, part 2, p. 606. Type: *Leptostomias macronema* Gilbert. Monotypic.

Nematostomias ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 5. Type: *Nematostomias gladiator* Zugmayer. Monotypic.

Body extremely long, little compressed. Eye very small. Front teeth slender, fanglike, unequal, project outside jaws in closed mouth. Pair of slender vomerine teeth, a similar tooth on each palatine and a pair on tongue. Gill openings large. No pseudobranchiae. Branchiostegals 17. No scales or lateral line. Infraorbital luminous bodies present. Head and body with numerous photophores, microscopic, most numerous along lower half of sides; 2 ventral rows of larger ones along each side. Dorsal and anal opposite, nearly equal. Pectoral without detached ray, small. Ventral inferior, far behind middle. Vent close before anal.

Melanostomias gladiator (Zugmayer)

Figure 95

Nematostomias gladiator ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 5. N. lat. 44° 19', W. long. 11° 19', in 4900 m., Bay of Biscay; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 76, Pl. III, fig. 5 (type).

Head 8 1/2; depth 12 3/4; dorsal 20; anal 24; pectoral 4; ventral 7. Eye 6 in head. Maxillary extends well beyond eye. Premaxillaries with a pair of fixed teeth, these 4/5 of eye; maxillary with long depressible canine, followed by 3 small, slender, well-spaced teeth, also with series of 3 small depressible inner teeth; mandible with 2 small symphyseal teeth, then an enormous canine follows 2 pairs of small teeth, of which the anterior are fixed and the posterior are depressible, then an isolated fixed tooth; on the front side there is a moderate depressible tooth. Tongue with a pair, vomer with a pair, and palatines with 2 or 3 pairs of small depressible teeth. Barbel with thin, fine accessory filament springing from near its base, a little less than half the length of the entire barbel. No scales. Behind the eye close above the maxillary is

a small infraorbital luminous body, much smaller than eye. Branchiostegal photophores 17, of which first 4 are before the rays and are very small; ventral row as 11 pectoral, 39 ventral, 17 anal, 4 supra-anal; subventral row as 40 ventral, 17 anal, 17 supra-anal. Dorsal and anal within last sixth of body, both reaching caudal. Pectoral

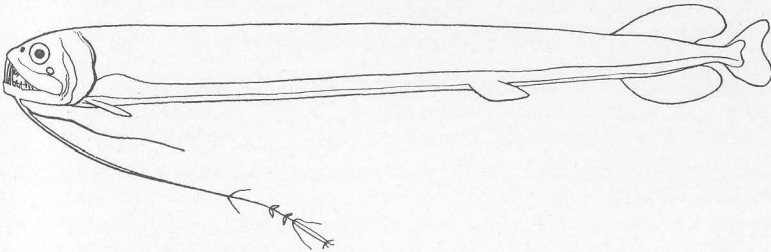


Fig. 95. *Malanostomias gladiator*, from Zugmayer.

low, close behind head, about as long as postocular. Ventral inserted a little before first third in head and trunk, about the size of pectoral. Length 270 mm. (Zugmayer.)

Eastern Atlantic.

ECHIOSTOMA Lowe

Echiostoma LOWE, 1843, Proc. Zool. Soc. London, II, p. 87. Type: *Echiostoma barbatum* Lowe. Monotypic.

Hyperchoristius GILL, 1883, Proc. U. S. Nat. Mus., VI, p. 256. Type: *Hyperchoristius tanneri* Gill = *Echiostoma barbatum* Lowe. Monotypic.

Body elongate, compressed. Head rather compressed. Snout short. Eye moderate. Mouth very wide. Teeth pointed, more or less unequal, premaxillary and front lower ones longest. Maxillary teeth uniserial, those on lower two-thirds small. Hind mandibular teeth in double or triple series. Vomer with a pair of fangs. Palatine with single row of small, pointed teeth. Two groups of similar teeth on tongue. Fleshy barbel on center of hyoid region. Opercular region very narrow, flexible. Gill openings very wide. Gill rakers minute. No pseudobranchiae. No air vessel. Body scaleless. Row of photophores along lower side of head, body, and tail. Large luminous organ behind eye along maxillary, longer than eye. Smaller eye like one in suture between opercle and interopercle. Dorsal fin far back, opposite anal. Caudal forked. Pectorals and ventrals feeble, latter behind middle in body. Vent not far advanced from caudal.

Echiostoma barbatum Lowe

Echiostoma barbatum LOWE, 1843, Proc. Zool. Soc. London, II, p. 88. Madeira.—GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 427 (Madeira).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 172 (northwest of Cape Verde, N. lat. 20° 41', W. long. 31° 53', 3000 m.).

Head $6\frac{3}{4}$; depth 8; dorsal 12 to 15; anal 16 to 18; pectoral 3 to 5; ventral 8. Barbel much shorter than head, not fringed terminally. Branchiostegals 12. Upper

pectoral ray produced to a very long fine filament reaching nearly to ventral base. Ventral fin narrow, prolonged. Black, with an elongate club-shaped, rose-colored spot between maxillary bone and eye. Length 228 mm. (Günther.)

Madeira.

The following small stomiatids have been described as distinct genera and species. They are doubtless larvae or imperfect young.

BENTHALBELLA Zugmayer

Benthalbella ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 14. Type: *Benthalbella infans* Zugmayer.

Body elongate, slender. Head moderate, occiput gibbous or with hump. Snout attenuated. Eyes telescopic, largely within the last half of head. Mouth very large, with rather slender jaws. Teeth in jaws, all depressed back, none on vomer or palatines. Gill opening large, free over a broad space. Branchiostegals at least 6. Abdominal cavity relatively restricted forward. Intestine short, narrow. No scales. Dorsal advanced, close behind ventral. Adipose dorsal above anal, which is moderate. Caudal with rounded lobes. Pectorals vertical, somewhat as arm. Ventrals present, smaller than pectorals.

One species, doubtless the larva of some stomiatid.

Benthalbella infans Zugmayer

Benthalbella infans ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 14. N. lat. 36° 7', W. long. 10° 18', in 4740 m.; 1911, Rés. Camp. Sci. Monaco, p. 140, Pl. II, fig. 8 (type).

Head $4\frac{4}{5}$; depth at dorsal origin $3\frac{1}{4}$ in head; dorsal 9; anal 17; pectoral 22; ventral 7. Profile of head abrupt at occiput. Eye large, telescopic, lateral, oblique. Mouth cleft reaches opposite hind eye edge. Lower jaw horizontal, projects slightly. Premaxillaries and maxillaries with series of short teeth, and similar though slightly larger mandibular teeth. Tongue with 8 hooked teeth. Dorsal begins little behind ventral origin, fin about as long as ventral. Low adipose fin about as long as anal. Anal inserted nearly midway between head and caudal base, fin moderate, about as long as head. Caudal forked, little shorter than head. Pectoral equals head. Ventral inserted slightly before first third in combined head and trunk, little over half of head. Vent close behind ventral. Yellowish white. Only eye pigmented. Length 62 mm. (Zugmayer.)

Eastern Atlantic.

STYLOPHTHALMUS Brauer

Periscope Fishes

Stylophthalmus BRAUER, 1902, Zool. Anzeiger, XXV, p. 298. Type: *Stylophthalmus paradoxus* Brauer. Monotypic.

Body elongate, cel-like. Head depressed. Snout long, depressed forward. Eye in young upon long immovable stalks, shorter with age. Scaleless. Dorsal and anal at end of body, first inserted before vent. Anal partly opposite dorsal, or posterior. Caudal forked or rounded. Pectoral short. Ventrals absent. Vent close before anal, on long papilla. Colorless, except lateral row of chromatophores.

Probably the larval and young stages of some stomiatid.

***Stylophthalmus paradoxus* Brauer**

Figure 96

Stylophthalmus paradoxus BRAUER, 1902, Zool. Anzeiger, XXV, p. 298. South of Cape Colony, Antarctic Sea, Indian Ocean; 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 67, Pl. v, figs. 1 to 7 (off Namaqua Land, S. lat. $26^{\circ} 49' 2''$, E. long. $5^{\circ} 54'$, in 4000 m.).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 176 (off Cape Verde, N. lat. $14^{\circ} 3'$, W. long. $19^{\circ} 10'$, in 1900 m.; northwest Cape Verde, N. lat. $17^{\circ} 28'$, W. long. $29^{\circ} 42'$, in 3000 m.).

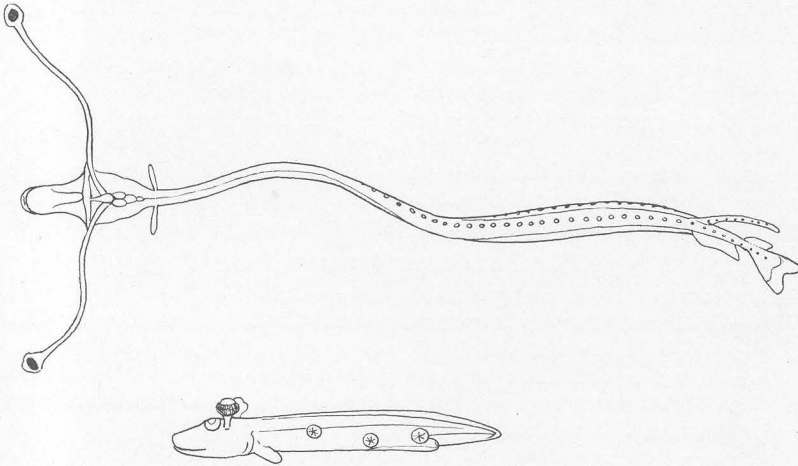


Fig. 96. *Stylophthalmus paradoxus*, from Brauer.

Head $8\frac{1}{2}$; depth 30; dorsal 60; anal 33. Body with sides compressed. Snout broadly rounded. Jaws with pointed teeth. Mouth cleft short. Row of luminous organs along side, branchiostegals 14, pectorals 10, 60 from ventral to anal origin and 10 to 12 to end of body. Anal begins behind dorsal base, reaches caudal. Caudal bilobate. Pectoral with wide base. Length 30 mm. (Brauer.)

Eastern Atlantic, Antarctic, and Indian Oceans. Reported by Barnard (1925, Ann. South African Mus., XXI, p. 140) from off Cape Point, to 1250 fathoms depth.

Astronesthidae

Body rather elongate. Head compressed. Mandibular barbel present, very long, free at tip, sometimes absent. Maxillary forms edge of upper jaw. Teeth pointed, unequal. Post-temporal impinging on occiput. Vertebrae and neural spines normal, not protruding before

dorsal fin. Body naked. Photophores present. Dorsal behind vent, before anal. Adipose fin present. Pectorals present.

Small fishes of the deep seas, referred to three genera.

ASTRONESTHES Richardson

Astronesthes RICHARDSON, 1844, 'Voy. "Sulphur,"' Fishes, p. 97. Type: *Astronesthes nigra* Richardson. Monotypic.

Stomianodon BLEEKER, 1849, Verh. Batav. Genoot. (Bijd. Bali), XXII, p. 10. Type: *Stomianodon chrysopekadion* Bleeker. Monotypic.

Phaenodon LOWE, 1850, Proc. Zool. Soc. London, XVIII, p. 250. Type: *Phaenodon ringens* Lowe. Monotypic.

Borostomias REGAN, 1908, Trans. Linn. Soc. London, XII, pp. 3, 217. Type: *Borostomias braueri* Regan.

Body compressed. Snout moderate. Eye not longer than snout. Mouth wide, lower jaw prominent. Upper teeth with 4 long curved canines, front of lower jaw with 2. Maxillary teeth fine, subequal (few and wide set in *Borostomias*). Palatine with a single row of small pointed teeth, like those on tongue. Gill rakers minute. No pseudobranchiae. Branchiostegals 24. No air vessel. Small luminous organ below eye. Sides and body covered with very small photophores. Dorsal fin rather long. Caudal forked. Paired fins long.

KEY TO THE SPECIES

- a.—BOROSTOMIAS. Dorsal and ventral origins opposite.
 b.—Photophores between isthmus and pectoral 6, between pectoral and ventral 15, between ventral and anal 20, between anal and caudal 11. *richardsonii*.
 bb.—Photophores between isthmus and pectoral 10, between pectoral and ventral 23, between ventral and anal 14, between anal and caudal 16. *elucens*.
 aa.—ASTRONESTHES. Dorsal origin behind ventral origin.
 c.—Photophores between isthmus and pectoral 8 to 10, between pectoral and ventral 17 to 20, between ventral and anal 18 to 20, between anal and caudal 11 or 12. *martensii*.
 cc.—Photophores between isthmus and pectoral 9, between pectoral and ventral 12 to 14, between ventral and anal 18 to 20, between anal and caudal 12. *niger*.

Astronesthes richardsonii Poey

Figure 97

Astronesthes richardsonii POEY, 1852, 'Mem. Hist. Nat. Cuba,' I, p. 176. Cuba.—BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 29 (west coast of Africa).

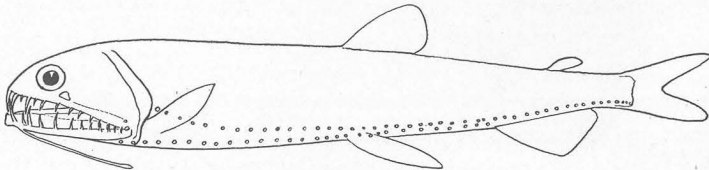


Fig. 97. *Astronesthes richardsonii*, modified from Goode and Bean.

Head $4\frac{2}{3}$; depth 8; dorsal 11; anal 14 or 15; pectoral 9; ventral 7; eye 4 in head. Body slender, height at dorsal origin equals postorbital part of head. Snout very short, $\frac{2}{3}$ of eye. No vomerine teeth. Few scattered small teeth on palatines. Photophores 35 between mandibular symphysis and ventral origin. Dorsal origin nearer caudal root than snout tip, dorsal base half of head and rays all imperfect. Adipose fin directly over tenth anal ray. Space between anal origin and caudal base equals head. Anal base equals postorbital part of head. Pectoral narrow, slender, longest ray $\frac{2}{5}$ of head. Ventral origin below dorsal origin, fin not reaching vent, length equals postorbital region of head. Black. Length 191 mm. (Goode and Bean.)

Reported by Barnard as *Borostomias richardsoni* (1925, Ann. South African Museum, XXI, p. 135) from off Great Fish Bay and Table Bay in 1100 fathoms.

Atlantic and Pacific Oceans.

***Astronesthes elucens* Brauer**

Astronesthes elucens BRAUER, 1906, 'Wiss. Ergebn. "Valdivia," XV (1), p. 31. Gulf of Guinea, N. lat. $0^{\circ} 55' 7''$, W. long. $4^{\circ} 37' 6''$, in 2500 m.

Head $4\frac{3}{5}$; depth $5\frac{2}{5}$; dorsal 14; anal 16; pectoral 7; ventral 7; eye $6\frac{2}{5}$ in head; head $1\frac{1}{2}$ in barbel. Lower canines somewhat shorter, upper similar and moderately well spaced. In jaws 5, in upper 8, in lower about 10, on palatines row of 9 small teeth. Photophores of upper lateral row to ventral origin 2, ventral row, from isthmus to pectoral 10, from pectoral to ventral 23, from ventral to anal 14, from anal to caudal 14. Dorsal origin opposite ventral origin behind middle in body and before last third in body length. Anal begins behind dorsal base, within last third of body length. Velvet black. Length 146 mm. (Brauer.)

Gulf of Guinea. Brauer thinks that this species is possibly identical with *Astronesthes gemmifer* Goode and Bean from the Gulf Stream off New England, differing very slightly in the photophores and fin rays.

***Astronesthes martensii* Klunzinger**

Astronesthes martensii KLUNZINGER, 1871, Verh. Zool. Bot. Gesell. Wien, XXI, p. 594. Red Sea.—LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 273, Pl. III, figs. 6-7 (Cape Verde, N. lat. 17° , W. long. 22°).

Astronesthes martensi PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 167 (N. lat. $0^{\circ} 46'$, W. long. $18^{\circ} 59'$, southwest of Liberia).

Head $4\frac{2}{5}$; depth $6\frac{1}{15}$; dorsal 11; anal 18; pectoral 8; ventral 7; eye $4\frac{1}{10}$ in head. Teeth 5 or 6 in jaws, second largest, others behind smaller. Barbel somewhat longer than head, with terminal luminous organ and 8 small filaments at end. Photophores between branchiostegal rays 21; upper ventral row between gill opening and anal fin 37; lower ventral row between isthmus and pectoral 10, between pectoral and ventral 17, between ventral and anal 20, between anal and caudal 12; many small pigment organs also on head and rest of trunk. Dorsal origin behind ventral origin, also behind middle in body. Small adipose dorsal above anal. Anal begins behind dorsal base, origin at last third in body. Velvet black, jaws brownish. Blackish dots sprinkled on transparent fins. Length 301 mm. (Brauer.)

Atlantic and Indian Oceans, in deep seas.

Astronesthes niger Richardson

Figure 98

Astronesthes nigra RICHARDSON, 1844, 'Voy. "Sulphur,"' Fishes, p. 97, Pl. L, figs. 1-3. Unknown, supposed to be the China seas.

Astronesthes niger GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 425 (Gulf of Guinea, Lagos); 1889, 'Rept. Voy. "Challenger,"' XXXI, p. 38 (West Africa).—LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 273, Pl. III, fig. 3 (N. lat. 4° to 36°, W. long. 8° to 36°; S. lat. 4° to 19°, W. long. 2° to 30°).—GOODE AND BEAN, 1895, 'Ocean. Ichth.,' p. 105, Fig. 123 (type of *Chauliodus fieldii* Valenciennes).—BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 29 (Gulf of Guinea, N. lat. 1° 51', E. long. 0° 31' 2", in 2000 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (south of Azores, 2865 to 3886 m.).

Stomias fieldii VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XVIII, p. 280. Between Mogador and New York.

Chauliodus fieldii VALENCIENNES, 1849, *op. cit.*, XXII, p. 290 (150 leagues southwest of Azores; St. Helena; between Mogador and New York).

Esox cirrhatus (Field) VALENCIENNES, 1846, *op. cit.*, XVIII, p. 280 (name in text).

Phaenodon ringens LOWE, 1850, Proc. Zool. Soc. London, XVIII, p. 251. Madeira.

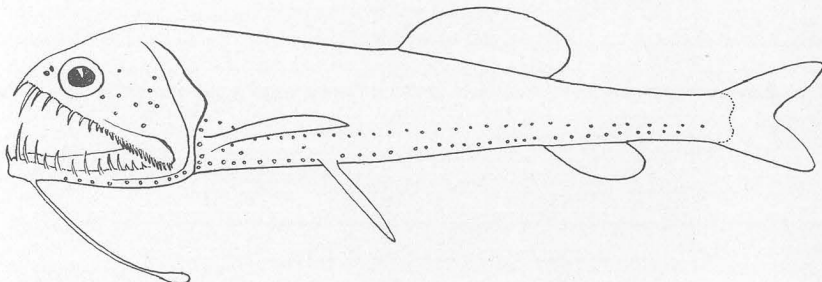


Fig. 98. *Astronesthes niger*, from Goode and Bean.

Head 4; depth 5 1/2; dorsal 14 to 16; anal 14; pectoral 9; ventral 7. Barbel shorter than head. Photophores numerous at lower surface of body, 22 between symphysis of mandible and ventral origin. Dorsal origin midway between end of snout and base of caudal. Pectoral nearly reaches ventral, latter ending some distance before vent. Brownish black. Sometimes oblong bluish spot behind shoulder. Length 102 mm. (Günther.)

Atlantic in deep seas.

Idiacanthidae

Body very slender and elongate. Head small, compressed. Snout short. Mouth cleft very wide. Gill openings broad. No gill rakers or pseudobranchiae. Body naked. Along each side of dorsal and anal base,

between two following rays, short, curved, spiny point belonging to ray in front. Dorsal origin far in advance of anal, its end above anal. No adipose fin. Pectorals absent. Ventrals placed before middle of body.

Eel-like deep-sea fishes.

IDIACANTHUS Peters

Idiacanthus PETERS, 1876, Monatsb. Akad. Wiss. Berlin, p. 846. Type: *Idiacanthus fasciola* Peters. Monotypic.

Bathyophis GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 181. Type: *Bathyophis ferox* Günther. Monotypic.

Body very long, compressed. Teeth on premaxillary and mandible large, quadrangular, bicuspid, depressible, in groups with each group increasing in size backward, those on maxillary small and close set. Few teeth on vomer, palatines, and tongue. Long fleshy barbel behind chin. Opercle narrow. Gills 4. Branchiostegals 15 or 16. Postorbital revolving luminous organ. Row of subventral photophores each side of ventral from isthmus to caudal; ventral row from gill opening to middle of anal. Very long dorsal begins above or before ventrals. Most dorsal and anal rays simple.

KEY TO THE SPECIES

a.—Dorsal rays 54; anal rays 35.....*atlanticus*.

aa.—Dorsal rays 60 to 67; anal rays 40 to 45.

b.—Dorsal origin opposite that of ventrals; vent at 6/8 of total length...*ferox*.

bb.—Dorsal origin rather nearer head than to ventral origin; vent anterior to 7/12 of total length.....*fasciola*.

Idiacanthus atlanticus Brauer

Figure 99

Idiacanthus atlanticus BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 62, Fig. 21. West coast South Africa, S. lat. 25° 25' 3", E. long. 6° 12' 4", in 2000 m. —BARNARD, 1925, Ann. South African Mus., XXI, p. 136 (copied).

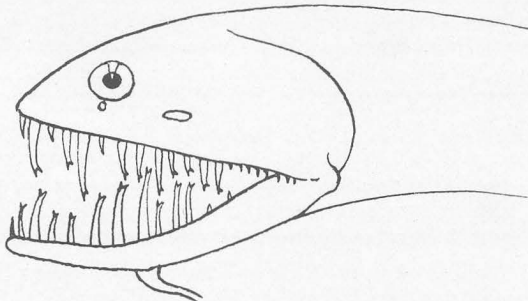


Fig. 99. *Idiacanthus atlanticus*, from Brauer.

Head 14 1/2; depth 34; dorsal 54; anal 35; ventral 6. Eye 7 in head, 1 1/2 in snout, 2 in interorbital. Premaxillary teeth in 4 groups, first two of 3, both of last of 4; teeth in each group gradually larger posteriorly, third, sixth, and seventh longest. Maxillary with 10 small, pointed teeth. Mandible with 3 groups of teeth, first of 3, second of 5, third of 3, and last of 2 small ones; eighth, third, and eleventh longest. Tooth each side of vomer, 2 in palatine with second larger, 2 each side of tongue and larger median. Preorbital luminous body not quite eye diameter behind eye. Ventral photophores as 11 pectoral, 29 ventral, 22 anal, 34 supra-anal; subventral row as 28 ventral, 22 anal, 16 supra-anal. Dorsal begins length of caudal before ventral. Vent shortly before anal, in papilla, below twenty-second dorsal ray. Velvet black. Fins whitish. Length 204 mm. (Brauer.)

South Atlantic.

Idiacanthus ferox (Günther)

Bathyopsis ferox GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 181. Middle of north Atlantic, 2750 fathoms.

Idiacanthus ferox MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (off Canaries and south of Azores, 2170 to 3886 m.).

Head 14 in total; dorsal 60; anal 45; ventral 6. Body band-shaped, tail 1/4 its length. Head high, compressed. Eye rather small. Mouth extremely wide, lower jaw protruding. Upper teeth 17, fourth and eighth longest; mandibular 20, longer, fourth and eleventh very long and hindmost very short. Vomer with 1 or 2 small teeth each side, well spaced. Palatine with row of 3 or 4 small teeth, and tongue with 3 pairs. Barbel about twice head length, dilated terminally, ends in filament. Post-orbital luminous body above middle of upper jaw; ventral and subventral row of photophores each about 23 to ventral fin, 17 behind ventral to vent. Dorsal begins opposite ventrals. Anal begins close behind vent. Caudal very narrow, apparently forked. Ventrals very narrow, pointed, not quite so long as head, inserted midway between vent and head. Black. Lateral folds of dilated part of barbel white. Length 203 mm. (Günther.)

Atlantic. Noticed from South Africa by Barnard (1925, Ann. South African Mus., XXI, p. 136).

Idiacanthus fasciola Peters

Idiacanthus fasciola PETERS, 1876, Monatsb. Akad. Wiss. Berlin, p. 846. Pacific Ocean, North Australia, and north of New Guinea.—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 168 (southwest of Azores, N. lat. 24° 41', W. long. 32° 21', 20 m.).

Head more than 14; depth 40 to 45; dorsal 63 to 67; anal 40; ventral 6. Snout equals eye or shorter. Eye 5 1/2, or more, in head. Premaxillary with 13 to 15 unequal teeth, in 4 groups, increasing in size posteriorly. Maxillary with few small, pointed teeth. Mandible with 12 unequal large teeth in 3 groups, behind 3 or 4 smaller. Vomer with 2 fangs, smaller teeth on palatines and tongue. Barbel twice as long as head. Interorbital with 2 diverging crests. Inconspicuous suborbital and small revolving postorbital luminous body; few on opercle; 15 or 16 branchiostegals; 33 to 35 in ventral row from isthmus to ventrals, 16 or 17 anals, 32 supra-anals; in subventral row 22 to 24 to ventral, 16 anal, 12 supra-anal. Dorsal origin nearer

ventrals than hind edge of head. Ventrals shorter than head. Velvet black, fins translucent. Iris and barbel black, latter with subterminal white ring. Length 180 mm. (Weber and Beaufort.)

Tropical Atlantic and Pacific.

Chauliodontidae

Viper Fishes

Body very long. Head much compressed, elevated. Mouth large. Teeth in both jaws with excessively long fanglike canines. Maxillary enters edge of upper jaw. Opercles incomplete. Interopercle rudimentary. Gill openings very wide. No pseudobranchiae. Body covered with large, thin, caducous scales or sometimes naked. Photophores present. Dorsal and anal moderate, former inserted before ventrals. Caudal forked.

Deep-sea fishes of rather small size and voracious habits. About seven genera.

CHAULIODUS Schneider

Chauliodus SCHNEIDER, 1801, 'Syst. Ichth. Bloch,' p. 430. Type: *Chauliodus sloani* Schneider. Monotypic.

Vipera (not Linné) CATESBY, 1771, 'Nat. Hist. Carolina,' II, p. 119. Type: *Vipera marina* Catesby. Monotypic. (Inadmissible.)

Chauliodes RISSO, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 441. Type: *Chauliodes schneideri* Risso. Monotypic.

Leptodes SWAINSON, 1838, 'Nat. Hist. Animals,' II, p. 303. Type: *Chauliodus sloani* Schneider. (*Leptodes* Swainson proposed to replace *Chauliodus* Schneider.)

Body compressed. Head short, bones thinly ossified. Snout much shorter than eye. Eye moderate. Mouth extremely wide, cleft reaching beyond eye and lower jaw projecting. Premaxillaries with 4 long fanglike canines on each side. Mandible with pointed wide-set teeth, anterior excessively long. None of the greatly enlarged teeth are received within the mouth. Maxillaries with fine teeth. Palatines with a single series of small, pointed teeth. No teeth on tongue. Opercle very narrow. Branchiostegals numerous. Dorsal high, anterior. Adipose fin moderate, sometimes fimbriate, opposite short low anal. Caudal and pectorals moderate. Ventrals large.

Chauliodus sloani Schneider

Figure 100

Chauliodus sloani SCHNEIDER, 1801, 'Syst. Ichth. Bloch,' p. 430, Pl. LXXXV. Atlantic. (On *Vipera marina* Catesby, 1771, 'Nat. Hist. Carolina,' II, p. 119, Pl. XIX. Gibraltar.)

Chauliodus sloanii COLLETT, 1890, Bull. Soc. Zool. France, XV, p. 223 (Funchal).

Chauliodus sloanei RICHARD, 1905 (June 25), Bull. Inst. Océanogr. Monaco, No. 41, p. 12 (near Hierro Island, Canaries, in 3250 m.), p. 18 (N. lat. 37° 20', W. long. 21° 40', in 2000 m.).—BRAUER 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 40, Figs. 7-9 (west Africa; Gulf of Guinea, N. lat. 1° 51', E. long. 0° 31', in 2000 m.; N. lat. 2° 36' 5'', E. long. 3° 27' 5'', in 600 to 2000 m.; N. lat. 0° 25' 8'', E. long. 7° 0' 3'',

in 2000 m.; S. lat. 55°, E. long. 7° 48' 5", in 3000 m.; S. lat. 25° 25' 3", E. long. 6° 12' 4", in 2000 m.).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 63 (off Senegal, N. lat. 27° 43', W. long. 18° 28', in 3000 m.; west of Madeira, N. lat. 31° 46', W. long. 25°, in 3000 m.; N. lat. 31° 21', W. long. 19° 9', in 4000 m.; Azores, N. lat. 36° to 39°, W. long. 26° to 31°, in 1229 m.; between Azores and Portugal in N. lat. 37° 13', W. long. 19° 10', in 3000 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 611 (off Morocco, Canaries, Azores, in 2170 to 3239 m.).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 167 (southwest of Azores in N. lat. 24° 41', W. long. 32° 21').—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 26 (Azores, in 3250 m.).

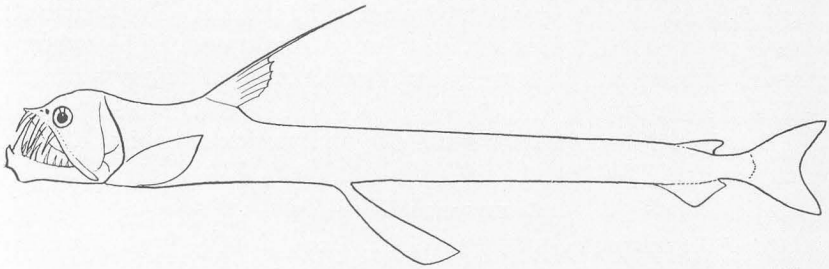


Fig. 100. *Chauliodus sloani*, from Goode and Bean.

Head 5 to 6 $\frac{1}{3}$; depth of head 6 $\frac{1}{2}$ to 7; dorsal 6 or 7; anal 12; pectoral 13 to 15; ventral 6 or 7; 52 in median lateral series, 7 transversely at dorsal origin; snout 4 in head from upper jaw tip; eye 4; maxillary 1 $\frac{1}{10}$; interorbital 4 $\frac{1}{3}$.

Body tapers back evenly to caudal base, sides compressed. Caudal peduncle slender, compressed, least depth $2\frac{3}{4}$ its length. Head obtuse in front, flattened sides not converging above or below. Snout short, as wide as long. Eye anterior, about first third in head. Mouth not completely closing. Maxillary with a row of compressed short attenuated teeth along lower edge, graduated to first third, after which they are uniform. Maxillary reaches hind preopercle edge. Mandible with 7 pairs of large canines, barbed, the first pair are enormous, slender, curved slightly back, and, when mouth is closed, they extend up along each side of snout well above upper eye edge. Each palatine with 7 short conic straight teeth. Nostril is a simple pore close before eye. Interorbital depressed. Gill rakers 4 + 15, minute, firm, pointed denticles along inner edge of gill arch. Single crescentic series of small infraorbital photophores, the first is the largest and begins in a small dark pigment blotch opposite front eye edge, the entire series is close to the eye. Below directly opposite eye center close to maxillary edge, rather large conspicuous photophore. Maxillary, cheek, and opercles with other small photophores. Rather large photophore between each branchiostegal ray. Photophores in upper ventral row from isthmus to pectoral 11, from pectoral to ventral 19, from ventral to anal 25, from anal to caudal 10. Abdominal photophores as double median row, preventral 19, postventral 26. Many other minute photophores scattered over the rest of body. Dorsal origin about first $\frac{2}{7}$ in head and trunk, first ray filament extended beyond ventral origin. Opposite middle of anal base thin,

moderately long adipose fin. Anal inserted at last fourth between gill opening and caudal base. Caudal well forked. Pectoral reaches a little beyond dorsal origin. Ventral inserted near first third between origin of pectoral and caudal base. Brown. Length 122 mm.

Tropical Atlantic. Reported by Barnard as *Chauliodus sloanei* (1925, Ann. South African Mus., XXI, p. 141) from off Cape Point to Durban in 790 fathoms. Described above from a Mediterranean example in the Academy.

Chauliodus pammelas Alcock

Chauliodus pammelas ALCOCK, 1892, Ann. Mag. Nat. Hist., London, (6) X, p. 355. Laccadive Sea, N. lat. 8° 49', E. long. 73° 18' 45", in 1370 fathoms.—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 167 (southwest of Azores, N. lat. 24° 41', W. long. 32° 21', 20 m.).

According to Weber and Beaufort, this species differs from *Chauliodus sloanei* Schneider in having only 20 or 21 photophores between the ventrals and anal. Reaches 250 mm.

Indian and Atlantic Oceans.

Gonostomidae

Body elongate. Head conic, compressed. Mouth large. Teeth moderate, some enlarged or canine-like. Opercle complete. Gill openings wide. Gill rakers long. Body usually covered with large, thin, caducous scales. Photophores present. Dorsal and anal well developed, median or posterior, mostly opposite. Caudal forked.

Bathypelagic.

KEY TO THE GENERA

- a.—Dorsal origin before that of anal, or dorsal fin above space between ventrals and anal; no adipose dorsal.....**MANDUCUS.**
- aa.—Dorsal origin behind middle of body length, opposite that of anal.
 - b.—Teeth in jaws small, increase in size from before backward, hind maxillary teeth more or less obliquely directed forward, sometimes few short fangs forward in mandible; suborbital not dilated or covering cheek; no adipose fin.....**CYCLOTHONE.**
 - bb.—Long fanglike teeth rather regular in jaws, with much smaller ones between; suborbital dilated, covers at least part of cheek; adipose fin present.
GONOSTOMA.

MANDUCUS Goode and Bean

Manducus GOODE AND BEAN, 1895, 'Ocean. Ichth.,' p. 514. Type: *Gonostoma maderense* Johnson. Monotypic.

Body oblong, compressed. Head elongate, conic, much compressed, with thin bones. Eye moderate. Mouth very wide, mandible largely included. Upper teeth uniserial in front, sharp, conic, with small ones between, followed on either side by a

few very long teeth with smaller ones behind. Lower teeth uniserial, small ones between and a double row of 8 smaller similar ones in front. Vomer with few teeth. Row of minute sharp teeth on palatines and entopterygoids, also small similar patch on upper side of tongue. Opercles thin. Gill openings very wide. Body with scales, except top of head and ridge on back, which are rugosely warted. Photophores in 2 rows on each side of belly close to ventral line. Dorsal median in back, over space between ventral and anal. Anal lower than dorsal, base longer. Pectoral and ventral well developed, latter narrow and shorter than pectoral.

Manducus maderensis (Johnson)

Gonostoma maderense JOHNSON, 1890, Proc. Zool. Soc. London, p. 458. Funchal, Madeira.

Head 5 1/5; depth 6 1/5; dorsal 11; anal 33; pectoral 10; ventral 8. Head profile rather steep. Snout short. Eye round, not reaching profile, 5 in head, a little less than snout. Top of head with 2 low converging ridges meeting in front of orbits. Cheeks with large scales. Lateral line begins near opercle edge, one-third of body depth from dorsal profile, slopes gently till opposite middle of dorsal, then midway to caudal base. Photophores close set, low down on each side of belly; subventral row with 60 to 70 spots, begins at throat and reaches caudal base; ventral row also extends from isthmus to caudal. Blackish, photophores silvery or steel blue. Length 130 mm. (Johnson.)

Madeira.

CYCLOTHONE Goode and Bean

Cyclothone GOODE AND BEAN, 1882, Bull. Mus. Comp. Zoöl., X, p. 221. Type: *Cyclothone lusca* Goode and Bean. Monotypic.

Sigmops GILL, 1883 (1884) Proc. U. S. Nat. Mus., VI, p. 256 Type: *Sigmops stigmaticus*. Gill. Monotypic.

Neostoma (Vaillant) FILHOL, 1884, La Nature, p. 184. Type: *Neostoma batyphillum* Filhol. Monotypic.

Body elongate, somewhat compressed. Head conic, compressed. Eye moderate, not conspicuous. Mouth cleft very wide, oblique, extends behind eye. Lower jaw projects strongly. Maxillary long, slender, falcate, somewhat dilated posteriorly, covers only part of cheek. Upper jaw with a single row of fine slender teeth, some enlarged. Lower jaw with similar teeth, sometimes a few canines forward. Teeth on vomer in patches, sometimes reduced to single pair of fangs. Palatine and pterygoid teeth present or absent. Gill openings very wide, membranes free from isthmus. Gill rakers numerous, long, slender. No pseudobranchiae. No air vessel. Body apparently without scales. Lower parts with inconspicuous series of photophores, latter arranged as in *Gonostoma*, usually less conspicuous. Dorsal and anal fins moderate, opposite, latter much longer. Adipose fin sometimes present.

KEY TO THE SPECIES

a.—CYCLOTHONE. No adipose fin.

b.—Luminous bodies distinct.

c.—General color white; scales loosely adherent, fallen; no precaudal luminous bodies. *signata*.

cc.—General color dark; scales adherent, large, thin.

- d.—Upper hind teeth erect, with alternating canines; metallic blue-black..... *livida*.
- dd.—Upper hind teeth oblique, with alternating canines.
- e.—Uniform brownish black..... *microdon*.
- ee.—Pale luminous non-pigmented streak before dorsal and another before anal..... *pallida*.
- ddd.—Upper hind teeth oblique, without canines, simply graduated longer behind..... *acclinidens*.
- bb.—Luminous bodies obscure or absent; vent midway between ventral and anal..... *obscura*.
- aa.—NEOSTOMA. Adipose fin present.
- f.—No predorsal photophores..... *bathypylum*.
- ff.—Median predorsal row of photophores..... *grandis*.

Cyclothone signata Garman

Figure 101

Cyclothone signata GARMAN, 1899, Mem. Mus. Comp. Zoöl., XXIV, p. 246, Pl. J, fig. 3. Gulf of Panama in N. lat. 6° 21', W. long. 80° 41', in 1763 fathoms.—BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV, p. 78, Pl. VI, fig. 6, Text Figs. 28 and 29 (Canaries to Cape Colony).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXV, p. 45 (off Azores, 1200 to 3000 m.; between Azores and Portugal, 1000 to 1500 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (off Morocco, Canaries, Cape Blanco, Azores, 535 to 5160 m.).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 28 (southeast of Pico, Azores, 1748 m.).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 177 (southwest of Liberia in N. lat. 0° 46', W. long. 18° 59' in 3000 m.; N. lat. 5° 27', W. long. 21° 41', in 1500 m.; N. lat. 17° 28', W. long. 29° 42', in 3000 m.; southwest of Ascension Island in S. lat. 14° 3', W. long. 19° 10', in 1900 m.; west of St. Helena in S. lat. 8° 43', W. long. 11° 55', in 3000 m.).

Cyclothone signata alba BRAUER, *op. cit.*, p. 80, Text Fig. 30. Atlantic Ocean (west coast of Africa to Canaries and Cape Colony; Indian Ocean between New Amsterdam and Sumatra; Bay of Bengal; between Ceylon and Chagos Archipelago; Zanzibar; northwest coast of Africa and Gulf of Aden; surface to 520 m.).—MURRAY AND HJORT, *op. cit.* (off Canaries and Azores, in 2170 to 3239 m.).—PAPPENHEIM, *op. cit.* (southwest of Liberia in N. lat. 5° 27', W. long. 21° 41', in 800 m.).

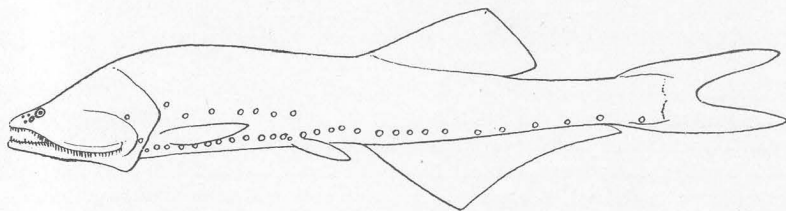


Fig. 101. *Cyclothone signata*, from Brauer.

Head 4 2/3; depth 7; dorsal 13 or 14; anal 19 or 20; pectoral 9; ventral 6; eye 12 in head; snout 2 in interorbital. Upper teeth on each side 6 or 7 short ones

anterior and 52 to 60 gradually larger posteriorly. Lower teeth each side 62 to 66, with 2 canines forward. Palatine teeth 3 or 4. Pterygoid teeth 2 or 3. No vomerine teeth. No scales. Small black anteroinfraorbital luminous organ; 2 photophores at front edge of preopercle; 9 or 10 between branchiostegals; no precaudal luminous blotches; upper lateral row of photophores 6 or 7; lower row 13 between isthmus and ventral fin, 3 or 4 between ventral and anal, 13 above anal to caudal. Dorsal and anal insertions opposite. Pectoral nearly reaches ventral, latter inserted well before middle in combined head and trunk length. Vent close behind ventral bases. Ground color whitish, sprinkled with dark dots. Reaches 280 mm. (Brauer.)

Eastern Pacific, Atlantic and Indian Oceans, to depths of 3000 meters. Reported as *Cyclothone signata* by Barnard (1925, Ann. South African Mus., XXI, p. 145) from off Cape Point and Agulhas Bank in 1500 fathoms.

Cyclothone livida Brauer

Figure 102

Cyclothone livida BRAUER, 1902, Zool. Anzeiger, XXV, p. 279. Atlantic Ocean; 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 80, Pl. VI, fig. 5, Text Fig. 31 (West Africa, Gulf of Guinea, between Canaries and Great Fish Bay, between N. lat. 25° and S. lat. 17°, in 1200 to 3000 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (off Canaries and Cape Blanco, in 2170 to 2603 m.).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 178 (south of St. Helena in S. lat. 28° 54', W. long. 8° 5', in 300 m.; southwest of Sierra Leone in N. lat. 5° 27', W. long. 21° 41', in 500 m.; northwest of Cape Verde Islands in N. lat. 17° 28', W. long. 29°, in 3000 m.).

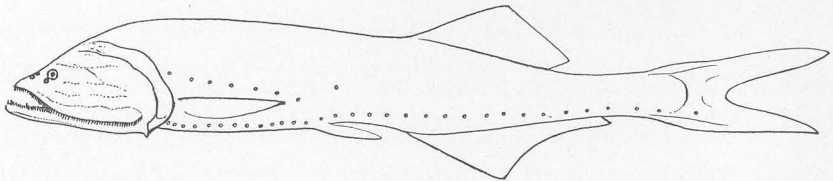


Fig. 102. *Cyclothone livida*, from Brauer.

Head 4 to 4 2/5; depth 6 1/5 to 7 2/5; dorsal 13 to 15; anal 16 to 18; pectoral 9 to 11; ventral 6. Eye 11 in head, 2 in snout, 2 in interorbital. Front somewhat concave. Upper teeth 7 or 8 forward, then first third of remaining dentition subequal, last 2/3 with slightly longer canines 15, these alternating with 3 to 5 regular smaller teeth; lower teeth with 2 large ones anteriorly, then 6 somewhat small ones and finally 80 to 90. Vomer with 5 or 6 teeth. Palatines with 8 to 10 teeth. Pterygoids with group of 10 to 12 teeth. Scales very thin, only distinct on trunk posteriorly, 6 rows between dorsal and anal. Photophores very small, clear; upper lateral row 7 or 8; ventral row from isthmus to ventral 13, between ventral and anal 5, between anal and caudal 15, rarely 14, of which 4 lie behind end of anal. Luminous body close

below front of eye, blackish; another at front preopercle edge, 10 between branchiostegals, 2 longitudinal rows on trunk, one at rudimentary caudal ray above and below. Dorsal and anal insertions about opposite. Pectoral not nearly reaching ventral, ventral not reaching anal. Ventrals and vent somewhat before middle in body. Blue-black. Length 390 mm. (Brauer.)

Eastern Atlantic. Listed by Barnard (1925, *Ann. South African Mus.*, XXI, p. 146) off Great Fish Bay, 1100 fathoms.

Cyclothone microdon (Günther)

Gonostoma microdon GÜNTHER, 1878, *Ann. Mag. Nat. Hist.*, London, (5) II, p. 187. Atlantic and Pacific Oceans, in 500 to 2900 fathoms.

Cyclothone microdon COLLETT, 1896, *Bull. Soc. Zool. France*, XXI, p. 95 (note).—RICHARD, 1905 (June 25), *Bull. Inst. Océanogr. Monaco*, No. 41, p. 8 (off Morocco in N. lat. 35° 44', W. long. 11° 52', in 1000 m.), p. 9 (N. lat. 28° 38' 45", W. long. 17° 59' 40", in 500 m.), p. 11 (off Canaries in N. lat. 29° 16', W. long. 16° 11', in 3000 m.), p. 12 (near Hierro Island, Canaries, in 3000 m.), p. 17 (N. lat. 36° 46', W. long. 26° 41', in 3250 m.), p. 18 (N. lat. 37° 20', W. long. 21° 40', in 2000 m.).—BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 82, Pl. VI, fig. 4, Text Fig. 32 (between Canaries and Cape Colony, and West Coast of Africa).—ZUGMAYER, 1911, *Rés. Camp. Sci. Monaco*, XXXV, p. 43 (off Azores, in 1200 to 3465 m.; between Azores and Portugal in 1000 m.; off Madeira in 1000 to 4000 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (off Morocco, Canaries, Cape Blanco, Azores, 1197 to 5160 m.).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 178 (south of St. Helena, in S. lat. 26° 59', W. long. 17° 6', in 1340 m.; S. lat. 24° 55', W. long. 1° 18', in 1500 m.; off Ascension Island in S. lat. 7° 53', W. long. 14° 27', in 3000 m.; northwest Cape Verde Islands in N. lat. 17° 28', W. long. 29° 42', in 3000 m.).—ROULE, 1919, *Rés. Camp. Sci. Monaco*, LII, p. 27 (off Azores in 2600 to 3250 m.; between Azores and Portugal in 2100 m.).—VAILLANT, 1919, *Rés. Camp. Sci. Monaco*, LII, p. 130 (between Azores and Portugal in N. lat. 37° 50' 15", W. long. 15° 22' 15", in 468 m.; Azores in N. lat. 38° 27', W. long. 26° 30' 15", in 1165 m.).

Neostoma quadrioculatum VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 99, Pl. VIII, fig. 2a-c. Gulf of Gascony, coasts of Portugal, Morocco, Canaries, Banc d'Arguin, Cape Verde, Azores, North Atlantic, in 950 to 4415 m.

Head 5; depth 8; dorsal 13 or 14; anal 19; pectoral 9 or 10; ventral 6. Eye 10 to 12 in head, 2 in snout, 2 in interorbital. Forehead a little concave, each side with 3 bony knobs. Upper jaw with 8 to 10 unequal teeth, only 2 somewhat enlarged; of the remaining 90 teeth, first third subequal, small; last 2/3 with 10 to 12 canines, alternating with 2 or 3 regular teeth. Lower teeth with first 3 or 4 small, then large canine, then 10 small teeth and a second large canine, remaining 90 to 100 teeth gradually higher backward. Vomer with a row of 4 or 5 teeth. Palatine teeth 2 or 3. Pterygoid teeth 4 to 6. Scales large, 4 rows between dorsal and anal fins, very thin. Photophores obsolete; upper lateral row 7+1 or 2; lower lateral row from isthmus to ventral 13, between ventral and anal 5, between anal and caudal 14 or 15 of which 3 or 4 lie behind end of anal. Below front eye edge small dark luminous body, 9 or 10 black dots between branchiostegals, 2 on upper edge of preopercle and luminous body on rudimentary caudal rays above and below. Dorsal and anal inserted some-

what behind center in body length. Pectoral reaches a little less than halfway to ventral, latter not to anal. Ventral inserted a little before midway in body. Vent somewhat behind ventral. Smutty brown to brownish black. Belly black. Length 600 mm. (Brauer.)

Arctic, Atlantic, Indian, Pacific, and Antarctic Oceans, to depths over 4000 meters. Listed by Barnard as *Cyclothone microdon* (1925, Ann. South African Mus., XXI, p. 146) off Cape Point and Agulhas Bank in 1500 fathoms.

***Cyclothone pallida* Brauer**

Cyclothone pallida BRAUER, 1902, Zool. Anzeiger, XXV, p. 281. Atlantic and Indian Oceans.—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 179 (southwest of Ascension Island in S. lat. 14° 3', W. long. 19° 10', 1900 m.; S. lat. 16° 54', W. long. 19° 47', 1000 m.; west of St. Helena, S. lat. 19° 1', W. long. 20°, 800 m.; south of St. Helena, S. lat. 26° 59', W. long. 17° 6', 1340 m.; southeast of St. Helena S. lat. 24° 55', W. long. 1° 18', 1500 m.; east of Ascension Island, S. lat. 8° 43', W. long. 11° 55', 3000 m.; S. lat. 7° 53', W. long. 14° 27', 3000 m.; southwest of Sierra Leone, N. lat. 0° 46', W. long. 18° 59', 3000 m.; N. lat. 5° 27', W. long. 21° 41', 1500 m.; northwest of Cape Verde Islands, N. lat. 17° 28', W. long. 29° 42', 3000 m.; N. lat. 28° 42', W. long. 34° 33', 3000 m.).

Cyclothone microdon pallida BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 84, Pl. VI, fig. 2, Text Fig. 33 (Cape Verde Islands, Gulf of Guinea, coast southwest Africa).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (off Morocco, Cape Blanco, Azores, 2603 to 3239 m.).

Cyclothone microdon var. *pallida* ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, No. 35, p. 44, Pl. v, fig. 3 (west of Canaries, N. lat. 26° 37', W. long. 36° 35', 4800 m.).

Head 4, nearly to 5; depth 7 or 8; dorsal 12 to 14; anal 17 to 19. Upper teeth each side with 9 forward, of which fourth large canine, entire series above with but 70. Lateral photophores of upper row 7+1, rarely 2. Blackish brown. Length 503 mm. (Brauer.)

Atlantic and Indian Oceans. Differs from *Cyclothone microdon* chiefly in the above characters. The clear brown longitudinal streak before dorsal and the lower one before the anal, without pigment spots, is another distinction, according to Brauer.

***Cyclothone acclinidens* Garman**

Cyclothone acclinidens GARMAN, 1899, Mem. Mus. Comp. Zoöl., XXIV, p. 247, Pl. J, fig. 4. S. lat. 0° to N. lat. 36°, W. long. 78° to 138°, in 122 and surface to 2413 fathoms.—BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 85, Pl. VI, fig. 1, Text Fig. 34a-c (West Africa, between Canaries and Cape Colony).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (southwest of Azores in 3886 m.).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 180 (southeast of St. Helena in S. lat. 24° 55', W. long. 1° 18', in 1500 m.; east of Ascension Island in S. lat. 8° 43', W. long. 11° 55', in 3000 m.; southwest of Sierra Leone in N. lat. 0° 46', W. long. 18° 59', in 3000 m.; N. lat. 5° 27', W. long. 21° 41', in 500 to 1500 m.; northwest of Cape Verde Islands in N. lat. 17° 28', W. long. 29° 42', in 3000 m.).

Head $4\frac{1}{2}$ to 5; depth 7 to $7\frac{1}{3}$; dorsal 13 or 14; anal 18 to 20; pectoral 10; ventral 6. Eye 9 or 10 in head, $1\frac{1}{2}$ in snout, $1\frac{1}{2}$ in interorbital. Upper teeth 8 to 10 small anterior, subequal; remaining dentition with first third of subequal small teeth (variable with age), remaining $\frac{2}{3}$ in adults 20 to 40 graduated longer posteriorly; in young only about last fourth of upper dental area with few as 3 slightly enlarged teeth posteriorly. Lower teeth first as three small ones, then a larger canine, then 12 small teeth and a larger canine, and 70 gradually larger posterior teeth. Vomer with a row of 4 or 5 teeth. Palatine teeth 4 to 6. Pterygoid teeth 6 to 8. Scales large, cycloid, very thin, 4 or 5 between dorsal and anal. Photophores in upper lateral row 7 or $8+2$ or 3; in lower lateral row 13 or 14 between isthmus and ventral, 4 between ventral and anal and 14 to 16 between anal and caudal. Below front eye edge small black luminous body and 10 between branchiostegal rays. Front preopercle edge with luminous body, photophore above and another below. Long luminous area along upper edge of caudal peduncle and on rudimentary caudal rays both above and below. Dorsal and anal insertions opposite, behind middle in body length. Pectoral nearly reaches ventral, latter not to anal. Belly black, body otherwise brown. Length 401 mm. (Brauer.)

Atlantic, Pacific, and Indian Oceans to depths over 2000 fathoms. Listed by Barnard (1925, *Ann. South African Mus.*, XXI, p. 147) off Cape Point in 2200 fathoms.

***Cyclothone obscura* Brauer**

Cyclothone obscura BRAUER, 1902, *Zool. Anzeiger*, XXV, p. 280. Atlantic and Indian Oceans; 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 88, Pl. VI, fig. 3, Text Fig. 35 (West Africa, Cape Verde to Cape Colony).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 181 (southwest of Sierra Leone, N. lat. $0^{\circ} 46'$, W. long. $18^{\circ} 59'$, 3000 m.; northwest Cape Verde Islands, N. lat. $17^{\circ} 28'$, W. long. $29^{\circ} 42'$, 3000 m.).

Head $4\frac{1}{5}$; depth $6\frac{3}{5}$; dorsal 13 to 15; anal 17 to 19; pectoral 9 or 10; ventral 6. Snout 3 or 4 times longer than very small eye. Upper teeth with 14 forward, of which the anterior is larger; then the first third of remaining dentition with 47 subequal small teeth; remaining $\frac{2}{3}$ of dentition with 61 larger teeth, of which 12 are as canines alternating with 3 or 4 regular teeth. Lower teeth 15 forward, with 2 as canines, others gradually larger backward, 77 to 79. Vomer with row of 5 teeth, palatines 3 to 5. Scales large, very thin, on caudal peduncle clearly 5 or 6 rows between dorsal and anal fins. Photophores absent from head and trunk, only between branchiostegal rays some small black dots. No luminous bodies on gill covers or before caudal. Dorsal and anal posterior to middle, insertions opposite. Pectoral not reaching ventral, latter not to anal. Vent midway between ventral and anal. Brownish black to black. Length 580 mm. (Brauer.)

Atlantic and Indian Oceans. Listed by Barnard (1925, *Ann. South African Mus.*, XXI, p. 147) off South Africa in 1500 fathoms.

***Cyclothone bathyphilum* (Filhol)**

Figure 103

Neostoma bathyphilum (Vaillant) FILHOL, 1884, *La Nature*, p. 184, Fig. 1. "Talisman" dredgings in eastern Atlantic, 2700 m.

Neostoma bathyphilum VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 96, Pl. VIII, fig. 1a (Gulf of Gascony and Azores, 1420 to 2285 m.).

Cyclothone bathyphila RICHARD, 1905 (June 25), Bull. Inst. Océanogr. Monaco, No. 41, p. 18 (N. lat. 37° 20', W. long. 21° 40', in 2000 m.).

Cyclothone bathyphilum ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 49, Pl. II, fig. 1 (off Madeira N. lat. 32° 32' 30", W. long. 17° 2', in 1968 m.).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 27 (between Portugal and Azores, 2100 m.; off Azores, 2600 m.).

Gonostoma bathyphilum VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (off Azores N. lat. 38° 9', W. long. 23° 15' 45", 4020 m.).

Head 4 1/2; depth 5 1/2; dorsal 12 or 13; anal 21 or 22; pectoral 10; ventral 7. Snout short, 5 in head. Eye moderate, 2 in snout, 2 in interorbital. Mouth cleft very wide, oblique. Maxillary slightly expanded behind. Teeth moderate, canines alternating above with several irregular small teeth between. Teeth on palatines, pterygoids, and pharyngeals. Opercular bones very thin. Gill rakers 10+15, twice eye. No scales. Upper lateral photophores 2+6+6; lower lateral 5 between pectoral and ventral, 5 between ventral and anal and 20 between anal and caudal, of which 4

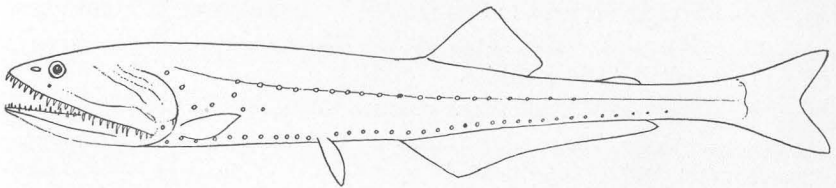


Fig. 103. *Cyclothone bathyphilum*, from Goode and Bean.

behind anal base. Photophores on branchiostegals between rays. Above maxillary expansion large luminous organ. Dorsal and anal insertions about opposite. Small adipose dorsal above last 3 or 4 anal rays. Caudal forked. Pectoral a little over half-way to ventral, latter not reaching vent. Velvet black. Length 132 mm. (Vaillant.)

Deep waters of the Atlantic to 2000 fathoms or more.

***Cyclothone grandis* Collett**

Cyclothone grandis COLLETT, 1896, Bull. Soc. Zool. France, XXI, p. 99. West of São Miguel, Azores. 4020 m.

Gonostoma grande MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (west of Canaries, south of Azores, Azores, 2865 to 3239 m.).

Head 5 1/10; dorsal 13; anal 23; pectoral 12; ventral 8. Body very compressed. Eye small, less than short snout, 6 in head. Mouth very large, oblique. Teeth unequal in jaws; premaxillary teeth 10 to 12, nearly equal; maxillary teeth more serrated, advanced, 7 or 8 conic ones alternating with many small teeth. Mandibular teeth serrated. Vomer, palatines, and pterygoids toothed, 5 or 6 on palatines. No scales. Photophores extremely small; predorsal series of 9 or 10 on back; single ventral series, 10 from isthmus to ventral, 4 from ventral to anal and 11 above anal, relatively high. Dorsal origin midway between snout tip and caudal base. Adipose fin present. Vent midway between snout tip and caudal base. Black. Length 180 mm. (Collett.)

Deep water off Azores. Reported by Barnard as *Gonostoma grandis* (1925, Ann. South African Mus., XXI, p. 143) off Cape Point in 800 fathoms.

GONOSTOMA Rafinesque

Gonostoma RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' p. 64. Type: *Gonostoma denudatum* Rafinesque. Monotypic.

Body oblong, compressed. Head conic, much compressed, bones thin. Eye moderate. Mouth very wide. Premaxillary short, not extending far below the level of eye. Maxillary much longer, forms nearly entire jaw edge. Jaws with a single band of teeth, unequal in size, minute ones alternating with long, pointed teeth. Band of minute teeth on palatine and pterygoids, palatines with few conic ones in front. Gill opening very wide, outer branchial arch extends forward behind symphysis of lower jaw, with very long gill rakers. No pseudobranchiae. Branchiostegals 13 or 14. No air vessel. Scales subequal. Photophores on lower parts of body, tail, and branchiostegal membrane. Dorsal on hinder half of body opposite anal. Adipose fin small, sometimes fimbriated. Anal long. Caudal forked. Pectorals and ventrals well developed.

KEY TO THE SPECIES

a.—Scales present, very thin, partly concealed.

b.—No vomerine teeth; infraorbital enlarged, completely covers cheek.

denudatum.

bb.—Vomer with 2 hooked teeth; infraorbital covers much less than half of cheek.....*rhodadenia*.

aa.—Scales absent; vomer edentulous; cheek not entirely covered by infraorbital. *elongatum*.

Gonostoma denudatum Rafinesque

Figure 104

Gonostoma denudatum RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' p. 64. Sicily.

Gonostoma denudatum JOHNSON, 1862, Ann. Mag. Nat. Hist., London, p. 279 (Madeira).—GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 391 (Madeira).—VAILLANT, 1888, 'Expéd. "Sci. "Travailleur" et du "Talisman,"' Poiss., p. 102 (coasts of Morocco, Cape Verde Islands, 460 to 1180 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612, Fig. 456 (Azores, 1235 m.; west of Azores).

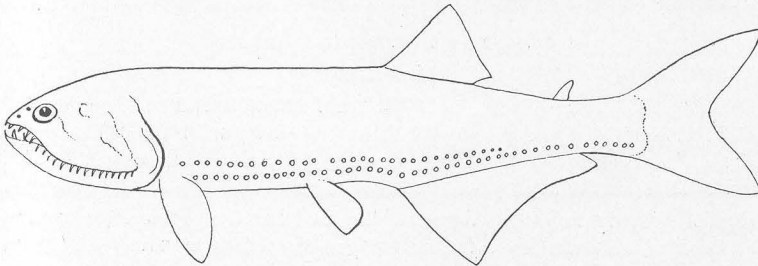


Fig. 104. *Gonostoma denudatum*, modified from Bonaparte.

Head 4; depth 5 1/2; dorsal 14 or 15; anal 30 or 31; pectoral 11 or 12; ventral 8; scales in lateral line 32 to 36. Jaws heterodont, premaxillary with 2 and maxillary with 12 large widely separated teeth, the spaces between filled with very small teeth. Lower jaw with 10 or 11 similar large teeth. Entire cheek covered with enormously enlarged infraorbitals. Reaches 172 mm. (Günther).

Warmer Atlantic and Mediterranean.

Gonostoma rhodadenia (Gilbert)

Cyclothone rhodadenia GILBERT, 1903, (1905), Bull. U. S. Fish Com., XXIII, part 2, p. 602, Pl. LXXI, fig. 1. Kaiwi Channel, Hawaiian Islands, 411 to 442 fathoms; Kauai, 409 to 550 fathoms.

Gonostoma rhodadenia MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (south of Azores, 3886 m.; Azores, 1235 m.).

Gonostoma polyphos ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 4. N. lat. 36° 7', W. long. 10° 18', in 4740 m.; N. lat. 36° 6', W. long. 9°, in 3660 m., off Portugal.—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 27 (between Fogo and San Nicolão Islands, Cape Verde, 3970 m.).

Head 4 2/3; depth 7; dorsal 13; anal 30; pectoral 11; ventral 8. Snout a little longer than eye, which is 7 in head. Jaw with row of 4 to 6 small teeth between each enlarged one. Vomer with pair of small distinct teeth. Group of teeth on front of palatines. Mandible well protruded. On snout 2 converging frontal crests. Scales absent. Suborbital luminous bodies 2, front one small and lower one slender; on the lower and behind the preopercle edge there is another similar one; branchiostegal photophores 9; ventral series with 5 pectorals, 10 ventrals, 4 anals, 16+4 supra-anals; subventral series hourglass-shaped, pectorals 9, anals 3, supra-anals 3; caudal base with 2 elongate luminous bodies below supra-anals, and 1 at upper rudimentary caudal rays; a slender one on scapular arch. Dorsal origin nearly midway between hind end of opercle and caudal base. Anal begins slightly before dorsal. Caudal deeply emarginate. Pectoral a little over halfway to ventral. Ventral about 2/3 of pectoral, little over its own length before anal. Black, with metallic reflections. Ventral photophores violet; subventral with upper portion of each organ reflecting green, blue, or violet, lower portion red or orange. Caudal organs transparent red. Length 250 mm. (Zugmayer.)

Atlantic and Pacific. There is very little in Gilbert's description to distinguish it from Zugmayer's.

Gonostoma elongatum Günther

Figure 105

Gonostoma elongatum GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 187. South of New Guinea, in 800 fathoms.—BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 75, Pl. IV, fig. 4, Text Fig. 27 (Gulf of Guinea in N. lat. 1° 51', E. long. 0° 31' 2'', in 2000 m.)

Head 4 4/5; depth 7 1 2; dorsal I, 12; anal IV, 25; pectoral 10; ventral 6; snout 5 in head measured from upper jaw tip; eye 6 1/4; maxillary 1 1/4; interorbital 5.

Body long, slender, well compressed, edges not trenchant, deepest at head.

Caudal peduncle well compressed, least depth about half its length or 5 in total head length.

Head well compressed, sides flattened, width $3 \frac{2}{5}$ in its total length. Snout short, conic, width $\frac{3}{4}$ its length. Eye a little less than snout, hind edge at last third in head measured from upper jaw tip. Mouth very large, lower jaw projecting. Maxillary reaches opposite preopercle edge, expansion $1 \frac{2}{5}$ in eye. Along each side of upper jaw 13 large teeth, with 4 or 5 much smaller ones between; mandible similar; no vomerine teeth; each palatine with a row of very small close-set teeth, with several of anterior graduated larger, until first largest and but little shorter than largest of maxillary; patch of fine low close-set teeth on pterygoids. Nostrils superior, about last $\frac{2}{5}$ in snout. Interorbital broadly convex. Preopercle greatly inclined. Opercle with series of close-set transversely lunate striae, each one becoming slightly larger progressively below. Gill rakers 8+11, slender, wide set, longer than gill filaments, equal eye.

No scales. Small luminous body above and behind eye; suborbital luminous body little shorter than eye, much narrower than pupil; slender luminous body close along and behind middle of preopercle. Subventral photophores 9 to ventral, obsolete after anal. Ventral row with 5 pectorals, others continuous to caudal base, obsolete. Caudal luminous bodies present apparently, but obsolete.

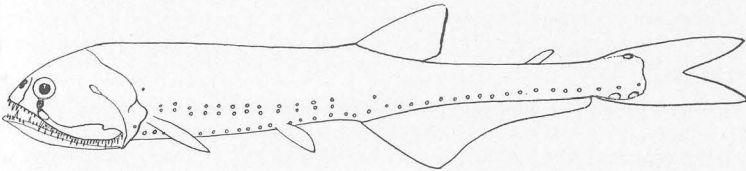


Fig. 105. *Gonostoma elongatum*, from Brauer.

Dorsal origin midway between maxillary and caudal base. Adipose fin small, placed nearer dorsal than caudal base. Anal begins very slightly before dorsal origin, first branched ray 2 in head. Caudal trilobate, at least over half of total head length. Pectoral low, slender, pointed, reaches halfway to ventral, half length of head. Ventral inserted midway between mandible tip and hind edge of adipose fin, reaches $1 \frac{1}{2}$ to anal, length $2 \frac{3}{5}$ in head.

Color in alcohol black, photophores obscurely slaty. Inside of mouth and gill opening black. Length 165 mm.

Atlantic and Indian Oceans to depths of 2000 mm. Described above from an example obtained at the mouth of the Congo by the Congo Expedition.

Maurolicidae

Body moderately long, compressed. Edge of upper jaw formed by maxillary and premaxillary, both toothed. Opercular apparatus incomplete. Gill opening very wide, outer gill arch extends forward behind mandibular symphysis. Pseudobranchiae present. No air vessel

or scales. Photophores present along lower side of head and trunk. Dorsal without spinous rays. Adipose fin rudimentary.

Deep-sea fishes, with rather few genera.

KEY TO THE GENERA

a.—MAUROLICINAE. Body shorter and deeper; anal short or moderate, rays usually less than 20.

b.—Body short, depth 2 1/2 to 4.

c.—Entire lower jaw received by dilated maxillaries . . . ICHTHYOCCUS.

cc.—Mouth cleft obliquely ascending, with lower jaw slightly prominent.

MAUROLICUS.

bb.—Body longer, depth 5 to 8; lower jaw enclosed within maxillary, symphyseal and hind inferior angles prominent VINCIGUERRIA.

aa.—DIPLOPHINAE. Body greatly elongate, bandlike, depth 16; mouth very wide, lower jaw projecting; anal elongate, rays 40 or more DIPLOPHOS.

ICHTHYOCCUS Bonaparte

Ichthyococcus BONAPARTE, 1840, 'Iconografia Fauna Ital.,' III, Pesci, part 1, fasc. XXVII, p. 138. Atypic. Type: *Gonostomus ovatus* Cocco. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 2, p. 206.)

Ichthyococcus BONAPARTE, *op. cit.*

Coccia GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 387. Type: *Gonostomus ovatus* Cocco. Monotypic.

Head and body strongly compressed, rather elevated. Eye moderate, lateral, directed upward. Mouth cleft moderately wide, entire lower jaw received between dilated maxillaries. Premaxillaries very small. Maxillary forms nearly the whole edge of the upper jaw, with a sharp and minutely serrated edge. A few minute teeth near mandibular symphysis. Palate apparently toothless. Interorbital exceedingly narrow ridge between the eyes. Gill rakers very short. Branchiostegals 10. Body covered with silvery pigment. Dorsal nearly midway in body, above ventrals. Anal moderate. Caudal forked. Pectorals and ventrals present.

Ichthyococcus ovatus (Cocco)

Figure 106

Gonostomus ovatus Cocco, 1838, Nuovi Ann. Sci. Nat., Bologna, II, p. 169, Pl. v, fig. 3. Messina.

Ichthyococcus ovatus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 104, Pl. XIV, fig. 2a (off Morocco, 2030 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (off Morocco, 1215 m.; Azores, 1235 m.).

Head 2 3/4; depth 2 1/2; dorsal 11?; anal 12; snout 2 3/4 in head; eye 2 3/4; maxillary 2; interorbital 2 in snout.

Body with the upper profile a little more evenly convex than the lower, deepest apparently midway in head and trunk. Caudal peduncle compressed, short, least depth 2 in head. Head with lower profile a little convex, a trifle more inclined than upper, which apparently little concave, width 3 in its length. Snout about as long as wide. Eye superior, midway in head. Mouth well inclined. Maxillary broad, expanded more behind, slips below preorbital, reaches eye. A few minute symphyseal

mandibular teeth uniserial. Preopercle keel inclined well forward. Opercle narrow, deep. Gill opening forward about opposite middle of snout. Double series of photophores along each side of mandible anteriorly. Dorsal inserted about midway in

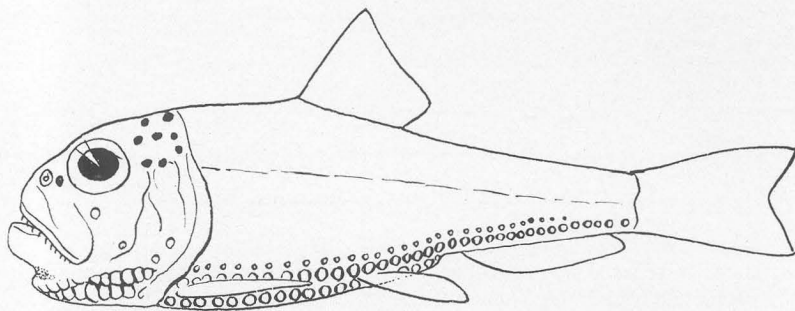


Fig. 106. *Ichthyococcus ovatus*, from Vaillant.

body. Anal inserted behind dorsal base. Pectoral nearly reaches opposite dorsal origin. Ventral inserted about opposite dorsal origin. Largely silvery. Length about 25 mm.

Eastern Atlantic and Mediterranean. Described above from Italian examples, in poor condition, in the Academy.

MAUROLICUS Cocco

Maurolicus Cocco, 1838, *Nuovi Ann. Sci. Nat.*, Bologna, II, p. 192. Type: *Scopelus amethystino punctatus* Cocco. Monotypic.

Body oblong. Eye moderate. Mouth cleft rather wide, oblique. Maxillary large, wide, much produced backward, receives slender premaxillary in upper concave part of its edge. Premaxillary and maxillary with a sharp edge, with uniserial minute teeth. Mandible with a few minute teeth. No vomerine or palatine teeth. Lower jaw protrudes. Gill rakers very long. Pseudobranchiae well developed. Branchiostegals 8 or 9. Body covered with silvery pigment. Dorsal on hinder half of body, before anal. Anal rather long, hind rays minute, hidden in skin and muscles. Caudal forked.

Maurolicus pennanti (Walbaum)

Figure 107

Argentina pennanti WALBAUM, 1792, 'Arted. Pisc.', III, p. 47 (on *Sheppy argentine* Pennant, 1769, 'Brit. Zool.', IV, p. 327, Pl. LXV. Sheppy).

Maurolicus amethystino-punctatus VAILLANT, 1919, *Rés. Camp. Sci. Monaco*, LII, p. 130 (Gulf of Cadiz, N. lat. 35° 59', W. long. 5° 24' 15'', surface; Pavoação, São Miguel, Azores, surface).

Head 3; depth 4; dorsal 10; anal 10+12 (?); ventral 6. Luminous spots as mere impressions, not placed upon black globular body; 12 pairs between throat and

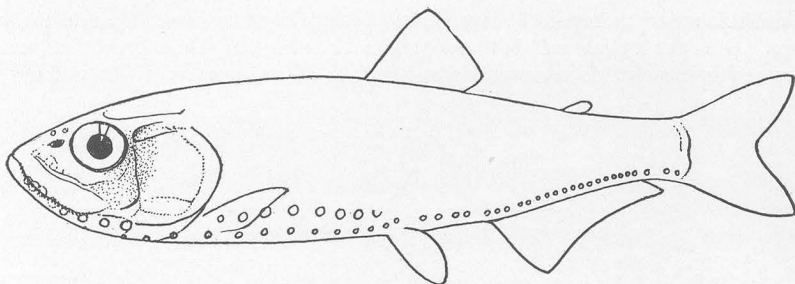


Fig. 107. *Maurolicus pennanti*, modified from Day.

ventral fins, without those of isthmus. Dorsal origin nearer caudal base than snout tip, immediately behind third anal ray. Length 5 mm. (Günther.)

Eastern Atlantic and Mediterranean. Reported by Barnard as *Maurolicus pennanti* (1925, Ann. South African Mus., XXI, p. 151) from off Cape Point in 190 fathoms, also Tristan d'Acunha.

VINCIGUERRIA Jordan and Evermann

Vinciguerria JORDAN AND EVERMANN, 1896, Bull. U. S. Nat. Mus., No. 47, part 1, p. (576) 577. Type: *Maurolicus attenuatus* Cocco. Monotypic.

Zalarges (Jordan and Williams) JORDAN AND STARKS, 1895, Proc. California Acad. Sci., (2) V, p. 793. Type: *Zalarges nimbarius* (Jordan and Williams) Jordan and Starks. Monotypic.

Body elongate. Head conic, compressed. Snout pointed. Eye large. Mouth cleft wide, bordered by premaxillary and maxillary, latter ventrally curved and reaches a little behind eye. Lower jaw inclosed within maxillaries, symphyseal and posterior inferior angle prominent, protruding. Series of small unequal teeth in jaws, slightly increasing in size backward. Row of 4 or 5 teeth on palatines. Gill membranes not joined, free from isthmus. Gill rakers well developed. Scales thin, cycloid. Besides those on head 2 rows of photophores, ventral extending from isthmus to caudal and subventral from opercle till over vent. Dorsal short, nearly median. Origin of short anal below hind portion of dorsal. Short adipose fin behind anal. Caudal forked. Pectorals low. Ventrals before dorsal.

Bathypelagic.

Vinciguerria lucetia (Garman)

Figure 108

Maurolicus lucetius GARMAN, 1899, Mem. Mus. Comp. Zoöl., XXIV, p. 242, Pl. J, fig. 2. N. lat. 0° to 21°, W. long. 82° to 106°, in 100 to 1832 fathoms.

Vinciguerria lucetia BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XI (1), p. 97, Fig. 40 (Gulf of Guinea).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 56, Pl. II, fig. 4 (off Canaries, N. lat. 28° 4', W. long. 16° 49' 30", in 1000 m.; east of Madeira, N. lat. 32° 18', W. long. 23° 58', in 1000 m.; between Madeira and Azores, N. lat. 33° to 37°, W. long. 25° to 41°, in 1000 to 3000 m.).—MURRAY AND HJORT,

1912, 'The Depths of the Ocean,' p. 612, Fig. 457 (off Morocco, Canaries, Cape Blanco, Azores, 141 to 3886 m.).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 181 (southwest of Sierra Leone, N. lat. 0° to 5° , W. long. 16° to 21° , 10 to 3000 m.; northwest of Cape Verde Islands in N. lat. $17^{\circ} 28'$, W. long. $29^{\circ} 42'$, 3000 m.).

Head $3\frac{1}{5}$ to $4\frac{1}{5}$; depth 5 to 8; dorsal 13 or 14; anal 14 or 15; eye oval, $3\frac{1}{3}$ to $3\frac{1}{2}$ in head, equals pointed snout or twice slightly concave interorbital. Photophores 2 suborbital, front black one between nostril and eye, other below hind orbital edge; 3 operculars, 2 above each other at preopercle edge and posterior behind lower anterior; 1 each side behind symphysis; 8 or 9 branchiostegals; ventral series of 21 to 23 between isthmus and ventrals, 8 to 10 between ventrals and anal, 12 or 13 between anal origin and caudal base of which 6 or 7 behind anal fin; subventral series of 11 to 13 between opercle and ventrals, then 5 to 9 to ventrals. Dorsal origin

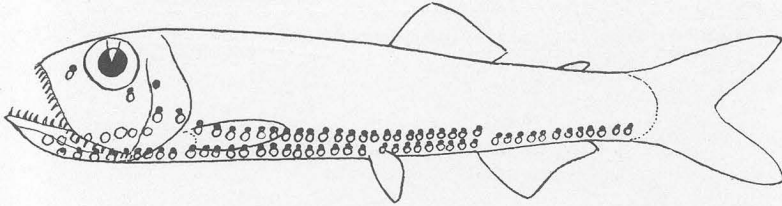


Fig. 108. *Vinciguerria lucetia*, from Murray and Hjort.

median or slightly advanced, eighth ray above anal origin. Pectoral not reaching ventral. Ventral inserted before middle of body, not reaching anal. Blackish above, sides of head and body silvery. Black spot at end of tail and some short transverse stripes on back. Length 50 mm. (Weber and Beaufort.)

Atlantic, Indian, and Pacific Oceans.

DIPLOPHOS Günther

Diplophos GÜNTHER, 1873, Jour. Mus. Godeffroy, II, p. 101. Type: *Diplophos taenia* Günther. Monotypic.

Body well elongate, bandlike. Head compressed. Snout pointed. Eye moderate. Mouth very wide, slightly oblique. Lower jaw projects. Jaws with small, pointed, and rather unequal teeth. Scales large, thin, deciduous (?). Dorsal fin in advance of anal, behind ventral. No adipose fin. Anal very long. Paired fins well developed.

Two species, of the open seas.

Diplophos taenia Günther

Figure 109

Diplophos taenia GÜNTHER, 1873, Jour. Mus. Godeffroy, II, p. 102. Mid-Atlantic in S. lat. 30° , W. long. 24° and N. lat. 22° , W. long. 30° ; 1889, 'Rept. Voy. "Challenger"' (Pelagic Fish.), XXXI, p. 32, Pl. IV, fig. (types).—LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn (Spolia Atlantica), (6) VII, p. 278, Pl. II, figs. 1-3 (N. lat. 10° , W. long. 25° ; S. lat. 10° , W. long. 12°).—BRAUER, 1906, 'Wiss.

Ergebn. "Valdivia," XV (1), p. 89, Fig. 36 (N. lat. $5^{\circ} 5' 3''$, W. long. $13^{\circ} 27' 5''$, in 3070 m.).

Head 6; depth 16; dorsal 8; anal 43; ventral 8. Snout more than twice eye. Maxillary extends back far behind eye. Photophores rounded, black, without silvery centers, very numerous, in two parallel rows along each side of lower profile; those of upper row smaller than those of lower, quite round, not extending so far toward head and caudal base as lower row; lower photophores larger and transversely oblong; a pair of still larger luminous organs at front of base of lower caudal rays. Dorsal short, first ray somewhat nearer snout end than caudal base. Anal begins below last

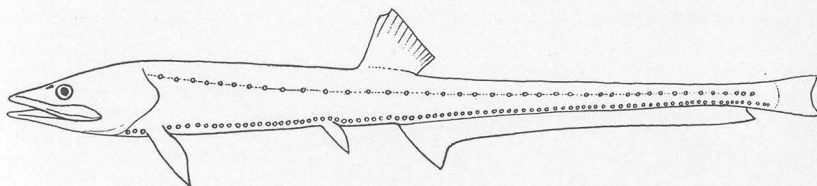


Fig. 109. *Diplophos taenia*, modified from Günther.

dorsal ray, ends short space before caudal. Paired fins short. Pectoral inserted nearer lower profile than upper. Ventrals nearly reach opposite dorsal origin. Brownish. Length 38 mm. (Günther.)

Open tropical Atlantic, usually found at the surface at night. Listed by Barnard from off Natal in 250 fathoms (Ann. South African Mus., XXI, 1925, p. 149).

Opisthoproctidae

Body oblong, compressed. Head conic, mostly compressed. Snout variously protruding, conic. Eyes telescopic, directed dorsally and separated by narrow septum. Mouth minute, simple. Teeth obsolete or minute. Front of snout and head translucent. Nostrils together, on papilla. Gill openings large. Pseudobranchiae present. Vertebrae 35. Scales large, thin, cycloid, very loose. Head naked. Dorsal postmedian, moderate. Adipose fin present. Caudal normally terminal, bilobate, on distinct caudal peduncle. Paired fins well developed.

Two genera, bathypelagic.

KEY TO THE GENERA

a.—Body rather slender, depth about $4 \frac{1}{2}$; eyes vertical, directed forward.

WINTERIA.

aa.—Body deep, depth about $2 \frac{1}{2}$; eyes vertical, directed upward.

OPISTHOPROCTUS.

WINTERIA Brauer

Winteria BRAUER, 1901, Sitzs. Gesell. Naturf. Marburg, VII, p. 126. Type: *Winteria telescopa* Brauer. Monotypic.

Body slender, sides somewhat compressed. Eye large, telescopic. Upper jaw broadens behind. Lower jaw included within upper. Teeth obsolete or very feeble. Interorbital very narrow. Opercle large, free forward. Gill openings wide. Scales moderately large, cycloid. Lateral line present. Dorsal small, at last one-third in body, base entirely before anal. Small adipose fin above anal. Ventral close before dorsal.

Winteria telescopa Brauer

Figure 110

Winteria telescopa BRAUER, 1901, Sitzs. Gesell. Naturf. Marburg, VIII, p. 126. Gulf of Guinea; 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 14, Pl. 1, figs. 4 to 6 (Gulf of Guinea in N. lat. 2° 36' 5", W. long. 3° 27' 5", in 3000 m.).

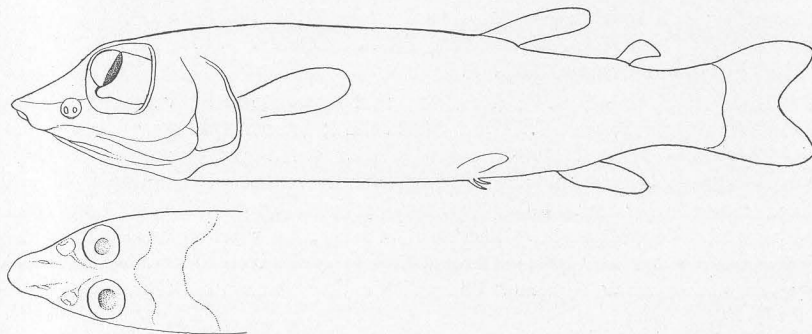


Fig. 110. *Winteria telescopa*, from Brauer.

Head $3\frac{1}{10}$; depth $4\frac{1}{2}$; dorsal 8; anal 8; pectoral 12; ventral 9; scales in lateral line 34, scales above 5, below 6; snout 3 in head; eye 3. Eye very large, obliquely dorsal and rostrad. Nostrils on somewhat laterally extended large papilla, close before eye. Interorbital narrow septum. Gill membranes overlap. Dorsal placed close behind ventral, not reaching adipose fin. Latter moderate. Anal inserted behind last fourth in body, like dorsal. Caudal evenly emarginate. Pectoral median laterally, about size of dorsal. Ventral inserted near last third in combined head and trunk. Blue or velvety black. Gill covers and eye edge metallic. Each scale of lateral line with small silvery blotch. All other scales each with two parallel short silvery longitudinal streaks. Fins white, bases black. Length 111.25 mm. (Brauer.)

Deep water in the Gulf of Guinea.

OPISTHOPROCTUS Vaillant

Opisthoproctus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 105. Type: *Opisthoproctus soleatus* Vaillant. Monotypic.

Body rather deep, strongly compressed. Belly level or flattened. Eyes large, close together. Mouth cleft minute, inferior on rostrum. Lower jaw leveled, expanded behind. Teeth minute or obsolete. Gill opening wide, membranes strong, free from isthmus. Gills 4. Scales large, in even longitudinal rows. Lateral line straight. Dorsal and ventral behind middle of body. Adipose fin moderate.

KEY TO THE SPECIES

- a.*—Front end of level belly advanced until close behind vertical of snout tip; ventral and dorsal origins about opposite; no anal. *soleatus*.
aa.—Front end of level belly advanced only about vertical with nostrils; ventral origin behind dorsal origin; anal present. *grimaldii*.

Opisthoproctus soleatus Vaillant

Opisthoproctus soleatus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 106, Pl. XIV, fig. 1-*a*. Off Morocco, 2030 m.—BRAUER, 1901, Sitzs. Gesell. Naturf. Marburg, No. 8, p. 125 (Gulf of Guinea); 1906, 'Wiss. Ergebn. "Valdivia," XV (1), p. 15, Pl. I, figs. 8-10 (N. lat. 0° 56' 4", W. long. 4° 34' 7", 4000 m., Gulf of Guinea).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 611 (south of Azores).—ROULE, 1919, Bull. Inst. Océanogr. Monaco, No. 52, p. 21, Pl. v, fig. 3 (east of Azores, 2600 m.).

Head $4\frac{1}{2}$; depth $2\frac{3}{5}$; dorsal 11; anal 13; pectoral 14; ventral 11; lateral line scales 19; transversely 7. Eye $2\frac{3}{5}$ in head; snout 3. Eye very large, large lens directed vertically. Mouth cleft very small, small opening on rostrum below. Nostrils shortly before eye. Dorsal origin opposite ventral. Small adipose fin midway between end of dorsal and caudal. Anal present. Pectoral low, not quite reaching ventral. Ventral origin at last third in body, not reaching vent. Vent close before anal. Brownish black, with wash of metallic sheen on gill opening and cheek. Eyes strong, with metallic sheen. Fins whitish. Length 52 mm. (Brauer.)

Eastern Atlantic.

Opisthoproctus grimaldii Zugmayer

Figure 111

Opisthoproctus grimaldii ZUGMAYER, 1911, Bull. Inst. Océanogr. Monaco, No. 193, p. 2. N. lat. 36° 10', W. long. 11° 48', in 4750 m., off Portugal; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 13, Pl. I, fig. 5 (type).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 611, Fig. 452 (off Morocco, 1215 m.; south of Azores).

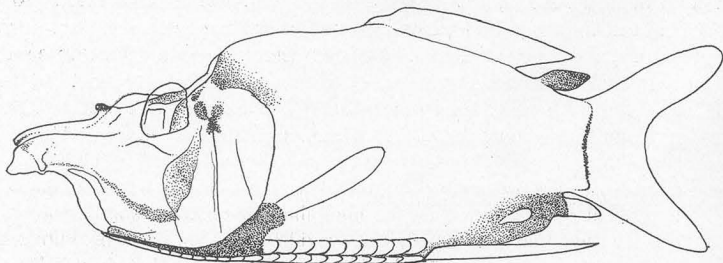


Fig. 111. *Opisthoproctus grimaldii*, from Zugmayer.

Head $2\frac{1}{3}$; depth $2\frac{1}{3}$ to $2\frac{1}{2}$; dorsal 14; anal 8; pectoral 14; ventral 14; scales in lateral line 27, transversely 7; snout $4\frac{4}{5}$ to $4\frac{9}{10}$ in head. Eye telescopic, vertical. Mouth very small, on under surface of snout. Rudimentary teeth in series on front mandibular edge and premaxillary with series of microscopic teeth forming rough surface. Nasal papilla well before eye. Branchiostegals rudimentary. Dorsal long, inserted little before ventral. Adipose fin moderate. Anal very small, opposite adipose fin. Caudal large, symmetrical, lobate. Pectoral not quite reaching ventral or slightly beyond dorsal origin. Ventral reaches caudal base. Blackish silvery on sides and body, deep black upon thorax, back, and behind ventral. Snout and front transparent white. Level portion of belly silvery, with 3 or 4 transverse black bands. Pyriform silvery blotch before anal. Fins covered with small black dots. Adipose fin black. Opercular region silvery, with nacre reflections. Length 48 mm. (Zugmayer.)

Sternoptychidae

Body short, front part elevated, compressed or elongate, and front part not differentiated by its height from posterior part. Eye large. Mouth cleft vertical or nearly so. Small teeth in jaws, present or absent on vomer. No barbel. Gill membranes free from isthmus or attached, also sometimes delicately united. Gill rakers well developed. Gills 4. Branchiostegals 5 to 11. Pseudobranchiae present or absent. Scales absent or very loose. Preorbital, postorbital, and ocular luminous organs single; on mandibular symphysis, in branchiostegal membrane and in body in groups; between isthmus and ventral in ventral and subventral series, between ventrals and caudal in one series; body without smaller scattered luminous organs; no whitish punctiform organs on fins. Dorsal origin, which may be preceded by spines in middle of body or behind it, above or before that of anal. Adipose fin low, totally or partly above hinder part of anal, which may be divided. Ventrals small, below or before dorsal origin.

KEY TO THE GENERA

- a.—Body high, short, depth $1\frac{1}{2}$; pseudobranchiae present; anal 11 to 17.
 b.—No abrupt ventral constriction between trunk and tail; eyes normal; teeth on vomer; dorsal fin preceded by a forked spine; anal not divided.
 POLYIPNUS.
 bb.—An abrupt ventral constriction between trunk and tail; no teeth on vomer; dorsal fin preceded by a large triangular transparent plate.
 c.—Eyes normal; space between trunk and tail filled by transparent integumentary plate; anal not divided. STERNOPTYX.
 cc.—Eyes telescopic; body hatchet-shaped, ventral constriction without integumentary plate; anal divided. ARGYROPELECUS.
 aa.—Body elongate, not elevated, depth $3\frac{3}{4}$; no pseudobranchiae; anal 23 or 24.
 VALENCIENNELUS.

POLYIPNUS Günther

Polyipnus GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 170. Type: *Polyipnus spinosus* Günther. Monotypic.

Polyipnus auct.

Snout very short. Eye large. Mouth cleft vertical, rather small, bordered above by slender premaxillaries, which followed by posteriorly expanded maxillaries. Mandible received within upper jaw. Bands of minute teeth on premaxillaries and mandible, in series on maxillary. Similar teeth on vomer. Preopercular spine strong. Spiny ridges on head and belly. Gill rakers rather long. Gill opening wide, membranes free from isthmus, delicately united. Branchiostegals 9 to 11. Body covered with large, extremely thin, deciduous scales. Luminous organs before, behind, and below eye, on opercle, between branchiostegals, in groups along isthmus, ventral edge, between ventrals and anal, above and behind anal, above and behind pectorals. Dorsal origin nearly midway in body. Adipose fin low. Anal begins at last third in body. Caudal forked. Pectorals low, long. Ventrals short.

Polyipnus spinosus Günther

Figure 112

Polyipnus spinosus GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 170, Pl. LI, fig. 13. Between Philippines and Borneo, 250 fathoms.—BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 120, Pl. VII, fig. 3, Text Figs. 64-66 (Gulf of Guinea, N. lat. 2° 36' 5", E. long. 3° 27' 5", in 1200 m.).

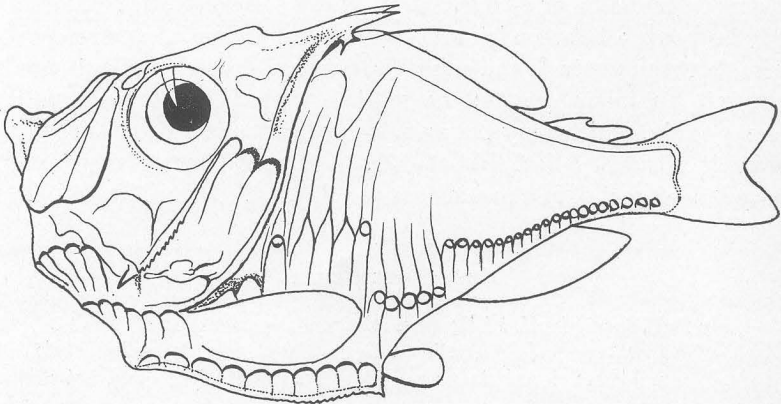


Fig. 112. *Polyipnus spinosus*, from Brauer.

Head 3; depth $1\frac{1}{3}$ to $1\frac{2}{3}$; dorsal 12 or 13; anal 15 to 17; pectoral 12 to 14; ventral 5; eye $2\frac{1}{2}$ in head. Snout very short, less than pupil. Blunt spine at mandibular symphysis and its lower hind angle, lower mandibular border denticulated. Head above with 2 serrated ridges, beginning on each side behind nostril and bordering concave space, slightly converge toward middle of occiput and continued by two

strong diverging crests, ending in sharp recumbent spine. Preopercle edge serrated near angle, which is armed with slender clawlike spine pointing vertically downward. Ventral edge of trunk serrated, with anterior and posterior spine, followed by a spinulous edge, each side between ventrals and anal. Black oval preorbital luminous organ before middle of eye; postorbital on same level, suborbital below middle of eye; small opercular below the level of suborbital; 6 branchiostegals; 6 between isthmus and pectorals; 10 along ventral edge; 5 between ventrals and anal, front one elevated; 12 to 16 above anal with 4 or 5 in separated group posteriorly decreasing in size backward; 2 above, 3 behind pectoral base, above last of which, one high up, nearly in middle of body height. Dorsal origin at last third in length. Pectorals almost reach small ventrals. Silvery, back yellowish brown. Length 85 mm. (Weber and Beaufort.)

Tropical Atlantic and Pacific. Reported by Barnard from off Cape Morgan and Natal in 306 fathoms (1925, *Ann. South African Mus.*, XXI, p. 155, Pl. VIII, fig. 2).

STERNOPTYX Hermann

Sternoptyx HERMANN, 1781, *Der Naturforscher*, XVI, p. 33. Type: *Sternoptyx diaphana* Hermann. Monotypic.

Sternoptyx CUVIER, 1817, 'Règne Animal,' II, p. 171. Type: *Sternoptyx diaphana* Hermann.

Body greatly elevated, compressed. Snout very short. Eye large. Mouth cleft subvertical, upper edge formed by very short premaxillaries and maxillaries. Lower jaw received in upper, hind lower angle with short spine, as also at preopercle angle and symphysis of humeral bones. At pelvic symphysis 2 spines, 1 directed forward, smaller backward. Bifid spine behind vent. Numerous small unequal teeth in jaws, none on palate. Gill opening very wide, membranes joined to isthmus. Gill rakers moderate. No scales. Luminous organs 1 below and 1 behind eye, 1 opercular, group on branchiostegals, group on isthmus, series along ventral edge, series between ventrals and anals, above anal, behind anal, above pectorals. Dorsal origin behind middle of body. Upper edge of predorsal plate dentated and strong spine along its hind edge. Low adipose fin reaches nearly from dorsal to caudal. Caudal broadly forked. Anal on tegumentary abdominal fold between trunk and tail. Pectorals low, extend beyond small ventrals.

Sternoptyx diaphana Hermann

Figure 113

Sternoptyx diaphana HERMANN, 1781, *Der Naturforscher*, XVI, p. 133, Pl. I, figs. 1-2; 1804, 'Observ. Zool.,' Fische, pp. 301, 328. Jamaica.—VALENCIENNES, 1849, 'Hist. Nat. Poiss.,' XXII, p. 309 (25 leagues north of St. Helena, Azores, from "requin" in N. lat. 29°, W. long. 45°).—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 102 (Morocco coast, Azores, 1123 to 2792 m.).—BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 115, Text Figs. 56-63 (Canaries, Sierra Leone, Gulf of Guinea, between Congo mouth and Cape Colony).—ZUGMAYER, 1911, *Rés. Camp. Sci. Monaco*, XXXV, p. 54, Pl. II, fig. 5 (off Azores, N. lat. 31° to 36°, W. long. 27° to 42°, in 2000 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (off Morocco, Canaries, Azores, 1215 to 3886 m.).—

PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 183 (south of Ascension Island in S. lat. 11° 19', W. long. 18° 34', in 1200 m.; S. lat. 14° 3', W. long. 19° 10', in 1900 m.; S. lat. 12° 11', W. long. 6° 16', in 2000 m.; S. lat. 10° 6', W. long. 7° 31', in 3000 m.; southwest of St. Helena in S. lat. 23° 33', W. long. 20° 51', in 3000 m.; southwest of Sierra Leone in N. lat. 0° 46', W. long. 18° 59', in 3000 m.; N. lat. 5° 27', W. long. 21° 41', in 1500 m.; northwest of Cape Verde Islands in N. lat. 17° 28', W. long. 29° 42', in 3000 m.).—JESPERSEN, 1915 (April 5), Rept. Danish Oceanogr. Exped. Medit., No. 3 (A.2), p. 28 (off Morocco in N. lat. 35° 53', W. long. 7° 26', in 1300 m.; N. lat. 35° 53', W. long. 7° 26', in 1225 m.).—ROULE, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 24 (east of Pico, Azores, in 1748 m.; between Portugal and Azores in 2100 m.; between Pico and São Jorge at surface).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 129 (off Azores in N. lat. 38° to 39°, W. long. 25° to 26°, in 1940 m.; from *Alepidosaurus ferox* off Madeira in N. lat. 32°, W. long. 16° to 17°, in 2480 m.).

Sternoptyx diaphanus LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 283 (S. lat. 19° 30', W. long. 26°; N. lat. 28°, W. long. 35°; N. lat. 30°, W. long. 19°).—COLLETT, 1896, Rés. Camp. Sci. Monaco, p. 125 (Azores, St. Helena, Cape Verde).—RICHARD, 1910 (February), Bull. Inst. Océanogr. Monaco, No. 162, p. 149 (in *Thynnus alalonga* from off Azores).

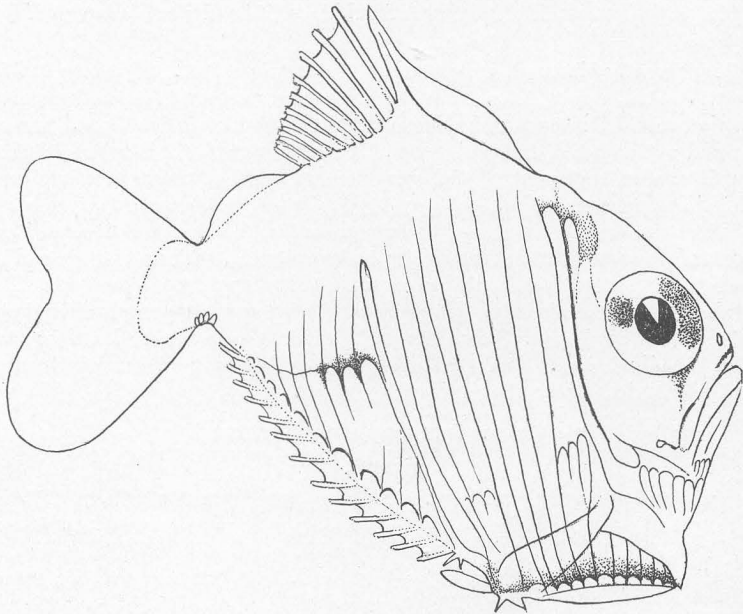


Fig. 113. *Sternoptyx diaphana*, from Zugmayer.

Head $2\frac{1}{2}$ to 3; depth about equals space between snout and caudal base; dorsal 9 to 12; anal 13 or 14; pectoral 10; ventral 5; eye usually 2 in head. Post-orbital luminous organ behind middle of eye, inconspicuous with age; suborbital

close to preopercular spine; 1 ventrally on opercle; 3 branchiostegals; ventral series of 5 on isthmus; 10 close set each side along ventral edge; 3 between ventrals and anal, far above ventral profile; 3 at beginning of tail above transparent integumentary fold; single organ above and slightly before it; 4 small organs between anal and caudal; 3 above pectoral base. Silvery, back dark, fins translucent. Length 45 mm. (Weber and Beaufort.)

Atlantic, Indian, and Pacific Oceans. Listed by Barnard as *Sternoptyx diaphana* (1925, Ann. South African Mus., XXI, p. 154) off Cape Point in 1014 fathoms.

ARGYROPELECUS Cocco

Argyropelecus Cocco, 1829, Archiv R. Acad. Peloritano, p. 146. Type: *Argyropelecus hemigymnus* Cocco. Monotypic.

Pleurothyris LOWE, 1843, 'Hist. Fish. Madeira,' p. 64. Type: *Sternoptyx olfersii* Cuvier. Monotypic.

Pleurothysis auct.

Body compressed, short, front portion much higher than posterior, short ventral ridge with an anterior and 2 posterior spines. Upper jaw edge formed by premaxillary and curved maxillary, which enclose mandible, which is furnished with a prominent hook at symphysis and at lower hind angle. Palatines with a row of small, curved teeth. Preopercle has 1 or 2 spines ventrally. Gill opening wide, membranes free from isthmus and each other. Gill rakers long. Branchiostegals 9. No scales. Luminous organs on head before and below eyes, on opercle, group on branchiostegals, ventral and lateral series on trunk, 3 groups on tail. Predorsal plate serrated, followed by 7 to 9 rays before dorsal. Long, low adipose fin present. Caudal deeply emarginate. Pectorals long and low. Ventrals very small.

Argyropelecus d'urvillei Valenciennes,¹ if distinct from *Argyropelecus hemigymnus*, may occur within the limits under consideration.

KEY TO THE SPECIES

- a.—Front part of body much deeper than hind part; luminous organs in 3 lateral series.
- b.—No spines along lower edge of tail.
- c.—Length of hind part of body somewhat more than 2/3 depth of front part; anal VII, 5.....*olfersii*.
- cc.—Length of hind part of body somewhat less than depth of front part; anal VI, 5.....*hemigymnus*.
- bb.—Spines present along lower edge of tail; anal VII, 5.....*acanthurus*.
- aa.—Front part of body a little deeper than hind part; luminous organs between pectoral and caudal in a continuous row; posterior portion of body equals anterior; anal VII, 6.....*affinis*.

Argyropelecus olfersii (Cuvier)

Figure 114

Sternoptyx olfersii CUVIER, 1829, 'Règne Animal,' II, 2nd Ed., p. 316. Found in the cooler parts of the Atlantic.

¹1849, 'Hist. Nat. Poiss.,' XXII, p. 301. Mid-Atlantic.

Argyropelecus olfersii VALENCIENNES, 1849, 'Hist. Nat. Poiss.,' XXII, p. 303 (southeast of Cape of Good Hope and between the Canaries and Brazil).—LOWE, 1850, Proc. Zool. Soc. London, p. 247 (Madeira).—LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift. Kjøbenhavn, (6) VII, p. 282 (Azores; N. lat. 33° to 47° , W. long. 23° to 27°).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 331 (Canaries).—COLLETT, 1896, Rés. Camp. Sci. Monaco, p. 127, Pl. III, fig. 14 (Azores).

Argyropelecus olfersii BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 108, Fig. 46 (Gulf of Guinea).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 52 (between Azores and Spain in N. lat. $43^{\circ} 4' 30''$, W. long. $19^{\circ} 42'$, at surface).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612, (off Morocco, Azores, in 1215 to 3229 m.).—JESPERSEN, 1915 (April 5), Rept. Danish Oceanogr. Exped. Medit., No. 3 (A.2), p. 23 (off northern Morocco).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 25 (southeast of Pico, Azores, surface to 1748 m.; between Pico and São Jorge, surface; Princess Alice Bank at surface; between Portugal and Azores in 2100 m.; near Azores in 2600 m.).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 135 (north of Madeira in N. lat. $36^{\circ} 54'$, W. long. $20^{\circ} 46' 15''$, at surface; off Azores in N. lat. $38^{\circ} 53'$, W. long. $26^{\circ} 40' 45''$, in 1935 m.).

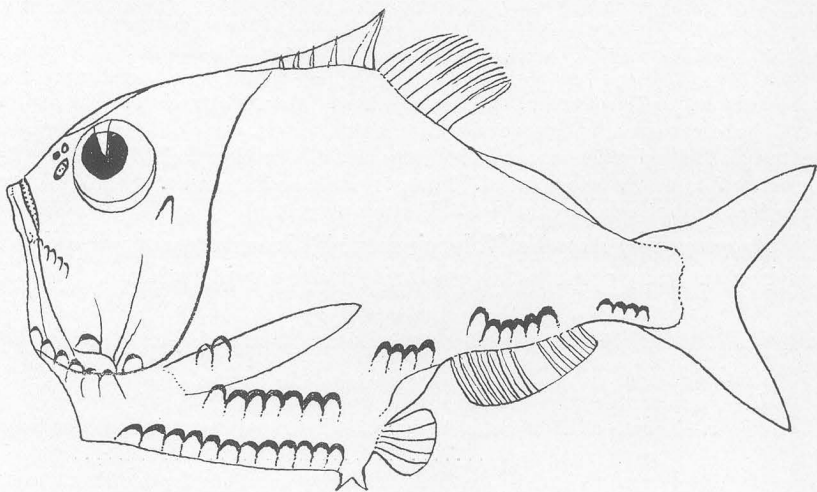


Fig. 114. *Argyropelecus olfersii*, from Brauer.

Head 3 to $3 \frac{1}{3}$; depth $1 \frac{3}{5}$; dorsal VII, 9; anal VII, 5; pectoral 10 or 11; ventral 6. Telescopic eye $2 \frac{1}{5}$ to 3 in head, nearly vertical, $\frac{1}{5}$ to $\frac{1}{3}$ longer than snout. Mouth cleft nearly reaches vertical through eye center. Mandible with prominent symphyseal spine and a short flat one at hind corner. Preopercular spine directed downward. Spine at shoulder. Preorbital luminous organ below nostril; suborbital near hind maxillary end; 2 operculars, dorsal nearly level with lower eye edge, lower behind preopercular spine; 6 branchiostegals; ventral series meets opposites,

6 behind isthmus, 12 along ventral edge; between ventrals and caudals on each side there are 3 far-distant groups, first of 4 before anal, with 2 median shorter; second group above middle of anal, 5 or 6 unequal, median somewhat shorter; third group before front caudal rays of 4 nearly equal organs; 2 organs above pectorals and series of 6 somewhat distant between it and ventral. Soft dorsal begins before second third of length, ends before anal origin. Adipose fin long and low. Pectoral reaches ventral, which inserted behind soft dorsal origin. Length 100 m. (Weber and Beaufort.)

Atlantic and Indian Oceans. Listed by Barnard as *Argyropelecus olfersi* (1925, Ann. South African Mus., XXI, p. 153) from off Cape Point in 460 fathoms.

***Argyropelecus hemigymnus* Cocco**

Argyropelecus hemigymnus Cocco, 1829, Giorn. Sci. Sicil., fasc. 77, p. 146. Messina.—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 103 (Canaries and off Morocco, in 1123 to 1200 m.).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 51 (Madeira at N. lat. 28° 4', W. long. 16° 49' 30'', in 1000 m.; between Azores and Portugal in N. lat. 37° 41', W. long. 15° to 19°, in 1000 to 3000 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 458, Fig. 458 (off Morocco, Canaries, Cape Blanco, Azores, in 1197 and 3886 m.).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 182 (south of Ascension Island in S. lat. 11° 19', W. long. 18° 34', in 1200 m.; southwest of Sierra Leone in N. lat. 0° 46', W. long. 18° 59', in 3000 m.; N. lat. 5° 27', W. long. 21° 41', in 5000 m.; northwest of Cape Verde Islands in N. lat. 17° 28', W. long. 29° 42', in 3000 m.; north of St. Helena in S. lat. 12° 11', W. long. 6° 16', in 2000 m.; southeast of St. Helena in S. lat. 23° 33', W. long. 20° 51', in 3000 m.; off Ascension Island in S. lat. 8° 43', W. long. 11° 55', in 3000 m.).—JESPERSEN, 1915 (April 15), Rept. Danish Oceanogr. Exped. Medit., No. 3 (A.2), p. 7 (off northern Morocco).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 25 (between San Miguel and Terceira, Azores, in 992 m.; between Portugal and Azores, in 2100 m.; off Azores in 2600 m.).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 129 (off Azores in N. lat. 37°, W. long. 24°, at surface; off Madeira in N. lat. 32° 36', W. long. 14° 27' 15'', at surface).

Head $2\frac{3}{4}$ to $3\frac{1}{8}$; depth $1\frac{2}{3}$ to $1\frac{4}{5}$; dorsal vi to x, 7 to 10; anal 10 or 11; pectoral 1, 9; ventral 1, 9; snout 3 to $3\frac{2}{3}$ in head measured from upper jaw tip; eye 2 to $2\frac{1}{2}$; maxillary 1 to $1\frac{1}{5}$.

Body strongly compressed, deepest at dorsal origin. Narrow caudal peduncle, its least depth twice its length, or 4 in head. Head width $2\frac{3}{4}$ its length, lower profile little more inclined. Snout short, length $\frac{4}{5}$ basal width. Eye high, its center a little behind middle in head. Mouth large, maxillary large, expansion little over half of eye, hind edge opposite hind pupil edge. Row of small, slender, short teeth in both jaws and along entire edge of maxillary. Short row of similar teeth on each palatine, none on vomer. Nostrils close before eye, posterior larger. Interorbital is a narrow constricted bony ridge. Lower end of mandible ends in strong, sharp-pointed spine. Preopercle with short spine at angle directed back and below, another directed forward. Gill rakers 8 to 11 + 11 to 13, slender, $1\frac{1}{4}$ in eye. Large silvery luminous organ on inner ceratobranchial arch showing indistinctly through maxillary as 6

whitish spots; a similar one on front shoulder girdle each side and below 12 pairs along ventral ridge of trunk; above them, level with isthmian, 6 others in parallel series, as if continuation behind base of pectoral fin; ventrals 4 each side of body; anals 6 pairs; caudals 4 pairs; series of 4 black pigment spots above anal organ in course of lateral line, though latter not developed; 2 large ones above pectoral axil; a large narrow organ close behind the eye, opposite its middle; small brown spot close before front eye edge medianly. Dorsal preceded by 6 spines graduated up to last, each greatly compressed and hastate in shape. Dorsal inserted just after ninth thoracic photophore, first branched ray highest, others graduated down. Anal similar, inserted after dorsal base. Caudal large, emarginate. Pectoral long, reaches nearly opposite depressed ventral tip. Ventral small, inserted below hind dorsal rays, rounded. Silvery, largely whitish, upper surface pale brownish. Fins pale. Length 37 mm.

Atlantic Ocean. Described above from Italian examples in the Academy. Listed by Barnard (1925, Ann. South African Mus., XXI, p. 153) from off Cape Point in 630 fathoms.

Argyrolepecus acanthurus Cocco

Argyrolepecus acanthurus Cocco, 1829, Giorn. Sci. Lett. Arti Sicilia, Palermo, XXVI, No. 77. Messina; 1831, Isis, XXIV, p. 1342 (Messina).

Argyrolepecus aculeatus VALENCIENNES, 1849, 'Hist. Nat. Poiss.,' XXII, p. 302. Azores.—GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 386 (copied).—COLLETT, 1903, Vid. Selsk. Forhandl., Christiania, No. 9, p. 108 (Azores); 1905, Zool. Anzeiger, XXVIII, p. 726 (Azores).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (off Morocco, Canaries, Azores, in 1215 to 2865 m.).

Argyrolepecus olfersii (not Cuvier) COLLETT, 1897, Arch. Math. Naturv. Christiania, XIX, No. 7, p. 14 (Azores).

Dorsal 9; anal 14; pectoral 10; ventral 7. Depth equals space between hind preopercle edge and caudal base. Tail very slender. Mandible with very obtuse spine at its hind corner. Preopercle with spine directed downward. Double row of spines along lower side of tail. (Valenciennes.)

Eastern Atlantic.

Argyrolepecus affinis Garman

Figure 115

Argyrolepecus affinis GARMAN, 1899, Mem. Mus. Comp. Zoöl., XXIV, p. 237. N. lat. 15° 24' 40", W. long. 63° 31' 30", 683 fathoms, off Antilles.—BRAUER, 1901, Sitzs. Gesell. Naturf. Marburg, No. 8, p. 120, Fig. 1 (eye); 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 103, Pl. VII, figs. 1-2, Text Figs. 43-44 (N. lat. 15° 51', E. long. 0° 31' 2", 200 mm., Gulf of Guinea; S. lat. 31° 0' 4", W. long. 8°, 200 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 616 (off Canaries, 2170 m.).—JESPERSEN, 1915 (April 15), Rept. Danish Oceanogr. Exped. Medit., No. 3 (A.2), p. 6 (off Morocco).

Head $3\frac{1}{5}$ to $3\frac{1}{2}$; depth 2 to $2\frac{2}{5}$; dorsal VII, 9; anal VII, 6; ventral 6; pectoral 11; snout $1\frac{1}{2}$ to $1\frac{7}{10}$ in eye; eye $2\frac{1}{5}$ to $2\frac{1}{3}$ in head. Mouth cleft equals half of body depth anteriorly. Premaxillary teeth 14, third and fifth longest; maxillary 12, small; mandibular 15, seventh and eighth longest. Vomer and pala-

tines toothless. Between ventral and anal there are 4 luminous organs, along anal 5, behind anal 5. Soft dorsal begins about midway in body, ends before anal origin. Adipose fin begins above hind part of anal. Preopercle with spine, 1 at shoulder, 1 at

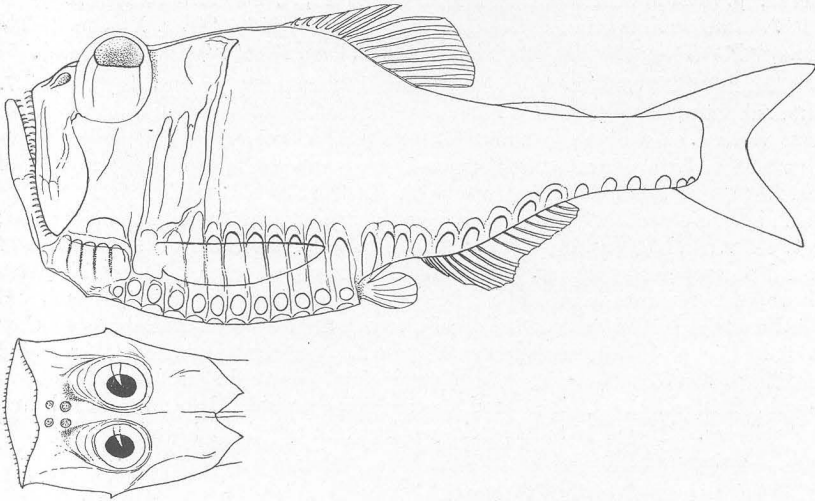


Fig. 115. *Argyropelecus affinis*, from Brauer.

end of isthmus, 2 before ventral. Obsolete streaks on back, end of tail and crosslines on side of back black, with silvery sheen. Length 85 mm. (Brauer.)

Atlantic. Listed by Barnard (1925, *Ann. South African Mus.*, XXI, p. 152, Pl. VIII, fig. 1) off southwest Africa, in 1000 fathoms.

VALENCIENNELUS Jordan and Evermann

Valenciennellus JORDAN AND EVERMANN, 1896, *Bull. U. S. Nat. Mus.*, No. 47, part 1, p. (576) 577. Type: *Maurolicus tripunctulatus* Esmark. Monotypic.

Body elongate, strongly compressed. Head strongly compressed. Mouth cleft wide, very oblique, bordered above by wide curved maxillary receiving anteriorly slender premaxillary. Mandible prominent, enclosed, very wide behind with prominent posterior inferior angle forming most prominent part of ventral profile of head. Jaws with series of minute teeth, curved backward. Gill membranes free from isthmus. Body scaleless. Luminous organs on head; ventral series between isthmus and ventrals and between ventrals and anal, organs touching each other; subventral series begins at isthmus and ends some distance before ventrals; between anal origin and caudal 5 groups of organs in rather large black patches. Origin of short dorsal above front rays of long anal, which reaches behind adipose fin. Caudal emarginate. Pectorals low, base below weak opercle. Ventrals short, before middle of body.

Valenciennellus tripunctulatus (Esmark)

Maurolicus tripunctulatus ESMARK, 1870 (1871), Forh. Vidensk. Selskr., Christiania, XIII, p. 488. Madagascar.

Valenciennellus tripunctulatus MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 612 (off Morocco, Canaries, Cape Blanco, Azores, 1197 to 3886 m.).

?*Valenciennellus stellatus* (not Garman?) BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 100, Fig. 42 (S. lat. 3° 55', E. long. 7° 48' 5", Gulf of Guinea).

Head $3 \frac{1}{3}$ to $3 \frac{3}{4}$; depth $3 \frac{3}{4}$; dorsal 7; anal 24; pectoral 10; ventral 7. Snout about equals eye, which $2 \frac{1}{2}$ in head. Mouth cleft very oblique, not very far from vertical. Both jaws with minute teeth, none on vomer and palatines? Photophores 16 or 17 in ventral series between isthmus and ventrals; lateral series, 10, of which 4 before pectorals, fifth above pectorals, 2 somewhat smaller, close together behind pectorals and followed at short space by 3 larger, equidistant and hindmost; between ventrals and anals series of 5 touching each other; these and lateral series of round organs, partly silvery, partly blackish, bordered by metallic reddish patch above; between anal origin and caudal 5 equidistant black spots, first, second, and third containing 3 white rounded organs, fourth 2, fifth 4; preorbital organ below nostril, series of 4 underneath cheek; 2 opercular, one behind eye and other behind maxillary; 2 or 3 on gill membrane. Dorsal origin opposite first anal rays, midway in length. Pectoral about $\frac{2}{3}$ of head, reaches short ventral. Brownish, opercle and belly silvery. Row of 15 to 17 black spots between opercle and caudal. Length 40 mm. (Weber and Beaufort.)

Atlantic and Indian Oceans.

Anotopteridae

Body greatly elongate, compressed. Head long, slender, attenuated. Snout conic. Eye moderate, within last third of head. Mouth large, cleft for about $\frac{2}{3}$ of head. Teeth small, inconspicuous. Gill cleft large. No scales. Lateral line present. No developed dorsal fin, only small adipose dorsal, close to caudal, leaves but short, slender caudal peduncle. Anal and caudal developed. Pectorals and ventrals present.

One genus in the eastern Atlantic. Deep-sea fishes.

ANOPTERUS Zugmayer

Anotopterus ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 13. Type: *Anotopterus pharao* Zugmayer. Monotypic.

Body slopes gradually back from head to short and slender caudal peduncle. Head moderate. Jaws attenuated. Teeth in jaws, on vomer, but none on palatines. Opercular apparatus complete. Branchiostegals 6. Anal and caudal well developed, latter forked. Pectorals and ventrals minute.

Anotopterus pharao Zugmayer

Figure 116

Anotopterus pharao ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 13. N. lat. 36° 64' 30", W. long. 11° 49', in 5100 m.; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 138, Pl. IV, fig. 4 (type).

Head $4 \frac{1}{5}$; depth $17 \frac{1}{4}$; anal 12; pectoral 12; ventral 4; tubes in lateral line 80; snout $1 \frac{3}{4}$ in head measured from its own tip; eye $7 \frac{1}{4}$; mouth cleft $1 \frac{1}{2}$; interorbital 11. Body slender, compressed. Head narrow. Lower jaw protrudes, ends in forward point. Upper jaw formed by premaxillary and maxillary. Upper front teeth short, small; lower feeble, depressed back, but stronger and erect posteriorly. Vomer with irregular series of very strong teeth. Gill opening large, gill membranes free over wide isthmus. Lateral line evident, complete, midway along side, at least posteriorly. Small adipose fin opposite end of anal, otherwise no dorsal. Pectoral little longer than eye. Ventral inserted about midway between head and

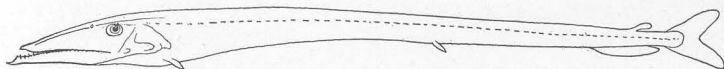


Fig. 116. *Anotopterus pharao*, from Zugmayer.

caudal base. Vent rather close behind ventrals. Clear gray on snout, all of back, and caudal peduncle. Sides of body silvery, yellowish below. Iris and opercles bluish. Length 165 mm. (Zugmayer.)

Eastern Atlantic.

ORDER LYOPOMII

Body slender, compressed, tapers behind. Abdomen rounded. Head partly conic. Mouth inferior. Bones of jaws, palatines, and pterygoids complete, normal. Teeth small, villiform. Preopercle entirely detached from suspensorium, rudimentary, connects only with lower jaw. Opercle normally connected. Subopercle enlarged, partly replaces usual position of preopercle, together with suborbital chain, which is extended backward to opercular edge. Cranium with condyle confined to basioccipital. Gills 4, a slit behind the fourth. No pseudo-branchiae. Branchiostegals about 14. Air vessel large, simple. Stomach caecal. Pyloric caeca in moderate number. Intestines short. Ovaries not closed. Scapular arch formed by proscapula, posterotemporal, and post-temporal, the latter discrete from side of cranium and impinging on supraoccipital. Hypercoracoid and hypocoracoid platelike, foramen in upper edge of latter. No mesocoracoid. Vertebrae 60 or more, front ones separate. Actinosts normal. Scales small, deciduous. Lateral line present. Dorsal fin short, high. No adipose fin. Anal extremely long, extends from vent to end of tail. No caudal fin. Pectoral placed high. Ventrals not far back.

Deep-sea fishes, included in the single family below.

Halosauridae

Body elongate, long slender tail narrowed into a sort of filament. Head depressed in front. Snout flattened, protrudes beyond mouth. Eye rather large. Mouth horizontal, moderate, front edge formed by premaxillary, hind edge by maxillary, which is moderately wide. Teeth in bands in jaws, on rudimentary palatines and pterygoids, none on vomer or tongue. Facial bones with large muciferous cavities. Bones of head unarmed. Gill rakers short. Gill membranes free from isthmus. Scales cycloid, present on trunk and sides of head. No axillary scales. Lateral line low, extends along sides of belly, its scales enlarged, each in a pouch of black skin with luminous organ at base. Dorsal inserted behind ventrals, before vent. Anal rays about 200. Pectoral long, narrow. Ventrals moderate.

KEY TO THE GENERA

- a.—Head without prominent lateral ridges; scales in lateral line scarcely enlarged.
 HALOSAURUS.
 aa.—Head with prominent lateral ridges; scales in lateral line enlarged.
 HALOSAUROPSIS.

HALOSAURUS Johnson

Halosaurus JOHNSON, 1863, Proc. Zool. Soc. London, p. 406. Type: *Halosaurus ovenii* Johnson. Monotypic.

Halosaurichthys ALCOCK, 1889, Ann. Mag. Nat. Hist., London, (6) IV, p. 454. Type: *Halosaurichthys carinicauda* Alcock, monotypic.

Head without angular ridges. Snout obtusely rounded. Vertex covered with scales. Scales of lateral line scarcely enlarged. No second dorsal fin. Anal high. Ventrals normal.

KEY TO THE SPECIES

- a.—Body very slender, depth 23 to 25.....*johnsonianus*.
 aa.—Body deeper, depth 17.....*ovenii*.

Halosaurus johnsonianus Vaillant

Figure 117

Halosaurus johnsonianus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman," Poiss., p. 181, Pl. xv, fig. 2, a-d. Morocco coasts, Canaries, Soudan, Banc d'Arguin, 834 to 2115 m.—RICHARD, 1910 (February), Bull. Inst. Océanogr. Monaco, No. 162, p. 151 (Azores, 1300 to 1372 m.).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (Azores, N. lat. 37° 42' 40", W. long. 25° 5' 15", in 1385 m.).

Head 6 1/2 to 7 3/5; depth 23 to 23 1/3; dorsal 9; anal 200(?); scales (pockets) about 213 (?) in median lateral series to end of tail; about 10 scales transversely at anal origin; snout 2 1/3 in head; eye 5 1/3 to 6; maxillary 2 1/4; interorbital 10.

Body greatly elongated, slender, tapering to a long narrow pointed tail. Head width 3 3/5 to 4 1/4 in its total length. Snout conic, width 2 1/4 to 2 1/2 in its length. Eye large, close to upper profile, front pupil edge midway in head length; diameter

2 1/3 to 2 1/2 in snout, a little greater than interorbital. Mouth large, inferior, front tip of lower jaw about opposite first 2/5 in head. Maxillary reaches opposite front of eye. Teeth conic, fine, small, in 2 or 3 irregular rows in each jaw; vomer with narrow band of small teeth. Tongue smooth, broad, edges free. Nostrils 2 small pores, close together and close before front eye edge. Interorbital slightly convex. Slender spine projects a little beyond end of maxillary.

Gill rakers 4+12, lanceolate, 2 1/2 in eye; gill filaments 2/3 of gill rakers. Scales all fallen, very caducous. Dorsal begins well behind ventral origin or a little nearer anal origin than pectoral base; third ray about 3 in head. Anal begins slightly behind

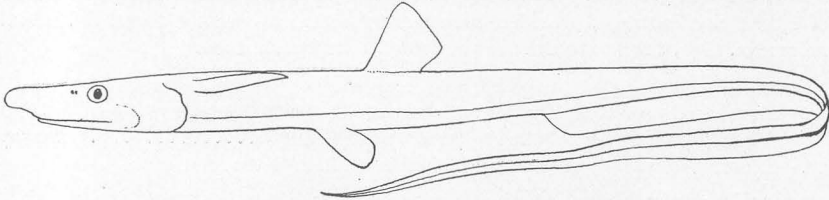


Fig. 117. *Halosaurus johnsonianus*, modified from Vaillant.

first 2/5 in total length; third ray about 4 1/4 in head. Pectoral apparently reaches about halfway to ventral; 2 1/4 in head. Ventral small, 4 1/4 in head, reaches about opposite dorsal origin.

Pale brown. Inside gill opening, pharynx, and mouth black. Fins all pale. Length 200 to 363 mm.

Eastern Atlantic. Described above from two paratypes, in the Museum of Comparative Zoölogy at Cambridge, received from the Paris Museum.

***Halosaurus ovenii* Johnson**

Halosaurus ovenii JOHNSON, 1863, Proc. Zool. Soc. London, p. 406, Pl. xxxvi, fig. 2. Madeira.

Halosaurus ovenii GÜNTHER, 1868, 'Cat. Fish. Brit. Mus.,' VII, p. 482 (type); 1887, 'Rept. Voy. "Challenger,"' XXII, p. 236 (type).—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 175, Pl. XIV, fig. 5, a-f; Pl. XV, fig. 1, a-c; Pl. XVI, fig. 3a (off Morocco, Canaries, Soudan, Banc d'Arguin, Azores, 830 to 1617 m.).

Head 7 1/2; depth nearly 2 in head, 17 in total; dorsal 11; anal 191; pectoral 11; ventral 10; about 170 scales in lateral line, 14 above, 6 below; 60 scales before vent. Preoral portion of snout half its length. Eye 5 in head, much greater than interorbital. Maxillary reaches eye. Scales of lateral line scarcely larger than others, without photophores. Front portion of dorsal covered with small scales. Ventral and anal base scaly. Dorsal inserted little nearer vent than gill opening. Anal inserted well before middle in body. Pectoral reaches halfway to dorsal. Ventral inserted little nearer vent than snout tip, a little shorter than pectoral. Brownish, silvery on abdomen. Inside mouth and gill opening blackish. Length 445 mm. (Johnson, Günther.)

Atlantic Ocean. Listed by Barnard as *Halosaurus oweni* (1925, Ann. South African Mus., XXI, p. 166) from off Table Bay in 600 fathoms.

HALOSAUROPSIS Collett

Halosauropsis COLLETT, 1895, Rés. Camp. Sci. Monaco, IX, p. 143. Type: *Halosaurus macrochir* Günther. Monotypic.

Aldrovandia (not *Aldrovandium* Chiaje, 1844) GOODE AND BEAN, 1895, 'Ocean. Ichth.', p. 132. Type: *Halosaurus rostratus* Günther.

Head with prominent lateral ridges. Snout pointed. Vertex scaleless. Scales of lateral line enlarged, provided with photophores. No second dorsal fin. Anal moderate, high, third to fourth that of dorsal. Ventrals normal.

KEY TO THE SPECIES

- a.—Snout well produced, length greater or equals space between eye and pectoral base; preoral part of snout exceeds half its length. *rostratus*.
- aa.—Snout moderately produced, length not exceeding postocular region of head.
- b.—Eye half of interorbital; preoral part of snout 3 times in its entire length. *macrochir*.
- bb.—Eye equals interorbital; preoral part of snout $3\frac{1}{2}$ in its entire length. *phalacrus*.

Halosauropsis rostratus (Günther)

Figure 118

Halosaurus rostratus GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 251. Mid-Atlantic, in 2750 fathoms; 1887, 'Rept. Voy. "Challenger,"' XXII, p. 241, Pl. LIV, fig. D (type).

Halosauropsis rostratus ROULE, 1919, Rés. Camp. Sci. Monaco, LIII, p. 29 (five miles northeast of Maio, Cape Verde, 1311 m.).

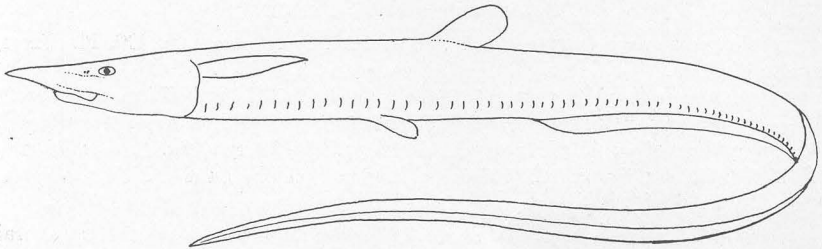


Fig. 118. *Halosauropsis rostratus*, from Günther.

Head $2\frac{3}{5}$ to vent; depth $2\frac{1}{2}$ in head; dorsal 10; ventral 9 or 10; 24 scales before vent; 13 scales above lateral line, 6 below. Snout much produced, spatulate, preoral portion half its length. Eye less than interorbital, $10\frac{3}{4}$ in head. Maxillary scarcely reaches eye. Palatine bands of teeth crescentic, rather widely separated from pterygoid band. Opercle smooth. Scales very caducous. Scales in lateral line

greatly enlarged, 3 times size of others, each with luminous organ, vertically elongated, rhombic, but not extending on upper or lower margins of scales. Lower side of head from snout to gill opening with 2 exceedingly wide muciferous channels, one begins on preorbital and other on mandible, open behind at gill opening by common and very wide aperture. Dorsal entirely before vent, little shorter than pectoral which reaches $2\frac{1}{2}$ to dorsal origin. Ventral inserted nearer vent than gill opening, reaches $2\frac{3}{4}$ to vent and fin about $\frac{2}{3}$ length of dorsal. Color light, lower part of head and gill cover black. Abdominal region blackish. Length 510 mm. (Günther.)

Eastern Atlantic.

Halosauropsis macrochir (Günther)

Figure 119

Halosaurus macrochir GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 250. Atlantic Ocean, 1090 fathoms; midway between Cape of Good Hope and Kerguelen's Land, 1375 fathoms.—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 170, Pl. XVI, fig. 2a-e (coasts of Morocco, Azores, 2200 to 2995 m.).

Halosauropsis macrochir MONACO, 1905 (June), Bull. Inst. Océanogr. Monaco, No. 45, p. 107, Pl. III, lower fig. (off Azores, 1300 to 1400 m.).—RICHARD, 1910 (February), Bull. Inst. Océanogr. Monaco, No. 162, p. 151 (Azores, 1300 to 1372 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 396, Fig. 103b (off Cape Blanco, 2603 m.; south of Azores, 2865 m.).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 29 (30 miles east of Terceira, Azores, 1805 m.; 55 miles north by northwest of Fayal, 1900 m.).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (Azores, N. lat. 37° to 39° , W. long. 26° to 30° , 1165 to 1919 m.).

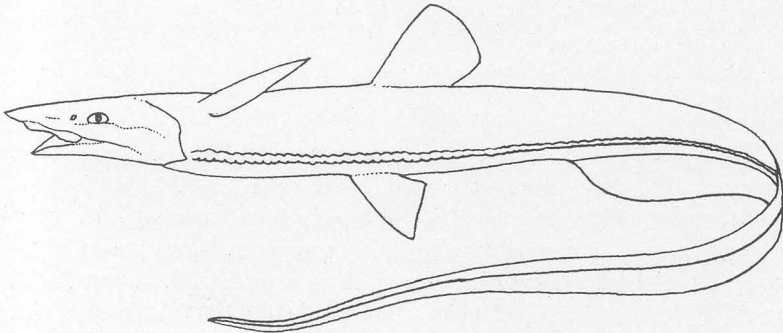


Fig. 119. *Halosauropsis macrochir*, from Murray and Hjort.

Head about $6\frac{1}{2}$; depth $1\frac{7}{8}$; dorsal 13; pectoral 11 to 13; ventral 10; scales 14 above lateral line, 5 below. Snout moderately produced, preoral portion $\frac{1}{3}$ its length. Eye rather small, $\frac{1}{2}$ of interorbital. Maxillary reaches eye. Premaxillary band of teeth broader than maxillary. Palatine teeth in 2 separate patches, each of oval shape, with pointed end, directed forward. Pterygoid teeth in a very narrow band which extends far backward in mouth cavity. Basibranchials with long, broad band. Gill

rakers 14, long as eye. Scales in lateral line enlarged, with broad deep black membrane, continued some length on tail and anal base, which like dorsal, covered in its basal half with small scales. From gill opening to vent 26 luminous spots and about as many behind vent along base of anal. Mandibular canal with 5. Head naked, only upper portion of gill cover and cheek covered with scales like on body. Dorsal origin midway between gill opening and anal origin. Pectoral narrow, very long, nearly reaches ventral. Ventral inserted slightly before dorsal origin, fin $1\frac{3}{4}$ in pectoral. Uniform black. Length 539 mm. (Günther.)

Atlantic Ocean. Listed by Barnard as *Aldrovandia macrochir* (1925, Ann. South African Mus., XXI, p. 168, Pl. VIII, fig. 4) off Cape Point and Table Bay in 1400 fathoms.

Halosauropsis phalacrus (Vaillant)

Halosaurus phalacrus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 185, Pl. xv, fig. 3; Pl. xvi, fig. 1 a-c. Off Morocco, Soudan and Azores, 1103 to 2220 m.—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 28 (1 $\frac{1}{2}$ miles off Hierro, Canaries, 1786 m.; 7 miles off Ile de Sal, Cape Verde, 1477. m.).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (Azores, N. lat. $39^{\circ}21'20''$, W. long. $31^{\circ}45'45''$, 1360 m.).

Head 9, to anal origin $2\frac{7}{8}$; depth $2\frac{1}{3}$ in head; dorsal 10; anal 200; ventral 8; 20 scales before vent. Head equally depressed below, muzzle spatuliform. Snout $2\frac{1}{3}$ in head. Preoral portion of snout $3\frac{1}{2}$ its length. Eye equals interorbital, 7 in head. Maxillary reaches eye. Opercle and temporal region scaly. Dorsal origin far behind ventral base, nearly midway between pectoral and anal origins. Pectoral high, not reaching ventral, $1\frac{3}{5}$ to dorsal origin. Ventral inserted well before dorsal origin, little nearer anal origin than eye, but a little over half of pectoral length. Flesh pink. Anal dusky. Head bluish black. Length 430 mm. (Vaillant.)

Eastern Atlantic.

ORDER HETEROMI

Spiny Eels

Body elongate. Jaw bones complete, a little aberrant. Vomer obsolete. Palatines and pterygoids well developed. Cranium with condyle confined to basioccipital. Exoccipital coalesced with epiotics and opisthotics. Opercular apparatus complete. Preopercle slightly connected with suspensorium. Suborbitals suppressed. Scapular arch formed by proscapula and post-temporal, latter detached from side of cranium and impinging on supraoccipital. Hypercoracoid and hypocoracoid coalescing in single lamellar imperforate plate. Actinosts normal. Anterior vertebrae separate. Air vessel with duct. Scales small. Ventrals abdominal.

Notacanthidae

Body somewhat compressed, ends in a tapering bandlike tail. Snout projecting. Mouth inferior. Both jaws with teeth, lower jaw

meets palate. Teeth close set in jaws and on palatines. Palatines movable. Sharp spine, mostly hidden by fleshy folds of lips at mouth angle. Gill openings wide, not restricted above, membranes separate, free from isthmus. Gill's 4. Gill rakers long, slender. Pseudobranchiae absent. Ovaries without oviducts. Shoulder girdle loosely suspended to skull by ligament. Scales cycloid. Dorsal represented by a series of short separated spines, few or no soft rays. Anal rays numerous, front ones spinous.

KEY TO THE GENERA

- a.—NOTACANTHINÆ. Dorsal spines 6 to 12; upper teeth compressed and obliquely triangular; ventrals confluent..... NOTACANTHUS.
 aa.—POLYACANTHONOTINÆ. Dorsal spines 27 to 38; teeth in jaws fine, erect; ventrals separate.
 b.—Snout proboscis-like; lateral line strongly arched; dorsal and anal spines long, flexible, latter not over 30..... POLYACANTHONOTUS.
 bb.—Snout not very elongate; lateral line straight; dorsal and anal spines low, strong, latter 50 or more..... MACDONALDIA.

NOTACANTHUS Bloch

Notacanthus BLOCH, 1787 (1788), Abhandl. Böhm. Ges. Wiss., p. 278. Type: *Notacanthus chemnitzii* Bloch. Monotypic.

Notacanthus auct.

Acanthonotus BLOCH, 1797, 'Naturg. Ausl. Fische,' XII, p. 113, Pl. ccccxvxi. Type: *Notacanthus nasus* Bloch = *Notacanthus chemnitzii* Bloch. (*Acanthonotus* Bloch proposed to replace *Notacanthus* Bloch. Precludes *Acanthonotus* Gray, 1831, and (Tickell) Day, 1888; versus *Acanthinotus* Swainson in Aves.)

Campylodon FABRICIUS, 1793, Danske Vidensk. Selsk. Skrift., Kjøbenhavn, IV, p. 22. Atypic. Type: *Campylodon fabricii* Reinhardt, 1838, Danske Vidensk. Selsk. naturvid. og mathem., Afhandl., VII, p. 120.

Campilodon CUVIER, 1829, 'Règne Animal,' II, p. 205. Type: *Notacanthus nasus* Bloch. Monotypic.

Kampylodon auct.

Body much compressed, elongate. Head much compressed. Snout obtuse, tip rounded, not proboscis-like. Mouth cleft inferior. Teeth acicular, uniserial on maxillaries, biserial on mandibulars, villiform and biserial on palatines. Gills 4. Branchiostegals, 8. Scales very numerous, moderate, round, thin, flexible. Dorsal almost rudimentary, of 12 to 15 very short flexible spines, remote from each other and not connected by membrane. Anal very long, origin close behind vent, which is nearly midway in body. Front part of anal of separate flexible spines, without membrane, resembling those of dorsal; these gradually lengthen, grading into articulated branched rays. No caudal. Ventrals broad, with wide peduncle-like bases, closely contiguous, separated only by slight basal groove, situated near vent.

Notacanthus bonaparte Risso

Figure 120

Notacanthus bonaparte RISSO, 1840, Archiv Naturg., 6 Jahrg., p. 376, Pl. x. Nice.

Notacanthus mediterraneus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 325, Pl. XXVII, fig. 2a-e (Soudan, 932 to 1232 m.; Banc d'Arguin, 1495 m.).

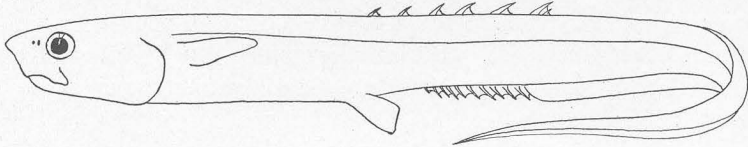


Fig. 120. *Notacanthus bonaparte*, from Vaillant.

Body slender, comparatively elongate, little deeper over ventral, depth 13. Dorsal VI to VIII; anal VI to XIV, 100 to 140; pectoral 9 to 12; ventral II to IV, 5 to 8. Snout produced, compressed. Large, curved spine in upper corner of mouth, sometimes hidden. Palatine teeth uniserial. Lateral line inconspicuous, nearer dorsal than ventral profile. Ventrals joined by membrane of considerable width between internal rays. Yellowish, with silvery reflections. Opercle limb, orbital edge, and mouth darker. Length 203 mm. (Goode and Bean.)

Eastern Atlantic and Mediterranean.

POLYACANTHONOTUS Bleeker

Polyacanthonotus BLEEKER, 1874, Verslagen Kon. Akad. Wet. Amsterdam, (2) VIII, p. 368. Type: *Notacanthus rissoanus* Filippi and Verany. Orthotypic.

Zanotacanthus GILL, 1876, 'Johnson's Univ. Cyclopaedia,' III, p. 883. Type: *Notacanthus rissoanus* Filippi and Verany. Monotypic.

Paradoxichthys GIGLIOLI, 1882, Nature, XXV, p. 535. Type: *Notacanthus rissoanus* Filippi and Verany. Monotypic.

Teratichthys (not König, 1825) GIGLIOLI, *loc. cit.* Type: *Teratichthys garibaldi-
anus* Giglioli = *Notacanthus rissoanus* Filippi and Verany. (*Teratichthys* Giglioli proposed to replace *Paradoxichthys* Giglioli.)

Body very slender, elongate. Snout prolonged into proboscis-like tip, at least 1/3 of head. Teeth in jaws erect, fine, in rows in each jaw, stronger on palate, arranged in form of horseshoe. Lateral line conspicuous, descending from angle of opercle in broad strong curve to below middle region of body at point not far from vent. Dorsal represented by numerous slender, curved, flexible, disjoined spines, 29 to 37. Anal of smaller, longer, slender, flexible spines, passing somewhat behind last of dorsal spines into a low short-rayed fin. Pectoral moderate, slender, above median axis close below pectoral. Ventrals slender, entirely separate, reach vent, with 1 spine.

Polyacanthonotus rissoanus (Filippi and Verany)

Figure 121

Notacanthus rissoanus FILIPPI AND VERANY, 1859, Mem. Accad. Sci. Nat. Torino, XVIII, p. 190. Nice. —VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 335, Pl. XXVII, fig. 1 (off Morocco, in 2212 m.).

Head 8. Body deepest medianly or at vent, depth 15. Dorsal XXIX to XXXVII; anal XXXIV to XLI, 100 to 150; pectoral 9 or 10; ventral I, 10. Snout very long, 3 in

head. Eye moderate, 8. Mouth cleft to orbit. Long straight spine, pointed backward, above maxillary, sometimes small and short. Interorbital very narrow, not half of eye. Opercle truncated behind. Gill opening large. No scales. First dorsal spine $2/3$ of its own length behind pectoral origin, little shorter than eye; highest spines in posterior third of fin, twice eye; spines all slightly curved back, soft ray

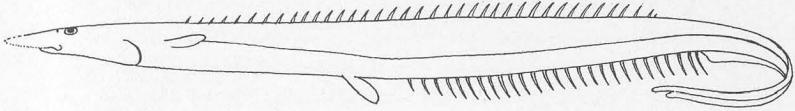


Fig. 121. *Polyacanthonotus rissoanus*, from Vaillant.

after last spine. Anal spines longer than dorsal, longest $2\frac{1}{2}$ times eye; first somewhat longer than first dorsal spine, placed behind vent under eighteenth dorsal spine. Length 199 mm. (Goode and Bean.)

Eastern Atlantic and Mediterranean.

MACDONALDIA Goode and Bean

Macdonaldia GOODE AND BEAN, 1895, 'Ocean. Icthyth.' p. 171. Type: *Notacanthus rostratus* Collett. Monotypic.

Body elongate. Snout moderate. Teeth in jaws erect, fine, also series on vomer and palate. Body and head covered with minute, imbricated scales. Line of pores on inner mandibular edge. Lateral line straight, conspicuous. Dorsal of numerous, short, straight, robust, disjointed spines, 27 to 34, first before pectoral origin. Anal with longer portion of low, short, slightly curved, disjointed spines, 35 to 55, passing to flexible rays below last dorsal spines. Pectoral moderate, placed far back, below middle line of body, remote from lateral line. Ventrals moderate, entirely separate.

Macdonaldia rostrata (Collett)

Notacanthus rostratus COLLETT, 1889, Bull. Soc. Zool. France, XIV, p. 307. Off Newfoundland, N. lat. $46^{\circ} 4' 40''$, W. long. $49^{\circ} 2' 30''$, in 1267 m.

Macdonaldia rostrata ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 29 (near Flores, Azores, 1360 m.).

Head $9\frac{1}{2}$. Body greatly compressed, tapers forward and backward from vent; depth $3\frac{1}{2}$ to vent. Dorsal xxviii to xxxi; anal xlii to liii. Snout compressed, pointed, produced beyond mouth less than eye diameter, 3 in head. Eye moderate, not far from upper profile, $2\frac{1}{2}$ in snout. Mouth small, cleft scarcely reaches front nostril. Each jaw with row of minute teeth, also row on vomer and palatine. Gill openings wide. Pectoral inserted behind gill opening twice its own length. Ventrals with broad bases, not confluent, reach to or slightly beyond vent. Length 419 mm. (Goode and Bean.)

Atlantic. Reported by Barnard as *Macdonaldia rostrata* (1925, Ann. South African Mus., XXI, p. 172, Pl. viii, fig. 5) from off Cape Point in 100 fathoms.

ORDER APODES

Eels

Body elongate, cylindrical, or compressed. Gill openings comparatively small. No pseudobranchiae. Premaxillaries not developed as distinct elements. Maxillaries border mouth. Opercles small, membrane covering large branchial chamber chiefly supported by long branchiostegals. Single pair of dentigerous upper pharyngeals opposed to separate lower pharyngeals. Gonaducts reduced to genital pores. Air vessel joined to esophagus by tube. Scales rudimentary or absent. Lateral line present or absent. Dorsal and anal fins continuous to or with reduced caudal, when present. Pectorals small or absent. Ventrals absent.

A large group of soft-rayed fishes, considered by Regan an offshoot of the herring-like fishes. Apparently of low organization, especially in forms of more simple structure, they are scarcely primitive but rather the result of a long-continued progression, according to the mouth and fins.

KEY TO THE FAMILIES

- a.—ENCHELYCEPHALI. Gill opening well developed, leads to large interbranchial slits; tongue present; opercles and branchial bones well developed.
- b.—MURAENOIDEI. Skin covered with rudimentary embedded scales, usually linear in form, arranged in small groups and placed obliquely at right angles to those of neighboring groups; tongue with free edges; hind nostril before eyes; pectorals and vertical fins well developed, latter confluent about tail.
- c.—Gill openings well separated; branchiostegals long, bent upward behind.
 - d.—Snout conic; jaws not very robust; gape longitudinal; lips thick; teeth in villiform bands in jaws and on vomer; gill openings lateral. MURAENIDAE.
 - dd.—Snout very blunt, jaws very strong; gape transverse; lips obsolete; teeth blunt, uniserial in jaws; gill openings ventral. SIMENCHELYIDAE.
- cc.—Gill openings inferior, very close together, apparently confluent; branchiostegal rays abbreviated behind; head conic; tongue small; hind nostril in front of eye. SYNAPHOBRANCHIDAE.
- bb.—CONGROIDEI. Scales entirely absent.
 - e.—Tip of tail with more or less distinct fin, dorsal and anal confluent around it; tail sometimes ends in long filament; color usually uniform brownish, blackish or silvery, fins often black bordered.
 - f.—Hind nostril entirely without tube, placed entirely above upper lip.
 - g.—Pectoral fins well developed.
 - h.—Skin of throat and chest with large regular scale pouches. MYROCONGRIDAE.
 - hh.—Skin of throat and chest without scale pouches.
 - i.—Tongue broad, largely free anteriorly and on sides; no canine teeth.
CONGRIDAE.
 - ii.—Tongue narrow, adnate to floor of mouth or only tip slightly free; canine teeth in front of jaws and on vomer. MUROENESOCIDAE.

- gg.*—No pectorals.
 - j.*—Snout very short and blunt; tail without terminal filament.
 - HETEROCONGRIDAE.
 - jj.*—Snout and jaws very much produced, upper jaw longer.
 - k.*—Tail ending in filiform tip.
 - l.*—Snout and jaws straight; vent distant from gill openings.
 - NETTASTOMIDAE.
 - ll.*—Jaws long, slender, tapering to point, recurved at tips; vent close to gill opening. NEMICHTHYIDAE.
 - kk.*—Tail abruptly interrupted terminally, not filamentous. CYEMIDAE.
 - ff.*—Hind nostril close to edge of upper lip; tongue more or less fully adnate to mouth floor; teeth subequal. ECHELIDAE.
 - ee.*—Tip of tail without rays, projects as firm point protruded beyond dorsal and anal; hind nostril on edge of upper lip; front nostril near snout tip, usually in small tube; tongue usually adnate to mouth floor. OPHICHTHYIDAE.
- aa.*—COLOCEPHALI. Gill opening small, rounded, leading to restricted interbranchial slits; tongue absent; opercles feebly developed; pectorals usually absent.
 - m.*—Vertical fins developed only terminal on tail.
 - HETERENCHELYIDAE.
 - mm.*—Vertical fins well developed. ECHIDNIDAE.

Muraenidae

Eels

Body elongate, subcylindrical, compressed behind. Head conic. Eyes covered with skin. Mouth terminal, with lateral cleft reaching below eye. Maxillary articulates with ethmoid bone near end of snout. Teeth small, cardiform, or villiform, in bands. Tongue distinct. Opercular apparatus well developed. Gill openings well separated, vertical, lateral. Branchial openings of gill clefts wide slits in pharynx. Skin scaly. Lateral line distinct. Dorsal and anal continuous with reduced caudal. Pectorals present, rays simple. Vent in anterior half of body.

One living genus, widely distributed in tropical and temperate waters. Unlike most fishes, eels freely descend to the sea for the purpose of reproduction, only the females ascending into fresh water again. The generation is largely concealed and the ova extremely minute. The young undergo a change from the larval stage like that of the congers.

MURAENA Linné

Eels

Muraena LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 244. Type: *Muraena anguilla* Linné. (Designated by Bleeker, 1865, Ned. Tijds. Dierk., II, p. 113.)

Murena RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 67. Type: *Muraena anguilla* Linné. (Slip for *Muraena*.)

Anguilla SHAW, 1803, 'Gen. Zool.,' IV, p. 15. Type: *Muraena anguilla* Linné. Tautotypic.

Tribranchus (Peters) MÜLLER, 1844, Abh. Akad. Wiss. Berlin, p. 193. Type: *Tribranchus anguillaris* (Peters) Müller. Monotypic.

Terpolepis McCLELLAND, 1845, Calcutta Jour. Nat. Hist., V, p. 225 (172, 208). Type: *Anguilla brevirostris* McClelland.

Head long, moderately pointed. Eye rather small, well forward, over mouth angle. Teeth in bands in each jaw, small, partly equal, and large patch on vomer. Lips rather full, with free edge behind, attached by frenum in front. Mandible protrudes. Tongue free at tip. Nostrils superior, well separated, front one with slight tube. Gill openings rather small, slitlike, partly below pectoral base. Body covered with imbedded linear oblique scales, some placed at right angles to others. Lateral line complete. Dorsal inserted at some distance from head. Pectorals well developed. Vent close before anal.

Voracious fishes, feeding mostly in the mud or along the bottoms of streams. The females are larger than the males, paler in color, with smaller eyes and higher fins. The females are supposed to die once they have spawned. Eels are able to move over considerable spaces of land in damp grass and often pass dams, waterfalls, or other obstructions when ascending streams.

Muraena anguilla Linné

Anguila (Canaries)

Muraena anguilla LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 245. Europe, Lake Commachio, Ferrariensi, Danube.

Muroena anguila POGGI, 1881, (article in 'Guidebook of Canary Isls.'). 'Guia de Santa Cruz de Tenerife,' [p. d. 36].

Anguilla anguilla VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 135 (Porto Santo, Madeira).

Anguilla latirostris LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 191 (Madeira).

Anguilla canariensis VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II, part 2, p. 88. Canaries.—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 403 (Santa Cruz, Tenerife).

Anguilla vulgaris GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 28 (Madeira, Azores).—BAADER, 1873-1874, Ber. Senckenberg. Naturf. Gesell., p. 182 (Mogador).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 332 (Canaries).—BOULENGER, 1905, Novit. Zool., XII, p. 505 (Morocco).

Head 7 to 9 1/4; depth 13 to 20 1/2; dorsal about 230; anal about 200; pectoral 18; head 2 1/6 to 2 3/5 to dorsal origin; head 3 to 3 4/5 to vent; snout 4 2/3 to 6 in head measured from upper jaw tip; eye 7 to 13; maxillary 2 7/8 to 4; interorbital 5 to 8 1/2.

Body moderately compressed or subcylindrical, tail more compressed terminally and tapering at tip, which is rather obtuse. Head conic, slightly depressed above, pharynx scarcely swollen, width about 2 2/3 its length. Snout rather depressed, length about 4/5 its width. Eye small, without distinct lids, about first fourth in head, or hind edge trifle before maxillary end. Mouth moderate. Mandible well protruded. Lips thick, fleshy. Teeth similar, minute, in rather narrow bands in jaws and on vomer, latter area only about first 2/5 of maxillary. Tongue depressed, smooth, free. Front nostril in short tube near snout end; hind one a rather small slit-like pore close before eye. Interorbital broad, depressed. Gill opening about 1 1/3 in snout. Scales minute. Dorsal origin trifle before middle in body. Pectoral rounded, broadly expanded, upper rays longer, 2 3/4 to 4 1/5 in head. Vent close before anal.

Dull olive-brown, lower surface and belly whitish. Iris pale. Length 166 to 826 mm.

North Atlantic. Described above from European and Mediterranean examples.

Simenchelyidae

Snub-nosed Eels

Snout very blunt. Mouth transverse, jaws very strong. No lips. Teeth blunt, in one series, on jaws only. Tongue with free edges. Hind nostril before eyes. Gill openings well developed, well separated, horizontal, inferior. Branchiostegals long, bent upward behind. Skin with rudimentary embedded scales. Lateral line present.

One genus.

SIMENCHELYS Goode and Bean

Snub-nosed Eels

Simenchelys (Gill) GOODE AND BEAN, 1879, Bull. Essex Inst., p. 27. Type: *Simenchelys parasiticus* (Gill) Goode and Bean. Monotypic.

Conchognathus COLLETT, 1889, Bull. Soc. Zool. France, XIV, p. 123. Type: *Conchognathus grimaldii* Collett. Monotypic.

Body elongate, eel-shaped. Head very short, rounded, very blunt anteriorly, slightly compressed. Mouth small, entirely anterior. Jaws equal, edges hard, with uniserial small, rounded, close-set, incisor-like teeth. No vomerine teeth. Mandible very deep, strong. Tongue broad, somewhat free anteriorly. Premaxillaries and maxillaries of each side coalesced and separated from each other by ethmoid. Lips full. Opercle sabre-shaped. Nostrils large, front one with slight rim, not tubular. Gill openings very small, longitudinal, before and below pectorals. Scales linear, disposed at right angles. Lateral line faint. Vertical fins confluent around tail, dorsal begins not far behind pectorals. Pectoral short. Vent before anal, median.

Two species in deep water, parasitic on larger fishes.

Simenchelys parasiticus Goode and Bean

Figure 122

Simenchelys parasiticus (Gill) GOODE AND BEAN, 1879, Bull. Essex Inst., p. 27. Newfoundland Banks.—MONACO, ALBERT I (PRINCE OF), 1904 (January 1), Bull. Mus. Océanogr. Monaco, No. 1, p. 10 (Azores, 1260 m.).—RICHARD, 1910 (February), Bull. Mus. Océanogr. Monaco, No. 162, p. 153 (Azores, 1260 m.); 1911 (November 15), *op. cit.*, No. 218, p. 9 (N. lat. 37° to 38°, W. long. 25°, 1560 m.).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 83 (off Cape Verde Islands, 1300 m.; Azores, 1007 to 1250 m.).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 135 (off Azores, N. lat. 37° to 39°, W. long. 25° to 31°, 880 to 1732 m.).

Conchognathus grimaldii COLLETT, 1889, Bull. Soc. Zool. France, XIV, p. 123. Graciosa, Fayal, S. Jorge, Pico, Florès and Corvo, Azores, 844 to 2000 m.

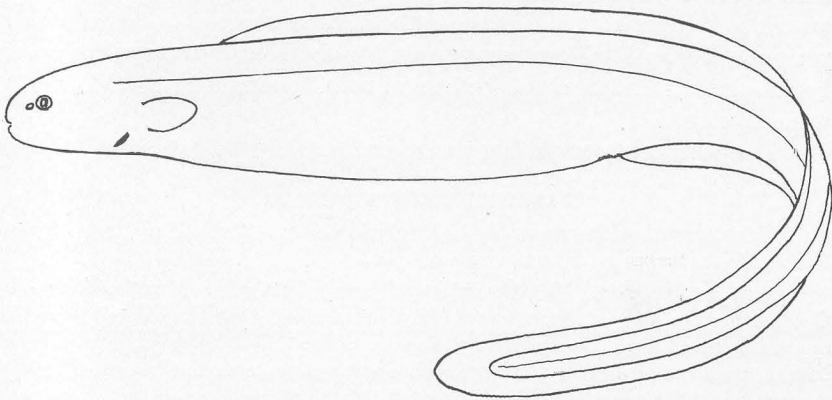


Fig. 122. *Simenchelys parasiticus*.

Head $10\frac{1}{2}$; depth $13\frac{1}{2}$; snout 5 in head; eye 8; mouth width 4; interorbital 4; head to dorsal origin 2; head to anal origin $5\frac{1}{3}$.

Body long, well compressed, tail tapering rather narrowly behind. Head small, front profile obtusely convex or bluntly rounded, width $2\frac{1}{10}$ its length. Snout blunt, profile and surface convex, length $\frac{3}{5}$ width. Eye rather ellipsoid, not elevated, about first third in head, without eyelids. Mouth small, transverse, terminal, with strong convex jaws; commissure about halfway to eye. Jaws equal, each with a row of small teeth. Lips thick, fleshy. Tongue smooth, depressed, round and free in front. Nostrils well separated, anterior with slight cutaneous rim near snout tip, posterior rather large pore close before eye. Interorbital and top of head well convex. Gill opening nearly equals eye. Scales small. Dorsal and anal moderately high. Pectoral little low, $2\frac{1}{2}$ in head. Vent close before anal.

Nearly uniform brown. Length 267 mm.

Deep waters of the North Atlantic, often found burrowing in large fishes. Reported by Barnard as *Simenchelys parasiticus* (1925, Ann. South African Mus., XXI, p. 181, Pl. VIII fig. 6) from off Cape Point in 810 fathoms. Described above from an example obtained in the Gulf Stream. The species reaches 610 mm.

Synphobranchidae

Body eel-shaped. Head conic. Snout produced. Eye over middle of mouth cleft. Teeth in bands, rather small, less numerous in young. Tongue small. Mucous membrane of mouth black. Hind nostril before eye. Gill openings well developed, inferior, very close together, united into an oval groove below pectoral bases, separated by considerable isthmus within. Branchial openings in pharynx wide slits. Stomach very distensible. Muscular and osseous systems well developed. Skin with rudimentary imbedded scales, lanceolate and placed at right angles, or small, rounded scales imbedded in the skin. Lateral line present. Vertical fins confluent around tail. Dorsal shorter than anal, begins close behind pectorals or behind vent, lower than anal. Pectoral well developed.

Deep-sea eels, comprising three genera.

SYNPHOBANCHUS Johnson

Synphobranchus JOHNSON, 1862, Proc. Zool. Soc. London, p. 169. Type: *Synphobranchus kaupii* Johnson. Monotypic.

Head long, pointed. Mouth very long. Jaws about equal. Maxillaries lateral Cardiform teeth, form a sharp, broad band in each jaw, become uniserial forward, upper inner and lower outer ones somewhat enlarged. Vomerine teeth in narrow band anteriorly. Tongue long, not free. Nostrils large, anterior with short tube, posterior close before eye. Gill openings inferior, horizontal, convergent forward, somewhat confluent at surface but separated by a considerable isthmus within. Branchiostegals peculiar, moderate, attached to sides of compressed ceratohyal and

epihyal, slender, abbreviated, moderately bowed, not curved up above opercle. Scales linear, placed at right angles. Dorsal low, begins behind vent. Anal rather high, rays slender, branched, not imbedded in skin. Vent near first fourth of body.

***Synaphobranchus pinnatus* (Gray)**

Figure 123

Muraena pinnata GRAY, 1854, 'Cat. Fish. Gronow,' p. 19. No locality.

Synaphobranchus pinnatus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 23 (Madeira; type of *Synaphobranchus kaupii* Johnson).—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 88, Pl. VI, fig. 2, a-c (Morocco, Canaries, Soudan, Banc d'Arguin, Cape Verde Islands, Azores, 405 to 3200 m.).—MONACO, ALBERT I (PRINCE OF), 1905 (June 5), Bull. Inst. Océanogr. Monaco, No. 39, p. 3 (Canaries, in 1000 m.).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 84 (Cape Verde Islands, 692 m.; Azores, 1229 to 3465 m.; Canaries, 1000 m.).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 99, Pl. VI, fig. 3, a-b (1 1/2 miles off Hierro, Canaries, 1786 m.; 6 miles south of São Miguel, 1187 m.; 30 miles east of Terceira, 1805 m.; 12 miles northeast of São Miguel, 1998 m.).

Synaphobranchus kaupii JOHNSON, 1862, Proc. Zool. Soc. London, p. 169, Fig. (dentition). Madeira.

Synaphobranchus pinnatus var. *parvipinnis* ROULE, 1916 (May 20), Bull. Inst. Océanogr. Monaco, No. 320, p. 1248. Southeast of Portugal, in 1500 m.

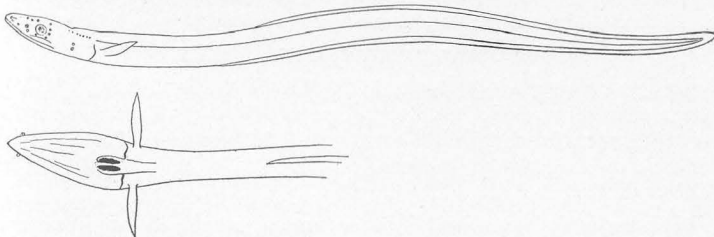


Fig. 123. *Synaphobranchus pinnatus*, from Roule.

Head $8\frac{1}{6}$; depth $19\frac{3}{4}$; snout 3 in head; eye 7; maxillary $1\frac{1}{4}$; commissure of mouth $1\frac{3}{5}$; interorbital 7; head $3\frac{1}{10}$ to dorsal origin; head $2\frac{1}{4}$ to anal.

Body well compressed, slender, long tail tapering and slender. Head slender, sides well compressed, profiles alike, width $3\frac{3}{4}$ its length. Snout long, conic, upper profile straight, surface convex, with fleshy tip slightly protruding beyond snout tip. Eye elongate, ellipsoid, without eyelids, about first $\frac{2}{5}$ in head. Mouth long, narrow, commissure horizontal, eye about opposite middle in maxillary length or about last third in commissure. Lips thin, little developed. Maxillary not free. Teeth small, conic, all little recurved and in narrow bands with numerous minute teeth along outer edges, more sparse larger ones forming inner series, these also little more enlarged anteriorly. Short row of moderately large recurved conic teeth on vomer, similar to inner larger ones along jaws. Tongue long, smooth, free only at sides. Mandible long, shallow; rami low, slender. Nostrils large well separated, anterior

about first fourth in snout, with broad cutaneous edge; posterior about last fourth in snout opposite middle of eye front, as horizontal slit. Interorbital narrow, convex. Top of head also convex. Gill opening about $\frac{3}{4}$ of eye. Scales small. Dorsal origin nearly head length behind vent. Caudal trifle longer than eye. Pectoral median in body depth, upper rays longer, $2\frac{1}{5}$ in head.

Uniform brown, vertical fins dusky posteriorly. Iris pale. Length 535 mm.

North Atlantic, Indian Ocean, and Japan, in deep water. Reported by Barnard (1925, *Ann. South African Mus.*, XXI, p. 184) from off Cape Point to East London in 560 fathoms. Described above from an example obtained in the Gulf Stream.

Myrocongridae

Gill openings in pharynx, narrow slits. Skin of throat and chest with traces of large scale pouches, regularly arranged, each about size of eye. Pectoral and vertical fins well developed.

MYROCONGER Günther

Myroconger GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 93. Type: *Myroconger compressus* Günther. Monotypic.

Head without conspicuous mucous cavities. Eye moderate. Mouth cleft wide. Teeth acicular, subequal, form broadish bands, vomerine series tapering to single series terminating far back in mouth. Hind nostril level with upper eye edge, anterior in tube. Scaleless. Dorsal begins before small gill opening.

Myroconger compressus Günther

Myroconger compressus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 93. St. Helena; 1869, *Proc. Zool. Soc. London*, p. 239 (St. Helena; no description).—MELLISS, 1875, 'St. Helena,' p. 110.—OSORIO, 1893, *Jorn. Sci. Math. Phys. Nat., Acad., Lisboa*, (2) V, p. 200 (St. Thomé).

Body compressed, rather deep, tail longer than body. Head about half of trunk. Snout moderate, depressed, lower jaw rather prominent. Eye half of snout, 8 in head. Mouth cleft extends somewhat behind eye. Dorsal begins midway between occiput and gill opening. Pectoral about long as snout. Uniform whitish. Length 560 mm. (Günther.)

St. Helena.

Congridae

Conger Eels

Body moderately long. Mouth with lateral cleft, not reaching far behind eye. Maxillary articulated with ethmoid near end of snout. Teeth conic, cardiform or compressed, in bands or in one or more series, well developed in jaws and on vomer. Tongue largely free in front. Nostrils lateral. Gill openings separate. Pharyngeal apertures of gill clefts wide. Pharyngeals ovate or oblong, covered with small teeth. Skin naked. Dorsal and anal continuous with reduced caudal. Vent remote from head.

Mostly large marine eels, found in most warm seas, usually at moderate depths. Many undergo transformation, the young loosely organized, transparent, band-shaped, and with very small head. The body shrinks with increased age, owing to the compacting of the tissues. Probably *Muroenesox* McClelland should be united with this family, as given by Weber and Beaufort.

KEY TO THE GENERA

- a.—Anterior nostrils tubular.
 b.—Teeth equal.
 c.—Outer series of teeth close set, forms cutting edge; front nostril superior. CONGER.
 cc.—Teeth villiform, in broad bands in jaws; front nostril on lower surface of projecting snout. PROMYLLANTOR.
 bb.—Teeth unequal.
 d.—Vomer without enlarged teeth.
 e.—Premaxillary teeth enlarged in area placed outside closed mouth. BATHYCONGRUS.
 ee.—Premaxillary teeth not enlarged, placed within closed mouth. ARIOSOMA.
 dd.—Vomer with row of long pointed canines. HOPLUNNIS.
 aa.—Anterior nostrils not tubular. UROCONGER.

CONGER Schaeffer

Conger SCHAEFFER, 1760, 'Stud. Ichth.,' p. 20. Atypic. Type: *Muraena conger* Linné. Tautotypic.—HOUTTUYN, 1764, 'Nat. Hist. Linn.' VII, p. 103. Type: *Muraena conger* Linné. Tautotypic.

Leptocephalus GRONOW, 1763, 'Zoöphylac.,' p. 135.—SCOPOLI, 1777, 'Intro. Hist. Nat.,' p. 453. Atypic.—GMELIN, 1789, 'Syst. Nat. Linné,' p. 1150. Type: *Leptocephalus morrissii* Gmelin. Monotypic. (Larva.)

Oxyurus RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 19. Type: *Oxyurus vermiformis* Rafinesque. Monotypic. (Larva.)

Helmictis RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' pp. 49, 62. Type: *Helmictis punctatus* Rafinesque. Monotypic. (Larva.)

Helmichthys COSTA, 1844, 'Fauna Napoli,' Pesci, fasc. 45. Type: *Helmichthys diaphanus* Costa. Monotypic. (Larva.)

Leptocephalichthys BLEEKER, 1856, Act. Soc. Sci. Ind. Néerl. (Manado 1), p. 69. Type: *Leptocephalichthys hypselosoma* Bleeker. Monotypic. (Larva.)

Gnathophis KAUP, 1859 (1860), Abh. Naturw. Verein Hamburg, IV (2), p. 7. Type: *Myrophis heterognathus* Bleeker. Monotypic. (Larva.)

Diaphanichthys PETERS, 1864, Monatsb. Akad. Wiss. Berlin, p. 399. Type: *Leptocephalus (Diaphanichthys) brevicaudus* Peters. Monotypic. (Larva.)

Atopichthys GARMAN, 1891, Mem. Mus. Comp. Zoöl., XXIV, p. 326. Type: *Atopichthys esunculus* GARMAN. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' part 4, p. 486.) (Larva.)

Microconger FOWLER, 1912, Proc. Acad. Nat. Sci. Philadelphia, p. 9. Type: *Leptocephalus caudatus* Fowler. Monotypic.

Body very long, subcylindrical forward, compressed behind. Head depressed above, pointed in front. Eye well developed, covered by skin. Mouth wide, cleft extends below middle of eye. Mandible protrudes. Outer teeth in jaws equal, close set, form cutting edge. No canines. Short, pointed band of teeth on vomer. Lips thick. Tongue free in front. Front nostril in a short tube near snout tip. Gill openings rather large, low, nearly vertical below pectoral bases. Vertebrae 156, of which 100 are caudal. Lateral line present. Inconspicuous mucous cavities on head. Dorsal fin inserted close behind pectoral base, nearer latter than vent. Tail about 1/2 longer than trunk.

Conger conger (Linné)

Congro (Madeira), Congrio (Canaries, Spanish Sahara), Gôbo paguête (Bom alimento), Dyéye (Senegambia)

Muraena conger LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 245. European Ocean.

Murocna conger POGGI, 1881, (article in "Guidebook of Canary Isls.") 'Guia de Santa Cruz de Tenerife,' [p. d. 35].

Leptocephalus conger JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 339 (Canary Islands).

Conger conger FOWLER, 1923, Proc. Acad. Nat. Sci. Philadelphia, p. 33 (Funchal Bay, Madeira).

Congrus vulgaris LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 192 (Madeira).

Conger vulgaris GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 38 (St. Helena).—STASSANO, 1890, Annali di Agricoltura, Roma, p. 32 (Spanish Sahara).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 333 (Grand Canary).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 249 (Port-Étienne).

Conger vulgaris var. *niger* GÜNTHER, 1869, Proc. Zool. Soc. London, p. 239 (St. Helena).—MELLISS, 1875, 'St. Helena,' p. 110.

Conger macrops GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 40. Madeira.—BUETTIKOFER, 1890, 'Reis. Liberia,' II, p. 480.—STEINDACHNER, 1895, Notes Leyden Mus., XVI, p. 87 (Liberia).—OSORIO, 1895 (March), Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 247 (Bom alimento); 1898, *op. cit.*, (2) V, p. 199 (Cape Verde, Anno Bom).

Leptocephalus morrissi GÜNTHER, *op. cit.*, p. 139 (Madeira).—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 95 (Morocco, Banc d'Arguin, 1105 to 1550 m.).—GÜNTHER, 1889, 'Rept. Voy. "Challenger,"' XXXI, p. 42 (West Africa).

Conger marginatus (not Valenciennes) ROCHEBRUNE, 1883, 1885, 'Faune Sénégalaise,' Poiss., p. 146 (Guet N'Dar, Maringouins, Sorres, Leybar).

Leptocephalus pellucidus GÜNTHER, 1889, 'Rept. Voy. "Challenger,"' XXXI, p. 42 (mid-Atlantic).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 333 (Canaries).

Head 6 1/2 to 7 1/2 in total length; depth 14 1/5 to 24; snout 3 4/5 to 4 2/3 in head; eye 5 to 11; maxillary 2 1/3 to 3; interorbital 5 2/5 to 9; head 1 1/4 to 1 3/5 to dorsal origin; head 2 2/5 to 3 to anal origin.

Body long, slender, little deeper or heavier forward. Tail long and tapering. Head depressed above, pointed in front. Snout depressed, longer than broad. Eye

elongate, about first third in head. Mouth wide, reaches below eye center. Main or outer row of small, strong, conic teeth; inner row of much smaller ones in each jaw; short band of vomerine teeth, like outer jaw series. Tongue smooth, depressed. Lips fleshy laterally. Front nostril near snout tip in short tube, hind one short slit close before eye. Gill opening low, as long as $1/3$ of snout. Skin smooth. Dorsal inserted at first fifth in total length. Space between dorsal and anal origins longer than head by half its length. Caudal rounded. Pectoral $2\frac{3}{5}$ to $3\frac{3}{4}$ in head.

Blackish or dark olive above, young brownish. Lower surfaces whitish. Vertical fins with narrow black border. Pectoral dusky. Mandible whitish. Length 240 to 1066 mm.

Atlantic Ocean. Reported by Barnard as *Conger vulgaris* (1925, Ann. South African Mus., XXI, p. 188) from off South Africa. Described from American (New Jersey) and Italian examples. Reaches 244 cm.

Larval Forms

Leptocephalus brachycephalus Pappenheim

Leptocephalus brachycephalus PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 191, Pl. IX, fig. 1, Text Fig. 9. North of Tristan da Cuna, S. lat. $30^{\circ} 21'$, W. long. $14^{\circ} 2'$, 10 m.; southeast of Sierra Leone, N. lat. $0^{\circ} 29'$, W. long. $18^{\circ} 57'$.

Myomeres 140 to vent. Body deep, bandlike. Head small. Eye very small. Pigment as narrow bar at base of each intermuscular segment fork on lower half of body. Length 173 to 240 mm. (Pappenheim.)

Tropical and South Atlantic.

Leptocephalus oxycephalus Pappenheim

Leptocephalus oxycephalus PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 190, Pl. IX, figs. 3-5. North of Tristan da Cuna, S. lat. $30^{\circ} 21'$, W. long. $14^{\circ} 2'$, 10 m.; northwest of Cape Verde Islands, N. lat. $24^{\circ} 41'$, W. long. $32^{\circ} 21'$; southwest of Sierra Leone, N. lat. $0^{\circ} 29'$, W. long. $18^{\circ} 57'$, 10 m.; Indian Ocean, S. lat. $25^{\circ} 0'$, E. long. $57^{\circ} 7'$, 20 m.

Myomeres 220 to 230, of which 180 to 190 are before the vent. Head low. Caudal normal. Intestine at end of first fourth in body, at about the thirtieth myomere. Length 60 to 197 mm. (Pappenheim.)

South Atlantic and Indian Oceans.

Leptocephalus taeniodes Pappenheim

Leptocephalus taeniodes PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 190, Pl. IX, fig. 2-a. Cape Verde Islands, N. lat. $0^{\circ} 12'$, W. long. $16^{\circ} 39'$ and N. lat. $0^{\circ} 29'$, W. long. $18^{\circ} 57'$.

Myomeres 160 to 165, of which 150 are before the vent. At the fiftieth myomere there is a dark pigment blotch, extending across five myomeres. Both jaws with 10 to 12 strong teeth each side. Length 161 to 212 mm. (Pappenheim.)

Eastern Atlantic.

PROMYLLANTOR Alcock

Promyllantor ALCOCK, 1890, Ann. Mag. Nat. Hist., London, (6) VI, p. 310. Type: *Promyllantor purpureum* Alcock. Monotypic.

Congrosoma GARMAN, 1899, Mem. Mus. Comp. Zoöl., XXIV, p. 308. Type: *Congrosoma evermanni* Garman. Monotypic.

Pseudophichthys ROULE, 1916 (May 20), Bull. Inst. Océanogr. Monaco, No. 320, p. 4. Type: *Pseudophichthys latedorsalis* Roule. Monotypic.

Body moderately long, subcylindrical, tail about as long as trunk. Snout obtuse. Eye rather small. Mouth subinferior, not terminal, cleft short, not extending beyond eye. Villiform teeth in broad bands in jaws, with broad confluent patch above. Tongue free. Front nostrils in a short tube near snout end, hind one a simple pore close before eye. Numerous large mucous cavities on lips and jaws. Vertebrae 109. Dorsal and anal confluent with small caudal, sometimes higher posteriorly. Pectoral well developed. Vent in front half of body.

Deep-sea eels of the Atlantic, Indian, and Pacific Oceans.

Gilbert says that "*Congrosoma* Garman seems to differ from *Promyllantor* only in the position of the posterior nostril, which is in advance of the eye."

The characters set forth by Roule to distinguish his *Pseudophichthys* from *Promyllantor* appear rather to be of subgeneric value. Although the progressively longer dorsal and anal rays might perhaps furnish an apparent distinctive generic character, no complete figure has been given for *Promyllantor purpureum*. Likewise nothing is furnished in the original description. *Promyllantor alcocki* Gilbert and Cramer is also represented by an incomplete figure, but the indication, as far as it permits, shows the dorsal and anal progressively higher posteriorly.

***Promyllantor latedorsalis* (Roule)**

Figure 124

Pseudophichthys latedorsalis ROULE, 1916 (May 20), Bull. Inst. Océanogr. Monaco, No. 320, p. 4. Three miles north of Fayal, Azores, 950 m.—ROULE, 1919, Rés. Camp. Sci Monaco, LII, p. 97, Pl. VI, fig. 4, a-c (type).

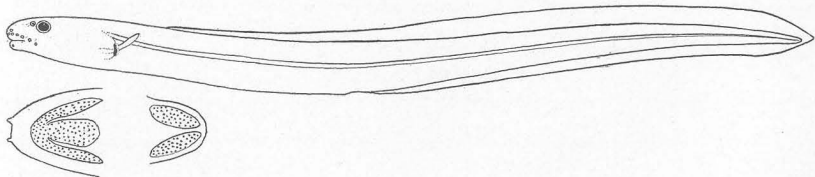


Fig. 124. *Promyllantor latedorsalis*, from Roule.

Head 7 to 8; depth 16 to 18; snout $3\frac{1}{2}$ in head; eye 5 to 6; combined head and trunk $2\frac{1}{2}$ in tail. Body moderately long, subcylindrical, slightly compressed behind. Head large. Snout obtuse and protruding. Mouth cleft short, about to hind nostril. Teeth uniform, villiform, equal, several rows within jaws; broad

median patch of villiform teeth on palate confluent forward with those of jaw; 2 simple distinct broad patches of fine mandibular teeth. Front nostril near edge of upper lip, within short obliquely cut tube; hind one large, oval, close before upper part of eye. Gill opening about size of eye. Lateral line well marked, complete. Unpaired fins confluent, dorsal and anal rays progressively longer posteriorly. Caudal short and pointed. Pectoral small, not reaching dorsal origin. Reddish gray, bluish on head. Length 321 mm. (Roule.)

Azores.

BATHYCONGRUS Ogilby

Bathycongrus OGILBY, 1898, Proc. Linn. Soc. New South Wales, XXIII, p. 292.
Type: *Congromuraena nasica* Alcock. Orthotypic.

Differs from *Ariosoma* in the premaxillary teeth enlarged and placed in area outside mouth.

Bathycongrus mystax (De la Roche)

Figures 125 and 126

Muraena mystax DE LA ROCHE, 1809, Ann. Mus. Paris, XIII, p. 328, Pl. xxiii, fig. 10. Barcelona.

Conger mystax PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 187 (southwest of St. Helena, S. lat. 19° 1', W. long. 20°, 800 m.).

Leptocephalus congris mystacis ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 102, Pl. VII, fig. 4, a-b (surface, off Teneriffe).

Congromuraena mellissii GÜNTHER, 1869, Proc. Zool. Soc. London, p. 239 (St. Helena; no description); 1870, 'Cat. Fish. Brit. Mus.,' VIII p. 93, St. Helena.—MELLISS, 1875, 'St. Helena,' p. 110.—CUNNINGHAM, 1910, Proc. Zool. Soc. London, p. 93, Pl. IV, fig. 1 (St. Helena).

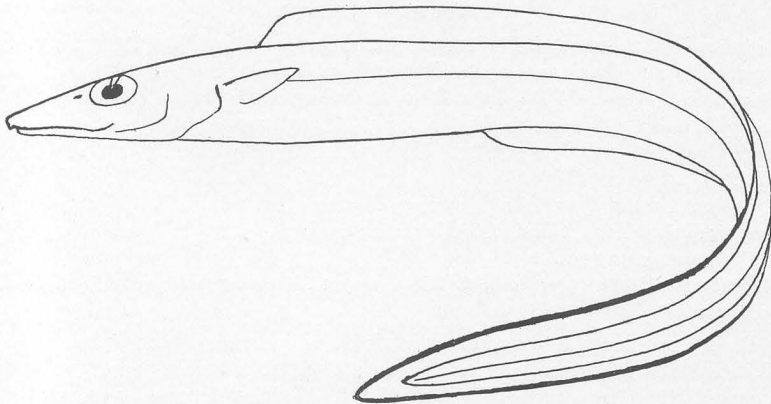


Fig. 125. *Bathycongrus mystax*.

Head $6 \frac{1}{2}$; depth 18; snout $3 \frac{1}{2}$ in head; eye $4 \frac{1}{2}$; maxillary $2 \frac{1}{2}$; interorbital $11 \frac{1}{4}$; head $1 \frac{1}{5}$ to dorsal origin; head $2 \frac{2}{5}$ to anal origin.

Body moderately robust, little compressed, tail slenderly acuminate. Head rather large, profiles alike, pharynx slightly swollen, width $3 \frac{1}{8}$ its length. Snout cavernous, convex, width $1 \frac{1}{2}$ its length, tip well protruded beyond mandible. Eye large, superior, close to upper profile, center about first $\frac{2}{5}$ in head, rounded, ellipsoid, without eyelids, adipose tissue within socket, especially behind. Mouth moderate, rather narrow, commissure slightly convex and rictus to first fourth of pupil.

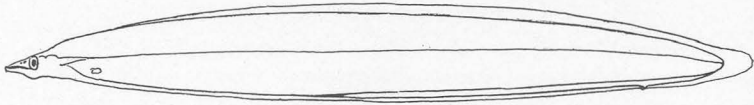


Fig. 126. *Bathycongrus mystax*, larva, from Roule.

Lips wide, fleshy, much developed laterally. Teeth in jaws conic, about uniform, in broad bands, when mouth closes those in front of upper jaw still visible and protruding downward. Vomerine teeth in broad band, like those in jaws. Tongue slender, pointed, smooth, free in front. Maxillary curved, not free, reaches eye center. Mandible strong, shallow. Nostrils remote, anterior in short tube in lip near snout tip, posterior close before eye as short horizontal slit. Interorbital narrowly constricted, convex. Gill opening $1 \frac{1}{2}$ in eye. Lateral line complete. Along mandible and lower side of head row of 9 pores. Dorsal inserted about midway in pectoral. Caudal pointed, about 2 in snout. Pectoral rather long, slender, $2 \frac{5}{6}$ in head.

Pale brownish generally, much paler below. Snout pale. Iris silvery. Fins pale, vertical ones with posterior darker brown edge. Length 382 mm.

Eastern Atlantic and Mediterranean. Described above from an Italian example.

ARIOSOMA Swainson

Ariosoma SWAINSON, 1838, 'Nat. Hist. Animals,' I, p. 220; 1838, II, p. 196. Atypic. Type: *Ophisoma acuta* Swainson = *Muraena balearica* De la Roche. (Designated by Ogilby, 1898, Proc. Linn. Soc. New South Wales, XXIII, p. 287.)

Ophisoma (not *Ophisomus* Swainson, p. 277) SWAINSON, 1839, *op. cit.*, II, p. 334. Type: *Ophisoma acuta* SWAINSON. (Designated by Bleeker, 1864, 'Atlas Ichth.,' IV, p. 20.)

Congermuraena KAUP, 1856, Archiv Naturg., part 1, p. 7. Type: *Congrus habenatus* Richardson. (Designated by Ogilby, *op. cit.*, p. 285.)

Congromuraena auct.

Congrellus OGILBY, *op. cit.*, p. 288. Type: *Muraena balearica* De la Roche. Monotypic.

Body very elongate, anteriorly subcylindrical, posteriorly compressed. Head moderate, conic, much shorter or longer than or equal to trunk. Snout sometimes prominent. Eyes large, covered by skin of head. Mouth wide, usually extends below eye. Lips variably thick or thin. Jaws with bands of small teeth, outer teeth not forming a cutting edge. Vomerine teeth in bands, none canine-like. Hind nostrils

opposite middle of eye; front ones tabulate, close to snout tip. Anterior bones of head with large muciferous cavities. Gill openings vertical, ventrally far distant from one another, begin below upper edge of pectoral bases, smaller than eye. Lateral line present. Dorsal begins before, over or behind gill opening. Tail $1/2$ to $2/3$ of total length.

Species few, small, closely related.

Ariosoma balearica (De la Roche)

Bocavante (Canaries)

Figure 127

Muraena balearica DE LA ROCHE, 1809, Ann. Mus. Nat. Hist. Paris, XIII, pp. 314, 327, Fig. 3. Ivica.

Congromuraena balearica VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 332 (Grand Canary).

Leptocephalus congrimuraenae balearicae ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 103 (west and parallel from Azores, 2000 m.).

Congrellus balearicus FOWLER, 1923, Proc. Acad. Nat. Sci. Philadelphia, p. 33 (Praia Formosa, Madeira).

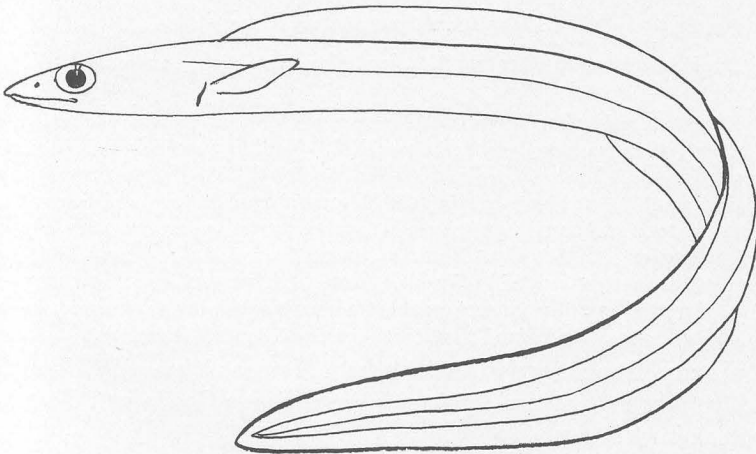


Fig. 127. *Ariosoma balearica*.

Head $6 \frac{1}{2}$ to 7; depth 19 to $22 \frac{2}{3}$; snout 4 to $4 \frac{2}{3}$ in head; eye $4 \frac{2}{3}$ to $5 \frac{2}{3}$; maxillary $2 \frac{3}{4}$ to $3 \frac{1}{2}$; interorbital $6 \frac{1}{6}$ to 14; head 1 to $1 \frac{1}{8}$ to dorsal origin; head $2 \frac{7}{8}$ to $3 \frac{1}{5}$ to anal origin.

Body robust, moderately compressed, tail but little more so, rather moderately tapering. Head somewhat depressed above, sides converging convexly below, width about $3 \frac{4}{5}$ its length. Snout depressed, cavernous, protrudes a little in front, surface convex, basal width about $7/8$ its length. Eye large, ellipsoid, close to upper profile,

a trifle before the first third in head. Mouth large and a little inclined. Lips a little fleshy. Teeth minute, pointed, in rather broad bands in jaws, also a short band continued on vomer and upper jaw front. Tongue smooth, small, depressed, rounded, free in front. Mandible shallow, rami low. Nostrils well separated, anterior close after mandible tip on snout inferiorly, with slight cutaneous edge, posterior simple pore about midway in snout. Interorbital broadly depressed. Gill opening $1 \frac{3}{5}$ in eye. Pores in lateral line inconspicuous. Dorsal begins a trifle before pectoral origin. Caudal 3 in eye. Pectoral with slender rays, $2 \frac{1}{2}$ in head.

Pale brown, sides burnished with silvery to whitish. Iris silvery. Edges of vertical fins narrowly dusky to blackish. Length 200 to 305 mm.

Tropical Atlantic and Mediterranean. Described above from Italian examples.

Hoplunnis Kaup

Hoplunnis KAUP, 1859 (1896), Abh. Naturw. Verein Hamburg, IV (2), p. 19. Type: *Hoplunnis schmidti* Kaup. (Designated by Bleeker, 1865, Ned. Tijds. Dierk., II, p. 115.)

Teeth in jaws biserial, small. Vomer with series of long, pointed canines. Gill openings narrow. Tail 4 times the length of rest of body.

Hoplunnis punctatus Regan

Hoplunnis punctatus REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 126. Lagos.

Depth at anal origin 50; tail $3 \frac{2}{5}$ long as rest of fish. Snout $2 \frac{4}{5}$ times diameter of eye, which is nearly twice interorbital. Maxillary extends well behind eye. Premaxillary with 2 pairs of canines and 2 median teeth behind; vomer with series of 5 spaced canines; maxillary teeth small, biserial; mandibular teeth biserial, outer series small, except 2 pairs of anterior canines, inner series small posteriorly, of about 9 stronger spaced teeth laterally. Dorsal origin in advance of gill opening, little farther from eye than latter from end of snout. Pectoral half length of snout. Olivaceous above, silvery below. Upper parts with numerous small dark spots forming irregular longitudinal series. End of tail blackish. Length 370 mm. (Regan.)

Lagos. Probably not distinct from *Hoplunnis schmidti* Kaup from Puerto Cabello, likewise *Hoplunnis diomedianus* Goode and Bean, and *Hoplunnis africanus*.

Uroconger Kaup

Uroconger KAUP, 1854, Cat. Apod. Fish., p. 110. Type: *Congrus lepturus* Richardson. Monotypic.

Congerodon KAUP, 1856, Archiv Naturg., part 1, p. 37. Type: *Congerodon indicus* Kaup. Monotypic.

Body elongate, anteriorly subcylindrical, posteriorly compressed. Tail strongly tapering, very long, slender, about $\frac{1}{2}$ longer than rest of body. Head conic, depressed. Eyes rather large, covered with skin. Mouth cleft moderately wide, extends to eye center or beyond. Jaws unequal. Lips moderate, membranous, upper with row of short slitlike pores. Teeth acicular, unequal, maxillary biserial,

mandibular biserial with anterior short third inner row. Vomer with some large anterior teeth, which may be followed by series of smaller ones. On premaxillary plate there are unequal teeth in 2 irregular series; an outer tooth may be enlarged. Hind nostril slitlike, near eye, below level of its upper edge; anterior near snout tip. Gill openings large, vertical, below and before pectoral base. Lateral line present. Dorsal, anal, and caudal confluent. Dorsal begins over pectoral bases. Pectorals well developed.

Eels of moderate size, mostly in deep waters of warm seas.

***Uroconger vicinus* Vaillant**

Figure 128

Uroconger vicinus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 86, Pl. VI, fig. 1, a-b. Soudan, Banc d'Arguin, off Cape Verde Islands, 633 to 1495 m.

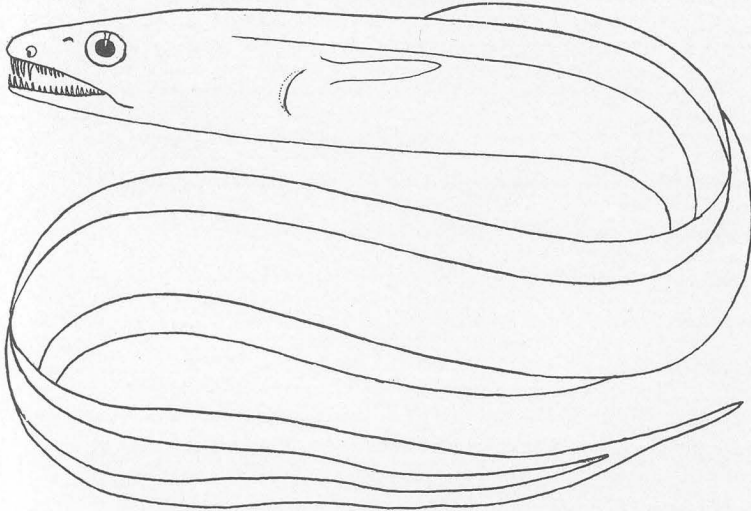


Fig. 128. *Uroconger vicinus*, from Vaillant.

Combined head and trunk about $2\frac{1}{2}$ in tail. Eye $2\frac{1}{2}$ in snout. Mouth cleft reaches eye center. Jaws armed with strong teeth on premaxillaries and front of mandible. Two strong teeth, one before other, anteriorly on vomer, posteriorly teeth obsolete. Front nostril close to snout edge, difficult to distinguish from labial pores. Gill openings moderate. Muciferous canals of head well developed, lower labial pores 4 to 6. Lateral line distinct. Dorsal begins a little before end of pectoral, latter $2\frac{1}{4}$ in head. Length 510 mm. (Vaillant.)

Atlantic. Also reported from off Zululand in 26 fathoms by Barnard (1925, Ann. South African Mus., XXI, p. 192).

Larval Forms

TILURUS Kölliker

Tilurus KÖLLIKER, 1853, Verh. Phys. Med. Ges. Würzburg, IV, p. 100. Type: *Tilurus gegenbauri* Kölliker. Monotypic.

Body much compressed, elongate. Tail ending in thread. Head small, compressed. Snout acutely pointed, moderate in length. Jaws toothed, lower one longer. Gill openings wide. Intestine ends far behind, at a very narrow part of the body. Dorsal as a broad fold of skin, distinct from nape. Anal very low fold. Pectorals very small.

Tilurus curvirostris (Strömman)

Figure 129

Leptocephalus curvirostris STRÖMMAN, 1896, 'Leptocephalids Univ. Mus. Upsala,' p. 41, Pl. v, figs. 1-2. Mid-Atlantic, N. lat. 22°, W. long. 65°.

Tilurus curvirostris PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 188, Pl. IX, fig. 4a; Pl. X, fig. 1, Text Fig. 7 (southwest of Sierra Leone, N. lat. 0° 29', W. long. 18° 57'; Cape Verde Islands, N. lat. 15° 6', W. long. 27° 44'; northwest Cape Verde Islands, N. lat. 24° 41', W. long. 32° 21').

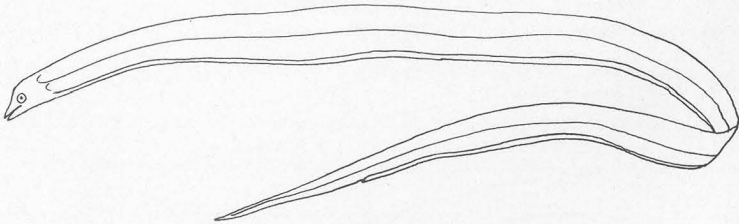


Fig. 129. *Tilurus curvirostris*, from Pappenheim.

Myomeres 450 to 500, of which about 344 to 360 are before the vent and 100 to 140 on tail. Length 90 to 378 mm. (Pappenheim.)

Eastern Atlantic.

Muroenesocidae

Body greatly elongated, eel-like. Jaws not excessively elongated. Vomer well armed with teeth. Tongue largely adnate. Hind nostril not labial. Gill openings rather wide. Branchiostegal membrane connects opposite sides below. Body scaleless. End of tail surrounded by caudal fin. Pectoral well developed.

Plain-colored eels, some of large size, living in rather deep water and resembling the congers.

MUROENESOX McClelland

Muroenesox McCLELLAND, 1844, Jour. Nat. Hist. Calcutta, IV, p. 408. Type:

Muroenesox tricuspidata McCLELLAND. (Virtually designated by Bleeker, 1864, 'Atlas Ichth.,' IV, p. 19.)

Cynoponticus COSTA, 1846, 'Faune Napoli,' Pesci, fasc. 52-53, p. 1. Atypic. Type: *Cynoponticus ferox* Costa (in Index, p. 6). Monotypic.

Brachyconger BLEEKER, 1865, Ned. Tijds. Dierk., II, p. 116. Type: *Conger savanna* Bancroft. Monotypic.

Congresox GILL, 1890 (1891), Proc. U. S. Nat. Mus., XIII, p. 234. Type: *Conger talabon* Cuvier. Orthotypic.

Mouth large. Snout moderately produced. Teeth in jaws in several series, those of one series enlarged and depressed, forming long canines in front. Vomer with several long series of teeth, median series of strong canines. Gill opening wide. Dorsal and anal well developed, former begins nearly above gill opening.

Large conger-like eels, found in most warm seas. Remarkable for the strong armature of teeth on the vomer. Species few.

***Muroenesox savanna* (Bancroft)**

Figure 130

Conger savanna BANCROFT, 1831, Proc. Zool. Soc. London, I, p. 135. Jamaica.

Muraena savanna CUVIER, 1829, 'Règne Animal,' II, p. 350. Martinique. (No description or figure.)

Muraenesox ferox REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 125 (Lagos).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 208 (Senegambia coast).

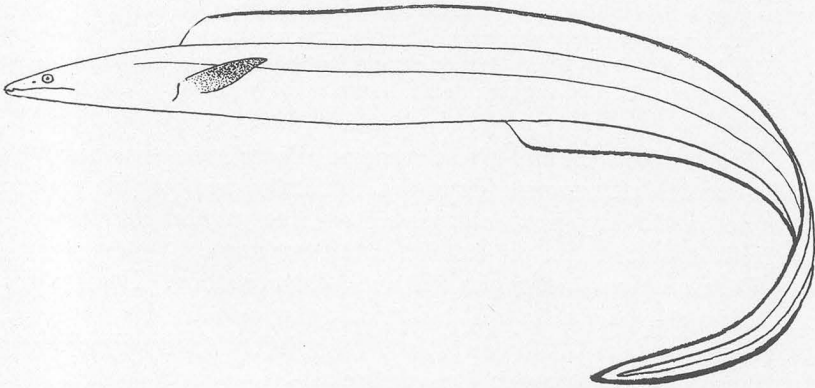


Fig. 130. *Muroenesox savanna*.

Head $6 \frac{5}{6}$ to $6 \frac{9}{10}$; depth $13 \frac{1}{2}$ to 14; dorsal 262; anal 180; snout $4 \frac{1}{3}$ to $4 \frac{2}{3}$ in head; eye 9 to $9 \frac{1}{2}$; mouth cleft $2 \frac{1}{2}$ to $2 \frac{2}{3}$; mandible 2 to $2 \frac{1}{8}$; interorbital $5 \frac{1}{2}$ to $8 \frac{1}{5}$; head $3 \frac{1}{6}$ to $3 \frac{1}{3}$ to anal origin.

Body long, moderately compressed, tail more so and tapering well behind. Head long, somewhat compressed, attenuated, sides slightly approximate below, profiles

similar, width about 3 in its length. Snout conic, protrudes well beyond mandible tip, surface convex, basal width $1 \frac{1}{5}$ its length. Eye without lids, ellipsoid, center trifle before first third in head. Mouth nearly horizontal, gape reaching little beyond hind eye edge. Jaws powerful, maxillary not distinct. Lips thick, fleshy, tough. Premaxillaries with transverse series of 4, or 1 or 2 smaller strong conic teeth arranged at upper jaw tip so as to protrude down before tip of closed mandible; latter fits in deep depression just behind premaxillary teeth; vomer with median row of enlarged culate compressed teeth, edge of each tooth entire and contour broadly triangular; posteriorly median vomerine teeth become molar-like; also a number of small granular to molar-like teeth along each side of vomer well forward; lateral jaw teeth, molar-like or rounded, but with at least one series having somewhat enlarged teeth, though grading off on each side and end to minute teeth in upper jaw, and posteriorly continued down on maxillary edge well behind eye; in upper jaw vomerine and lateral dental areas begin about midway in snout length; mandible with cluster of enlarged conic symphyseal teeth fitting in depression of upper jaw; lateral mandibular teeth similar, though with more compressed regular cutting edge than upper and with one or more series or a narrow band of small granular teeth externally along their whole length. Owing to knobbed symphysis, the rami of the mandible become distinctly convergent close behind, and a keel-like series of vomerine teeth wedge into the resulting narrow space when mandible closes. Front nostril lateral, opposite depression in upper jaw for mandible end, with a broad raised cutaneous edge, placed slightly behind first fourth in snout; hind nostril slitlike pore laterally on snout at about the last fourth in its length. Interorbital broadly convex.

Gill opening $1 \frac{1}{4}$ in snout. Lateral line complete, single series of 126 large elongate tubelike impressions. Dorsal begins trifle before pectoral, fin high. Anal similar. Caudal $6 \frac{1}{5}$ in head. Pectoral small, low, 3 in head.

Dark brown on upper surface. Edges of dorsal, caudal, and anal with dark to blackish brown. Body below light to smutty brownish. Jaws and sides of head smutty brown. Pectoral largely dusky brown. Iris yellowish. Length 915 to 1016 mm.

Tropical Atlantic and Mediterranean. Described above from West Indian and Mediterranean examples. A comparison of this material does not reveal any appreciable differences, except those due to age, to the individual, or to the preparation of the specimens.

Regan reports 2 examples 800 and 1200 mm. long. He says that the vomer has a row of 11 to 13 teeth ending opposite the front eye edge; teeth long, slender, little compressed, very feebly tricuspid at apices. In *Muroenesox savanna* vomerine series ends below hind eye edge, of 17 or 18 teeth, which are short, compressed, and distinctly tricuspid. Other noteworthy differences are the much stronger lower front canines and the longer pectorals of *Muroenesox ferox*.

Heterocongridae

Body greatly elongated, subcylindrical. Tail compressed, nearly twice or more in head and trunk. Snout obtuse, very short. Mouth

cleft small, obliquely ascending upward, reaching eye. Lower jaw projects. Teeth in jaws and on vomer small, acicular, in narrow bands and not separated from those of premaxillary plate. Tongue free. Front nostrils very small and concealed, and hind nostril a slit near the eye. Gill openings lateral, narrow slits. Lateral line present. No scales. Dorsal, anal, and caudal confluent. No pectorals. Vent far behind gill openings.

One genus.

HETEROCONGER Bleeker

Heteroconger BLEEKER, 1868, *Verslagen Kon. Akad. Wet. Amsterdam*, (2) II, p. 331. Type: *Heteroconger polyzona* Bleeker. Monotypic.

Characters included above. Two species.

Heteroconger longissimus Günther

Heteroconger longissimus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.', VIII, p. 45. Lanzarote, Canary Islands.—VINCIGUERRA, 1892, *Atti Soc. Ital. Sci. Nat.*, XXXIV, p. 332 (Canaries).

Head 6 to vent from gill opening. Tail more than twice body length. Eye small. Vertical fins rather indistinct, low. Uniform blackish. Length 483 mm. (Günther.)

Canaries.

Nettastomidae

Sorcerers

Body elongate, more or less compressed. Tail ends in slender point or filament. Snout elongate, pointed, upper jaw longer. Teeth recurved, in cardiform bands in jaws and on vomer, the last separated from premaxillary teeth. Tongue not free. Nostrils superior or lateral, anterior nostril tubular or not, and not far behind snout tip, posterior nostril is slitlike and above or just before eye. Gill openings small or moderate, subinferior and separate. Branchial openings in pharynx wide slits. No scales. Lateral line present. Dorsal, anal, and caudal confluent. No pectorals. Vent far behind head, in front half of body.

Bathypelagic eels, with fragile bodies, living in tropical and warm seas.

NETTASTOMA Rafinesque

Nettastoma RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.', p. 66. Type: *Nettastoma melanura* Rafinesque. Monotypic.

Hyoprurus KÖLLIKER, 1854, *Verh. Phys. Med. Ges. Würzburg*, IV, p. 101. Type: *Hyoprurus messinensis* Kölliker. Monotypic.

Gavialiceps ALCOCK, 1889, *Ann. Mag. Nat. Hist.*, London, (6) IV, pp. 46, 460. Type: *Gavialiceps taeniola* (Wood-Mason) Alcock. Monotypic.

Snout much produced, depressed, without fleshy proboscis. Median vomerine

teeth somewhat larger than others. Nostrils nearly superior, anterior at bony portion of snout tip, posterior above and before eye. Gill openings moderate. No pyloric appendages. Air vessel present. Head with numerous mucous pores. Dorsal low, begins nearly over gill openings.

KEY TO THE SPECIES

- a.*—Head smaller, 10 in total.....*melanura.*
aa.—Head larger, 5 1/5 in total.....*hasta.*

Nettastoma melanura Rafinesque

Figure 131

Nettastoma melanura RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 66 Pl. XVI, fig. 1. Sicily.—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 96 (six miles off São Miguel, 950 m.; three miles off Fayal, 950 m.).

Nettastoma melanurum VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 83, Pl. v, fig. 2, *a-b* (Soudan and Cape Verde Islands, 90 to 760 m.).

Hyoprorus messinensis VAILLANT, *op. cit.*, p. 95 (Morocco, 550 m.).

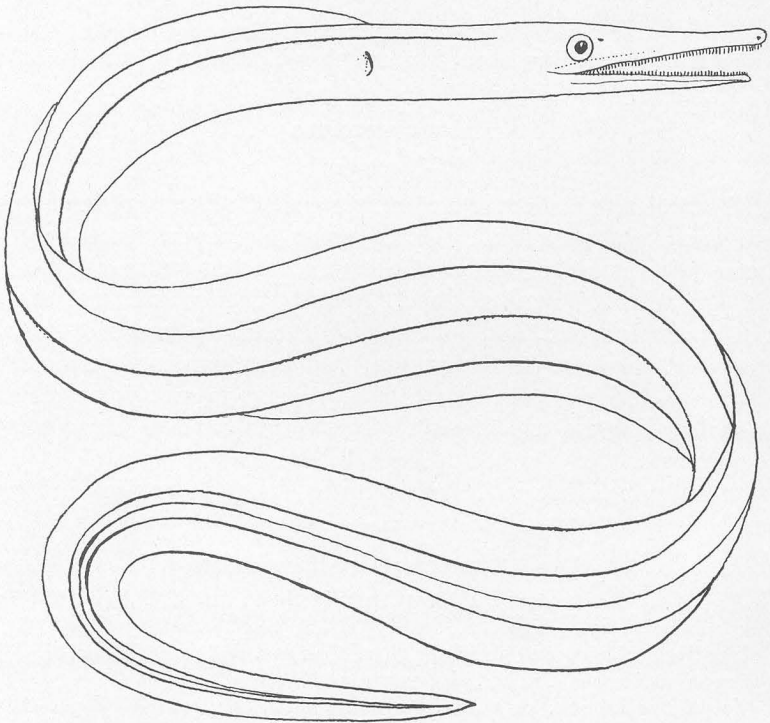


Fig. 131. *Nettastoma melanura*, from Vaillant.

Head 10; depth 40 ; snout 2 1/2 in head; eye 6 in snout; combined head and trunk 1 3/4 in tail. Tail long, and tapering. Upper jaw a little longer than mandible. Teeth robust. Mouth cleft reaches hind eye edge. Interorbital less than eye. Gill opening about equals eye. Dorsal and anal well developed, high. Length 670 mm. (Vaillant.)

Eastern Atlantic and Mediterranean.

***Nettastoma hasta* (Zugmayer)**

Gavialiceps hasta ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 7. N. lat. 36° 14', W. long. 8°, 1400 m., off Portugal; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 86 (type).

Head 5 1/5; depth 44. Body very long, moderately compressed. Snout extended into a long beak formed by jaws and premaxillaries; more than 2 in head. Eye 20 in head. Premaxillary teeth small, though larger than other teeth; mandible with series of minute teeth; vomer armed with small crowded teeth which fill all the space between maxillaries for one-third of beak in pavement. Gill clefts united at their front part. No scales or lateral line. Dorsal and anal very little developed, the former beginning well behind head. Caudal minute. No pectoral. Vent distant from gill opening nearly double length of snout. Steel gray or silvery. Head black anteriorly, thorax and abdomen black. Length 310 mm. (Zugmayer.)

Eastern Atlantic.

***Venefica* Jordan and Davis**

Venefica JORDAN AND DAVIS, 1888, (1892), Rept. U. S. Fish Comm., XVI, p. 651. Type: *Nettastoma procerum* Goode and Bean. Orthotypic.

Body very elongate, compressed. Head moderate, conic, somewhat depressed. Snout prolonged into a slender fleshy flap. Eyes covered with skin. Bands of cardiform teeth in jaws and on vomer. No lips. Tongue not free. Front nostrils in tubes at top of snout, behind base of flap, hind nostrils at upper part of front eye edge. Gill openings small, subinferior, separated by rather wide interspace. Pores in course of sensory canals of head well developed. Lateral line well developed, with numerous pores in single row. Dorsal origin above or somewhat before gill opening. Dorsal, anal, and caudal confluent. No pectoral. Vent far back in front half of body.

Bathypelagic in tropical and warm seas.

***Venefica proboscidea* (Vaillant)**

Nettastoma proboscideum VAILLANT, 1888, 'Expéd. "Travailleur" et du "Talisman,"' Poiss., p. 84, Pl. VII, fig. 3. Morocco, 2200 m.

Head 10; depth about 50. Upper jaw projects well beyond lower and is prolonged in a proboscis-like tip half length rest of upper jaw. Eye about 8 in snout, measured to base of proboscis. Mouth cleft extends nearly 2 eye diameters beyond eye. Teeth fine, cover jaws and palate in rasp. Front nostril tubular at base of proboscis, hind nostril less than eye diameter before eye and a little above its center. Gill opening little longer than eye. Lateral line distinct, complete. Dorsal begins somewhat near gill opening. Anal begins near vent. No pectoral. Length 960 mm. (Vaillant.)

Eastern Atlantic.

Nemichthyidae

Snipe Eels

Body excessively slender, more or less compressed, deepest medianly, tapers back to an usually long and slender filiform tail, forward to a very long slender neck, abruptly enlarged at head. Head small, short, rather wide, top depressed. Snout protruded, extremely slender, nearly needle-like, upper jaw longer. Eye moderate, mandible slender like upper jaw. Mouth cleft extends behind eye. Jaws and vomer with close-set teeth, points sometimes directed backward. Tongue not free. Nostrils large, close together, before eye, without tube or flap. Gill opening large, separated by a narrow isthmus or partly confluent. Branchial openings in pharynx wide slits. Suspensorium vertical. Vertebrae numerous. No scales. Lateral line with or without pores. Dorsal and anal long, confluent with reduced caudal or extend to end of filamentous tail. Pectoral small, well developed. Vent near gill openings or more posterior.

Singular bathypelagic eels, of warm and temperate seas.

KEY TO THE GENERA

- a.*—Dorsal origin behind pectoral origin; vent far distant from pectorals; jaws unequal.
b.—Dorsal origin behind anal origin **SERRIVOMER.**
bb.—Dorsal origin immediately behind pectoral base **AVOCETTINA.**
aa.—Dorsal origin before pectoral origin; vent immediately behind pectorals; jaws equal **NEMICHTHYS.**

SERRIVOMER Gill

Serrivomer (Gill and Ryder) GILL, 1883 (1884), Proc. U. S. Nat. Mus., VI, p. 255. Type: *Serrivomer beanii* (Gill and Ryder) Gill. Monotypic (name only); *op. cit.*, p. 260 (description).

Body slender, elongate, moderately compressed, tapering from trunk to snout and to end of tail. Head rather long and pointed. Snout pointed, somewhat curved upward, not longer than rest of head. Eye above mouth angle. Jaws moderately attenuated, lower somewhat longer. Mouth cleft reaches behind eye. Teeth in front third of jaws small, compressed, in several rows; in second third larger, lancet shaped, depressible and uniserial; in last third small, less compressed. Vomerine teeth much larger, bladelike, alternating, crowded to appear as a compressed serrate row. Gill openings wide, inferior, descend forward. Gill membranes united, joined to thin partition attaching them to isthmus. No scales. Dorsal, anal, and caudal confluent. Dorsal origin behind anal origin, latter about midway between pectoral and dorsal origins. Pectoral small, rather high. Vent at end of first or in front of second fourth of length.

Bathypelagic in tropical seas.

Serrivomer beanii Gill

Figure 132

Serrivomer beanii (Gill and Ryder) GILL, 1883 (1884), Proc. U. S. Nat. Mus., VI, p. 255 (name only), p. 260. N. lat. $41^{\circ} 40' 30''$, W. long. $65^{\circ} 28' 30''$, in 855 fathoms.

Serrivomer sector GARMAN, 1899, Mem. Mus. Comp. Zoöl., XXIV, p. 320, Pl. LXIII. N. lat. 3° to 7° , W. long. 79° to 86° , 134 to 1772 fathoms; off Guaymas, 51 miles south, to 700 fathoms.—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 185 (N. lat. $28^{\circ} 42'$, W. long. $34^{\circ} 33'$, 3000 m.).

Fig. 132. *Serrivomer beanii*, from Brauer.

Head $5 \frac{1}{2}$ to 6; depth 51; dorsal 159 to 165; anal 160 to 161; pectoral 6 or 7; caudal 6; snout $2 \frac{2}{3}$ in head; eye 18 to 20, broader than deep. Mouth cleft reaches somewhat beyond eye. Dorsal begins a little behind anal origin, which is distant from head half its length. Dorsal rays shorter than those of anal. Pectoral very small, as long as eye. Silvery, with small black spots. Length 560 mm. (Brauer; Garman.)

Atlantic, Indian, and Pacific Oceans. Barnard reports it south of Agulhas Bank in 560 fathoms (1925, Ann. South African Mus., XXI, part 1, p. 200).

AVOCETTINA Jordan and Davis

Avocettina JORDAN AND DAVIS, 1888 (1892), Rep. U. S. Fish Comm., XVI, p. 655. Type: *Nemichthys infans* Günther. Orthotypic.

Body exceedingly elongate, band-shaped, tail tapering to a point. Body depth at front third is much less than in second third. Head nearly as deep as wide. Snout produced into a long slender bill, longer than mandible, tip of each with slight pad. Eye moderate, without orbital margin. Teeth in jaws and on vomer close set, points directed backward. Tongue not free. Gill openings rather wide, with narrow interspace where gill membrane fastens to isthmus. No scales. Lateral line formed by one series of pores. Dorsal origin immediately behind pectoral origin, anal origin close behind vent. Vent far behind pectorals.

Avocettina infans (Günther)

Figure 133

Nemichthys infans GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 251. Mid-Atlantic, 2500 fathoms.—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 95, Pl. VII, fig. 1a (Azores, 2995 m.).

Avocettina infans BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV, p. 129, Pl. VIII, figs. 5-6 (between Sierra Leone and Cameroon, N. lat. $5^{\circ} 5' 3''$, W. long. 13°

27' 5", 3070 m.; Gulf of Guinea, N. lat. $0^{\circ} 26' 3''$, W. long. $6^{\circ} 32'$, 4000 m.; N. lat. $3^{\circ} 31'$, E. long. $7^{\circ} 25' 6''$, 600 m.).

Nemichthys richardi VAILLANT, *op. cit.*, p. 385 (on p. 93).

Head about $9 \frac{1}{2}$; depth 40 to 48; dorsal 325 to 353; anal 240 to 307; pectoral 14 or 15; snout $1 \frac{1}{3}$ to $1 \frac{2}{5}$ in head; eye 14, in postorbital $2 \frac{1}{3}$ to $2 \frac{3}{5}$ and twice or somewhat less in interorbital. Dorsal origin less than twice eye from pectoral base.

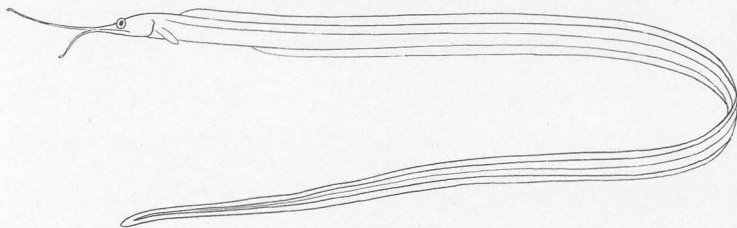


Fig. 133. *Avocettina infans*, from Brauer.

Postorbital $3 \frac{3}{5}$ to 4 in the space between the anal and the pectoral base. Pectoral somewhat less or more than length in postorbital. Dark brown, lateral pores in a blackish line. Length 600 mm. (Weber and Beaufort.)

Atlantic and Indian Oceans. *Nemichthys richardi* Vaillant was based on a small example 240 mm. long, in which the eye is very small and nearer the snout tip than the gill opening. It also shows the vent at about the first third in the entire length. Barnard reports *Avocettina infans* off Cape Point in 480–630 fathoms (1925, Ann. South African Mus., XXI, part 1, p. 199).

NEMICHTHYS Richardson

Nemichthys RICHARDSON, 1848, 'Voy. "Samarang,"' Fishes, p. 25. Type: *Nemichthys scolopacea* Richardson. Monotypic.

Leptorhynchus LOWE, 1850, Proc. Zool. Soc. London, XVIII, p. 252. Type: *Leptorhynchus leuchtenbergii* Lowe. Monotypic.

Belonopsis BRANDT, 1854, Mém. Acad. St. Pétersbourg, Sav. Étrang., p. 174. Type: *Leptorhynchus leuchtenbergii* Lowe. Monotypic.

Tilurella ROULE, 1911, Comp. Rend. Acad. Sci. Paris, CLIII, p. 732. Atypic. Type: *Nemichthys scolopacea* Richardson.

Body exceedingly elongate, slender, tapers toward tail. Head rather stout. Jaws prolonged as a slender straight bill, not expanded at tip. Eyes large. Jaws and vomer with small closet-set teeth, points directed backward. Tongue not free. Nostrils close together, near eye. Gill openings wide, extend downward and forward, nearly confluent. No scales. Dorsal origin above gill openings. Anal origin immediately behind vent. Pectorals well developed. Vent below pectorals.

Bathypelagic in tropical seas.

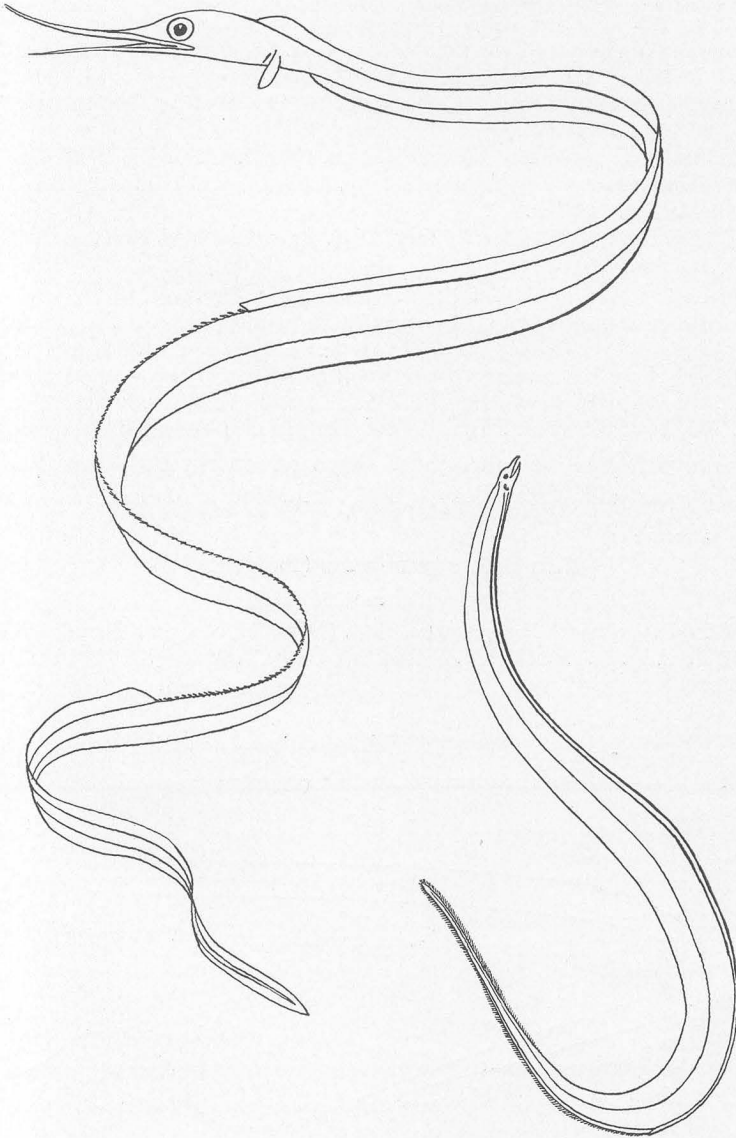


Fig. 134. *Nemichthys scolopacea*, from Brauer, larva from Roule.

Nemichthys scolopacea Richardson

Figure 134

Nemichthys scolopacea RICHARDSON, 1848, 'Voy. "Samarang,"' Fishes, p. 25, Pl. x, figs. 1-3. Southern Atlantic.—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 21 (type; Madeira).—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 93, Pl. VII, fig. 2a (Banc d'Arguin, 888 m.).—BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV, p. 126, Pl. IX, fig. 1 (Cape Verde, N. lat. 16° 14' 1", W. long. 22° 38' 3", 1694 m.).

Tilurella (Nemichthydis) scolopacei ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 108, Pl. VII, fig. 1a-d (southwest of Azores, 1500 m.), p. 110, Pl. VII, fig. 2a (northwest of Madeira, 3500 m.).

Leptorhynchus leuchtenbergii LOWE, 1850, Proc. Zool. Soc. London, XVIII, p. 252. Madeira.

Head 10 to 11; depth 57 to 72; dorsal more than 300; pectoral 11. Eye about 3 in postorbital part of head, 7 in snout in large examples. Mouth cleft extends slightly behind eye. Nostrils close before eye. Lateral line with 3 rows of pores. Dorsal begins an eye diameter before the pectoral. Anal begins an eye diameter behind the vent. Pectoral about equals head depth. Vent shortly behind pectoral base. Blackish. Iris bluish. Length 1445 mm. (Brauer; Weber and Beaufort.)

Tropical Atlantic and Pacific. Barnard reports it off Cape Point in 400 fathoms and Natal Coast (1925, Ann. South African Mus., XXI, part 1, p. 198).

Nemichthys gaussianus (Pappenheim)

Figure 135

Tilurella gaussiana PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 187, Pl. x, fig. 3a. South of St. Helena, S. lat. 30° 21', W. long. 14° 2', 10 m.

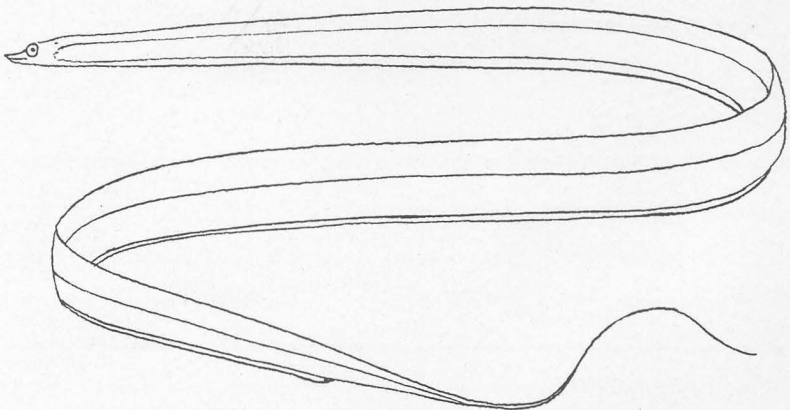


Fig. 135. *Nemichthys gaussianus*, from Pappenheim.

About 260 preanal myomeres. Tail, for about fourth of total length, forms a long slender terminal filament. Length 355 mm. (Pappenheim.)

South Atlantic.

Cyemidae

Body moderately elongate, trunk and tail nearly equal in length. Snout and lower jaw produced, slender. Maxillary extends backward far behind the small eye. Suspensorium directed obliquely backward. Vertebrae about 80. Vent equidistant from gill openings and end of short tail.

Regan says that the suggestion that *Cyema* is a *Nemichthys* with regenerated tail cannot be entertained. The four known specimens are very much alike, and the posterior caudal vertebrae decrease in length backward in a perfectly regular manner.

CYEMA Günther

Cyema GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 251. Type: *Cyema atrum* Günther. Monotypic.

Body compressed, bandlike, soft. Eye very small. Gill openings very narrow, close together on ventral surface. Vertical fins well developed, confined and interrupted at end of tail. Pectoral well developed. Vent midway in body.

Cyema atrum Günther

Figures 136 and 137

Cyema atrum GÜNTHER, 1870, Ann. Mag. Nat. Hist., London, (5) II, p. 251. Pacific and Antarctic, 1500 to 1800 fathoms.—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 91, Pl. VII, fig. 4a (off Morocco, 2210 m.).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 85, Pl. IV, fig. 4 (southwest of Azores, N. lat. 27° 36', W. long. 38° 29', 2225 m.).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 135 (N. lat. 32° 36', W. long. 14° 27', 4360 m., off Madeira).



Fig. 136. *Cyema atrum*, from Zugmayer.

Head $3 \frac{1}{5}$ to $3 \frac{1}{4}$; depth 10 to 12; dorsal 90 to 93; anal 86 to 93; pectoral 13 or 14; lateral pores 90. Head conic. Jaws produced into a slender beak. Teeth minute, quincunx. Front nostril in a short tube, hind one small round pore, close

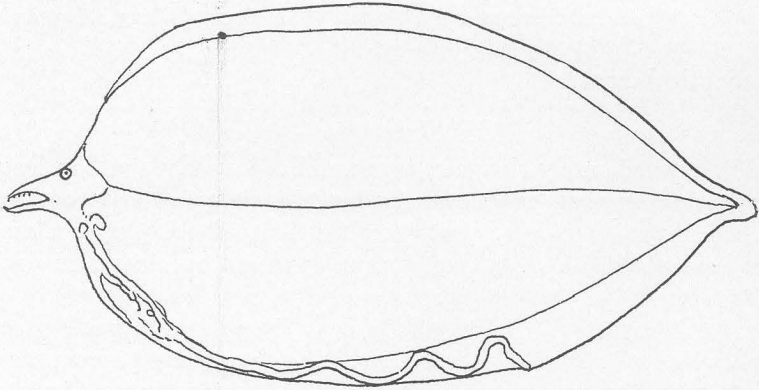


Fig. 137. *Cyema atrum*, larva, after Brauer.

together before eye. Dorsal and anal origins opposite, near last $\frac{2}{5}$ in total length. Pectoral rudimentary. Violet velvet-black. Iris blue. Length 100 to 125 mm. (Zugmayer.)

Widely distributed in the Atlantic, Indian, and Pacific Oceans.

Echelidae

Worm Eels

Body elongate, wormlike or slightly compressed, or short and much compressed. Snout rather short, made more or less prominent by the prominence of the ethmoid, with the premaxillary plate beyond the articulation with the maxillaries. Eye large or small. Mouth cleft reaches beyond eye. Teeth in jaws in one or more series or bands, variable in form and size; on premaxillary in a group or in rows, generally larger, or even caniniform. Vomerine teeth present or absent. Tongue not free. Front nostrils in short tube at edge of upper lip, hind ones generally near eye in upper lip, in valve or protruding flap. Gill openings small, separated by interspace of different breadth. Branchial openings in pharynx are wide slits. No scales. Dorsal, anal, and caudal confluent. Dorsal origin above or far behind gill openings, before, above, or behind vent. Pectorals well developed, vestigial, or absent. Vent far behind gill openings, in front half of length.

Usually small plain-colored eels, more or less suggestive of worms, living in coral reefs, sandy shores, or surface near them, in tropical seas.

KEY TO THE GENERA

- a.*—Dorsal origin close behind pectoral base, or much nearer latter than vent.
b.—Teeth in jaws in cardiform bands..... ECHELUS.

- bb.—Teeth in jaws mostly biserial **PARAMYRUS.**
 aa.—Dorsal origin midway between pectoral base and vent, or nearer latter; teeth in jaws variably biserial or triserial **MYROPHIS.**

ECHELUS Rafinesque

Echelus RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 63. Type: *Echelus punctatus* Rafinesque. (Designated by Bleeker, 1864, 'Atlas Ichth.,' IV, p. 20.)

Myrus KAUP, 1856, Archiv Naturg., part 1, p. 53. Type: *Muraena myrus* Linné. Tautotypic.

Body elongate, subterete. Tail longer than rest of body. Teeth in jaws in cardiform bands. Vomer with teeth. Nostrils on or very close to edges of upper lip, front one tubular, hind one lobed. Vertical and pectoral fins well developed. Dorsal begins close behind pectoral base. Caudal very short.

Echelus pachyrhynchus (Vaillant)

Figure 138

Myrus pachyrhynchus VAILLANT, 1888, 'Expéd. "Travailleur" et du "Talisman,"' Poiss., p. 81, Pl. v, fig. 1a-b. Morocco and Cape Verde Islands, 460 to 1435 m.

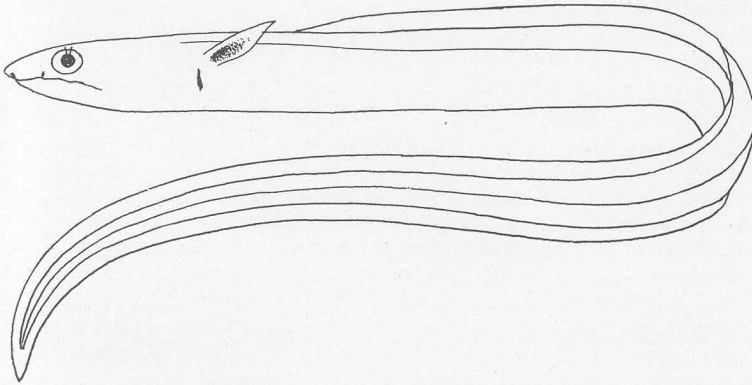


Fig. 138. *Echelus pachyrhynchus*, from Vaillant.

Head little over 8; depth over 19. Body long, tail $\frac{3}{5}$ of total. Head long. Snout very short, 3 in head. Eye $1\frac{4}{5}$ in snout. Mouth inferior, cleft extends behind eye, length $2\frac{1}{10}$ in head. Teeth fine, numerous, premaxillary somewhat more developed; vomerine form median line on palate. Front nostril in a tube. Gill opening little less than eye. Skin naked. Lateral line distinct. Pectoral moderate, $2\frac{2}{3}$ in head, not quite reaching dorsal origin. Grayish, fins paler. Gill opening black. Length 360 mm. (Vaillant.)

Eastern Atlantic.

PARAMYRUS Günther

Paramyrus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 51. Type: *Conger cylindroidens* Ranzani. (Designated by Jordan and Davis, 1888 (1892), Rept. U. S. Fish Comm., XVI, p. 641.)

Holopterura COPE, 1871, Trans. Am. Philos. Soc., (2) XIV, p. 482. Type: *Holopterura plumbea* Cope. Monotypic.

Body very elongate, cylindrical, compressed posteriorly. Snout projects beyond mandible. Mouth cleft reaches hind eye edge or somewhat beyond. Teeth in jaws mostly biserial. Vomer with one or more rows of teeth. Nostrils on edge of upper lip, anterior in broad tube near snout tip, posterior slightly before eye in pendulous valve. Gill openings small, separated by broad isthmus. No scales. Lateral line present. Dorsal origin above pectorals, or well behind (*Holopterura*). Dorsal, anal, and caudal confluent. Pectorals small. Vent near second third in length.

Tropical Atlantic and East Indies.

Paramyrus plumbeus (Cope)

Holopterura plumbea COPE, 1871, Trans. Am. Philos. Soc., (2) XIV, p. 482. Monrovia, Liberia.—FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 240, Fig. 6 (type).

Head 8; depth $32 \frac{2}{3}$; snout $6 \frac{7}{8}$ in head; eye $9 \frac{3}{4}$; maxillary $3 \frac{1}{3}$; inter-orbital 8; mandible $2 \frac{4}{5}$; pectoral 6; about 114 (?) pores distinct in lateral line; head $3 \frac{2}{5}$ to vent.

Body compressed, sides rather flattened, and tail gradually tapers behind but not acuminate at tip. Head width $4 \frac{1}{2}$ in its length. Snout conic, upper profile and surface convex; basal width $1 \frac{1}{6}$ its length, tip projecting well beyond mandible. Eye large, rather ellipsoid, without eyelid, center a trifle before first fifth in head. Mouth large, broad, horizontal or but slightly inclined. Lips fleshy, entire, rather thick. Teeth conic, sharp-pointed, mostly directed back, moderate in size, not continuous above with premaxillary or vomerine series; upper lateral teeth biserial; mandibular teeth similar, continuous across symphysis; several rather large premaxillary teeth, visible from below in closed mandible; vomerine teeth like upper laterals, beginning just behind front nostril, biserial, conic, slope backward, and anterior little enlarged; almost all teeth are a little larger anteriorly in jaws. Front nostril in small tube on upper lip opposite closed mandible tip; hind nostril is a deep slit in upper lip, opening downward below front eye edge. Interorbital convex. Gill opening inclined in crescent from opposite upper median pectoral rays obliquely back, about equals eye. Pores on head little evident. Dorsal origin distant from gill opening, equals space between gill opening and front eye edge. Caudal length about $\frac{3}{4}$ of eye. Pectoral small, upper ray longest. Vent close before anal.

Largely brownish, obscurely dotted with darker. Head above like back, pale below. Iris pale slaty. Fins all pale brown. Length 232 mm.

Liberia. Described above from the type of *Holopterura plumbea*.

MYROPHIS Lütken

Myrophis LÜTKEN, 1851, Vidensk. Medd. Nat. Fören., Kjøbenhavn, I, p. 1. Type: *Myrophis punctatus* Lütken. Monotypic.

Body elongate, partly terete. Teeth partly equal. Vomerine teeth anteriorly in 2 or 3 series. Vertical fins low, surround tail. Tail much longer than rest of body. Dorsal begins before vent. Pectoral very small.

***Myrophis punctatus* Lütken**

Myrophis punctatus LÜTKEN, 1851, Vidensk. Medd. Nat. Fören., Kjøbenhavn, I, p. 1. West Indies.—MONOD, 1927, 'Faune Colon. françaises,' p. 678 (copied).

Myrophis longicollis PETERS, 1864, Monatsb. Akad. Wiss. Berlin, p. 397 (Liberia).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalambie,' Poiss., p. 147 (Gambia).

Myrophis vafer (not Jordan and Gilbert) PIETSCHMANN, 1913, Jahrb. Nassau. Ver. Naturk., Wiesbaden, LXVI, p. 177 (Cameroon).

Head $7\frac{4}{5}$ to $8\frac{2}{3}$; depth $24\frac{1}{3}$ to $25\frac{1}{2}$; snout 6 to $6\frac{1}{5}$ in head; mouth $2\frac{3}{5}$ to $3\frac{1}{4}$; interorbital 7; head $3\frac{1}{6}$ to $3\frac{1}{3}$ to vent; eye $1\frac{1}{2}$ to $1\frac{3}{4}$ in snout.

Body subcylindrical, but slightly deeper than wide and sides with convex surfaces. Head conic, with swollen thorax. Snout conic, width $1\frac{1}{5}$ its length; tip projects about $\frac{1}{3}$ of eye diameter beyond mandible. Eye ellipsoid, lids not free, front edge midway between snout tip and rictus; a little more posterior in small examples. Teeth conic, a little larger in front of jaws, where biserial along sides, inner row a little larger and depressible; row of similar teeth down vomer, smaller and biserial behind; teeth below like upper jaw teeth, irregularly triserial in front, rest largely biserial. Tongue fleshy, not free. Front nostril in short tube close behind snout tip; hind nostril deep slit within upper lip close before front of eye. Interorbital slightly convex. Gill opening small, little inclined, about as long as eye. Pores on head inconspicuous; a row along face of each mandibular ramus; a row along and near edge of upper lip. Dorsal origin about midway between vent and rictus; slightly more posterior in young. Caudal $1\frac{1}{2}$ in eye. Pectoral 5 to 7 in head, rounded, with about 11 rays.

Uniform brown, covered with numerous brownish dots, very small or microscopic, rounded, and crowded. Slightly larger and more conspicuous dots along the middle of side of trunk, but not extending below on abdomen. Pectoral and iris pale like belly and under surface. Dorsal brown like back, anal pale like belly. Length 198 to 390 mm.

Tropical Atlantic. Described above from 18 examples obtained at the mouth of the Congo by the Congo Expedition.

Ophichthyidae

Snake Eels

Tongue more or less firmly joined in mouth. Front nostril near snout tip, usually in a small tube. Hind nostril in upper lip, opens downward. Gill openings not confluent. Eggs numerous, moderate, like those of ordinary fishes. Body scaleless. Vertical fins and sometimes pectorals absent. End of tail always projects beyond dorsal and anal fins, without rudiment of caudal. Color frequently variegated.

Numerous small or moderate-sized eels, very abundant about coral reefs in tropical seas.

KEY TO THE GENERA

- a.—Body finless, or sometimes only rudimentary dorsal or anal, no pectorals; gill openings close together. CAECULA.
- aa.—Body with distinct fins, at least on back; pectorals present.
- b.—Teeth blunt, mostly granular or molar.
- c.—Dorsal rather high, begins on head before gill opening; pectorals short. MYRICHTHYS.
- cc.—Dorsal low, begins behind gill opening; pectorals small. PISODONOPHIS.
- bb.—Teeth all pointed, none molar; pectorals well developed.
- d.—Snout moderate or short, less than 1/4 of head, jaws not produced into slender beak.
- e.—Teeth subequal, without canines. OPHICHTHUS.
- ee.—Teeth unequal, some long canines either on vomer or sides of one or both jaws. MYSTRIOPHIS.
- dd.—Snout very long, attenuate, clavate at tip, its length more than 1/4 of head; jaws slender and elongate. OXYSTOMUS.

CAECULA Vahl

Caecula VAHL, 1794, Skriv. Naturh. Selsk., Kjøbenhavn, III (2), p. 149. Type: *Caecula apterygera* Vahl. Monotypic.

Coecula AGASSIZ, 1845, 'Nomencl. Zool.,' Pisces, p. 18. Type: *Caecula apterygera* Vahl.

Sphagebranchus BLOCH, 1795, 'Naturg. Ausl. Fische,' IX, p. 88. Type: *Sphagebranchus rostratus* Bloch. Monotypic.

Caecilia (not Linné) LACÉPÈDE, 1800, 'Hist. Nat. Poiss.,' II, p. 135. Type: *Caecilia branderiana* LACÉPÈDE = *Muraena caeca* Linné. Monotypic.

Apterichthys DUMÉRIL, 1806, 'Zool. Analytique,' p. (12) 331. Atypic. Type: *Muraena caeca* Linné.

Apterichthys OKEN, 1817, Isis, p. 1182 (on Cuvier, 1817, 'Règne Animal,' II, p. 234). Type: *Muraena caeca* Linné. (Designated by Bleeker, 1865, Nat. Tijds. Dierk., II, p. 120.)

Apterichthys, *Apterichthe* auct.

Pterurus (not *Pterourus* Scopoli, 1777) RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' pp. 43, 59. Type: *Pterurus flexuosus* Rafinesque. Monotypic.

Typhlotes FISCHER, 1813, 'Zoognos. Tab. Synopt. Illustr.,' 3d Ed., I, p. 75. Type: *Sphagebranchus rostratus* Bloch. (*Typhlotes* Fischer proposed to replace *Sphagebranchus* Bloch.)

Branderius RAFINESQUE, 1815, 'Analyse de la Nature,' p. 93. Type: *Sphagebranchus rostratus* Bloch. (*Branderius* Rafinesque proposed to replace *Sphagebranchus* Bloch.)

Ichthyapus BRISSOUT DE BARNEVILLE, 1847, 'Rev. Zool.,' p. 219. Type: *Ichthyapus acutirostris* Brissout de Barneville. Monotypic.

Anguisurus KAUP, 1856, Archiv Naturg., part 1, p. 52. Type: *Anguisurus punctulatus* Kaup. Monotypic.

Ophisurapus KAUP, loc. cit., p. 52. Type: *Ophisurapus gracilis* Kaup. Monotypic.

Ophisuraphis auct.

Scytallurus DUMÉRIL, 1856, Mém. Acad. Sci. Paris, XXVII, p. 199. Type: *Sphagebranchus imberbis* De la Roche. Monotypic.

Pelia (Schlegel) BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, (2) XVIII, p. 128. Type: *Pelia cephalopeltis* (Schlegel) Bleeker. Monotypic. (Name in synonymy.)

Body well elongated, cylindrical. Head short or moderate. Snout pointed, projects beyond mouth, with sharklike profile. Eyes small, placed before or above middle of mouth cleft. Mouth small, reaches behind or far behind eye. Lips without filaments. Teeth conic, pointed, small, mostly uniserial. Vomerine teeth equal in size, stouter, biserial. Tongue scarcely free in front. Front nostril tubular, at border of upper lip, or at ventral surface of prominent part of snout. Hind nostril slit in border of upper lip, face downward. Gill slits small, close together, inferior, vertical or converge forward. No scales. Lateral line present. Dorsal origin above or generally more or less behind gill openings. Dorsal and anal sometimes absent, or very low, not confluent, ending at a short distance from end of tail. Pectorals absent.

Small eels, rather numerous in species. Mostly found on sandy shores of temperate and tropical seas, some entering fresh water.

KEY TO THE SPECIES

a.—No fins.

b.—Head 7 to vent. *anguiformis*.

bb.—Head 11 to vent. *acutirostris*.

aa.—Dorsal begins shortly behind gill opening; head 6 to 8 to vent. . . . *cephalopeltis*.

***Caecula anguiformis* (Peters)**

Ophichthys (*Sphagebranchus*) *anguiformis* PETERS, 1876 (1877), Monatsb. Akad. Wiss. Berlin, p. 849. Atlantic Ocean southeast of Leton Rock, N. lat. 15° 40', W. long. 23° 5' 8', in 38 fathoms.

Head 17, to vent 7. Body elongate, wormlike. Snout pointed, extends over mouth, 7 1/2 in head. Eye midway in mouth, half its diameter from upper lip, 2 in snout. Teeth pointed series. No fins. Flesh color, with small black dots. Length 260 mm. (Peters.)

Eastern Atlantic.

***Caecula acutirostris* (Brissout de Barneville)**

Ichthyapus acutirostris BRISSOUT DE BARNEVILLE, 1847, Rev. Zool., p. 219. Open sea below the equator.

Head 11 to vent. Body elongate, cylindrical. Snout pointed, projects over mouth. Eyes small, distinct. Teeth conic, more or less curved, pointed; canines in both jaws, anterior largest; longitudinal band of similar teeth on vomer, though usually less strong than in jaws. Nostrils above snout, each without appearance of orifice, not notched. Two gill openings upon pharynx distinct, very closely approximated. Skin naked, without scales. Pores distinct on head and in lateral line. No fins. Brown. Length 220 mm. (Brissout de Barneville.)

Open sea.

Caecula cephalopeltis (Bleeker)

Murongulédi, Muhongolédi, Mongolodi (Cameroon)

Figure 139

Sphagebranchus? cephalopeltis BLEEKER, 1862, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, (2) XVIII, p. 128. Guinea Coast.—PETERS, 1876 (1877), Monatsb. Akad. Wiss. Berlin, p. 251 (Cameroon).—BOULENGER, 1915, 'Cat. Fresh-water Fishes Africa,' III, p. 10, Fig. 7 (Gambia, Ngomo, Ogowe).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, IX, p. 249 (Port Étienne).—MONOD, 1927, 'Faune Colon. françaises,' p. 678 (Douala Bay, Cameroon).

Pelia cephalopeltis (Schlegel) BLEEKER, *loc. cit.*, (nom. in synonymy).

Ophichthys (Sphagebranchus) büttikoferi STEINDACHNER, 1894, Notes Leyden Mus., XVI, p. 88, Pl. IV, fig. 2. Mountain brook at Hilltown, Liberia.

Ophichthys büttikoferi BÜTTIKOFER, 1890, 'Reis. Liberia,' II, p. 480 (name only).

Ophichthys büttikoferi PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 116 (Baie du Lévrier); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 27 (Baie de Cassado, Baie du Lévrier).

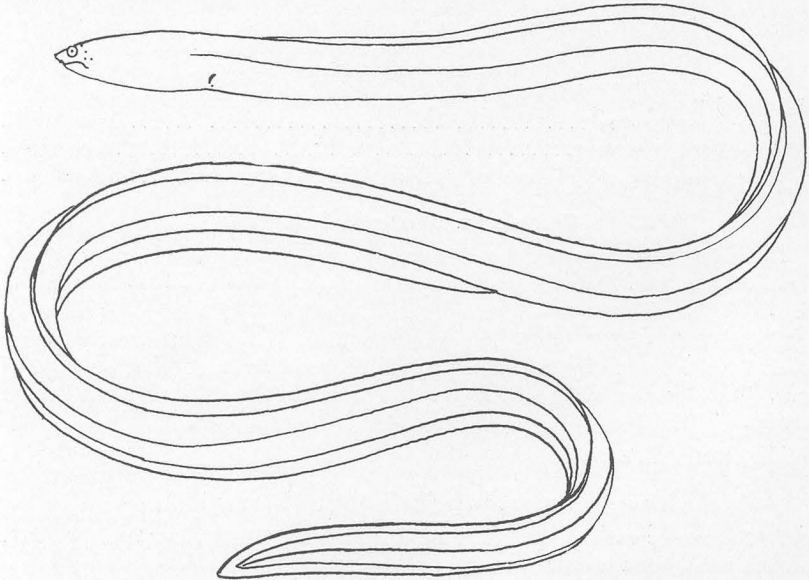


Fig. 139. *Caecula cephalopeltis*, from Boulenger.

Head 6 to 8 to vent. Body extremely slender, cylindrical, depth 65 to 85. Tail longer than body. Head very small. Snout acutely pointed, projecting very strongly beyond mandible. Eye very small, midway between snout tip and mouth angle. Front teeth above uncovered. Dorsal begins shortly behind gill openings. Brownish above, whitish beneath. Length 535 mm. (Boulenger.)

Gambia to Ogowe.

MYRICHTHYS Girard

Myrichthys GIRARD, 1859, Proc. Acad. Nat. Sci. Philadelphia, p. 58. Type: *Myrichthys tigrinus* Girard. Monotypic.

Body well elongated. Head small, conic. Snout short, pointed, convex, much projecting beyond mouth. Eye small. Mouth small, cleft reaches to hind eye edge or beyond. Teeth obtusely conic or granular, biserial in jaws, on vomer, and premaxillary plate. Tongue not free. Front nostrils in tubes on flattened lower surface of snout. Hind nostrils wide, in upper lip, looking downward, anteriorly with flap. Gill openings rather small, oblique, lateral slits, separated by an interspace of moderate extent. Dorsal and anal end at a short distance before end of tail. Dorsal begins on nape, far before gill openings. Pectorals short, broad rudiments. Vent in front half of length.

Tropical seas.

Myrichthys pardalis (Valenciennes)

Morena pintada (Canaries), Schykbo (Senegambia), Cobra d'agua (St. Thomas Island)

Figure 140

Ophisurus pardalis VALENCIENNES, 1836, 'Hist. Nat. Canaries,' II, part 2, p. 90, Pl. xvi, fig. 2. Arrecife, Lanzarote, Canaries.—RICHARDSON, 1844–1848, 'Voy. "Erebus" and "Terror,"' Ichth., p. 100 (Lacrotta, Canaries).

Ophichthys pardalis GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 82 (Lanzarote and Cape Verde Islands).—ROCHEBRUNE, 1883–1885, 'Faune Sénégalie,' Poiss., p. 148 (Guet N'Dar, Gorée, Cape Verde).—STEINDACHNER, 1891, Sitzs. Akad. Wiss. Wien, C (1), p. 363 (Lanzarote, Arrecife, Puerto de Cabras, Grand Canary).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 333 (Grand Canary).—OSORIO, 1895 (March), Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 246 (Anno Bom Island); *op. cit.*, 1898, (2) V, p. 200 (Cape Verde, St. Thomé, Anno Bom).

Ophichthys (Sphagebranchus) guineensis OSORIO, 1894 (February), Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 179. St. Thomas Island, West Africa; *op. cit.*, p. 184 (Bissau); *op. cit.*, 1898, V, p. 200 (Bissau; St. Thomé).

Head $11 \frac{3}{4}$; depth at vent about $33 \frac{4}{5}$; snout $5 \frac{1}{5}$ in head; mouth $3 \frac{1}{4}$; mandible $2 \frac{3}{5}$; interorbital $7 \frac{1}{4}$; eye $2 \frac{1}{8}$ in snout; head $4 \frac{1}{2}$ to anal origin.

Body subcylindrical, slender and long; tail tapers gradually to a point near the end, where it abruptly becomes a rather slender point. Head moderate, occiput and pharynx with a swollen appearance, width $3 \frac{3}{4}$ its length. Snout conic, depressed, protruded beyond mandible, width $1 \frac{1}{3}$ its length. Eye ellipsoid, a trifle before the first fourth in head, eyelids not free. Mouth rather large, nearly horizontal. Jaws strong, rather curved. Lips thick, fleshy, entire. Teeth in upper jaw with irregularly biserial lateral area, not continuous with vomerine or premaxillary area, extending back to a point opposite the middle of eye; mandibular areas longer, better developed anteriorly, not continuous across symphysis; premaxillary and vomerine area continuous, forming an irregular biserial area well posterior to the lateral jaw teeth; all teeth obtuse, granular or rounded; when mandible closes, the premaxillary teeth are quite conspicuous. Tongue not evident. Mandible strong, shallow, rami low. Front nostril short tube before mandible tip on upper lip. Hind nostril deep slit in

upper lip below front eye edge. Interorbital slightly convex. Gill opening small, equals eye. Lateral line complete, without conspicuous pores. Dorsal origin about midway between hind eye edge and gill opening. Anal little lower than dorsal. Pectoral short or low fold with weak rays, along upper or hind edge of gill opening and upper rays longest.

Dull brown above, below paler or whitish. About 28 deep brown saddle-like blotches on back, mostly regular on each side. Alternating with these below lateral line along side another series of similar blotches, but not approximated inferiorly except toward end of tail. On head above there is a dark brown blotch at occiput, another at nape, one just before gill opening, another just behind rictus, 3 small ones behind each eye, and also small one on interorbital. Snout marked with a number of small brown spots, also similar though obsolete ones on mandible. Each of the larger dark spots on body has a small rounded pale dot or speck medianly. Dorsal pale brownish with saddles of back reflected basally, alternating marginally dusky half-

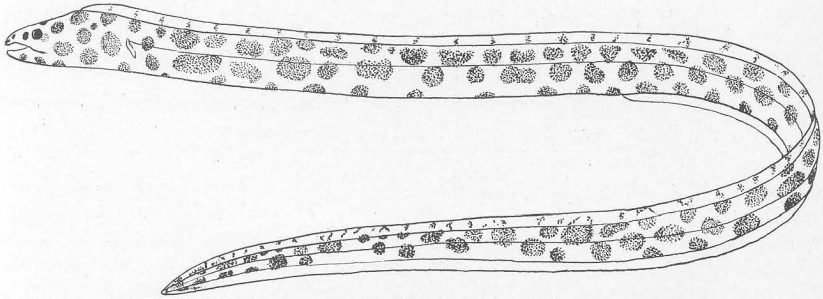


Fig. 140. *Myrichthys pardalis*, from Valenciennes.

blotches its whole length, obsolete posteriorly so that fin edge appears to have a more or less dark margin. Submarginally blotches are broken up into more or less distinct small dark brown spots. Anal immaculate pale brown, also pectoral. Tail pale at tip. Iris grayish. Length 393 mm.

Tropical Atlantic. Described above from a West Indian (St. Martin's) example.

Ophichthys (Sphagebranchus) guineensis Osorio was based on an example 85 mm. long. It is probably the young. It is said to have long uniserial upper teeth curved backward, a small group of large vomerine teeth, no pectoral, dorsal beginning before the gill opening and the body white, marked with numerous variable black spots, confluent and very small on head and tail.

PISODONOPHIS Kaup

Pisodonophis KAUP, 1856, Archiv Naturg., p. 47. Type: *Pisodonophis cancrivorus* Kaup. (Designated by Bleeker, 1864, 'Atlas Ichth.,' IV, p. 36.)

Pisodontophis, *Pisoodonophis* auct.

Teeth blunt, mostly granular or molar. Vomer with teeth. Front nostril in a short tube, usually near snout tip, Dorsal low, begins behind gill opening. Anal well developed. Pectoral present, small.

Small, slender, usually plainly colored tropical eels.

KEY TO THE SPECIES

- a.*—Body with 16 or 17 black crossbands, wider than pale interspaces . . . *semicinctus*.
aa.—Body with 3 series of large round brown spots on side, a single series along median line of back *dromicus*.

***Pisodonophisemicinctus* (Richardson)**

Schyk (Senegambia)

Ophichthysemicinctus RICHARDSON, 1844–1848, 'Voy. "Erebus" and "Terror,"' Ichth., p. 99. West Africa north of the equator.

Pisodonophisemicinctus KAUP, 1856, Archiv Naturg., part 1, p. 49 (Gambia, Gorée).—KAUP, 1856, 'Cat. Apod. Fish.,' p. 22 (Gambia, Gorée).—DUMÉNIL, 1858, Arch. Mus. Hist. Nat. Paris, p. 179.

Ophichthysemicinctus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 80 (type; West Africa, Gambia River, Brass River).—ROCHEBRUNE, 1883–1885, 'Faune Sénégalie,' Poiss., p. 147 (Guet N'Dar, Barbarie, Gorée, Banc d'Arguin, Gambia mouth).—BUETTIKOFER, 1890, 'Reis. Liberia,' II, p. 480.—STEINDACHNER, 1895, Notes Leyden Mus., XVI, p. 88 (Robertsport, Liberia).—PIETSCHMANN, 1913, Jahrb. Nassau. Ver. Naturk., Wiesbaden, LXVI, p. 177 (Bibundi, Cameroon).

Head $3\frac{2}{3}$ to vent. Combined head and trunk $1\frac{1}{4}$ to $1\frac{1}{3}$ in tail. Snout moderate, depressed, rather obtuse. Eye small, in front third of head. Mouth cleft rather wide, extends behind eye. Teeth granular, forms broadish bands, narrower in young. Dorsal begins somewhat before gill opening, and like anal well developed. Pectoral $3\frac{1}{2}$ in head. Body and tail with 16 or 17 broad black crossbands, broader than interspaces between and not extending across abdomen. Head with numerous small brownish-black spots. Length 738 mm. (Günther.)

***Pisodonophisdromicus* (Günther)**

Ophichthysdromicus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 80. West Africa.

Head 7 to vent; depth about 90 in total length. Snout moderate, slightly compressed, rather pointed. Eye small, in first fourth of head. Mouth cleft moderately wide, extending behind eye. Teeth granular, biserial; uniserial on side of mandible. Dorsal begins behind occiput, like anal well developed. Pectoral short, 7 in head, rays distinct. Tail longer than body. Upper side of head with 3 large spots. Along side are 3 series of large round brown spots, and a single series along median line of back, spots arranged alternately. Length 762 mm. (Günther.)

West Africa. Perhaps not different from the preceding species.

OPHICHTHUS Ahl

Ophichthus AHL, 1789, 'De Mur. et Oph.,' p. 5. Type: *Muraena ophis* Linné. (Designated by Bleeker, 1865, Ned. Tijds. Dierk. II, p. 119.)

Ophichthys auct.

Ophisurus LACÉPÈDE, 1800, 'Hist. Nat. Poiss.,' II, p. 195. Type: *Muraena ophis* Linné. (Designated by Bleeker, *loc. cit.*)

Cogrus RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 62. Type: *Cogrus maculatus* Rafinesque. Monotypic.

Centrurophis KAUP, 1856, Archiv Naturg., part I, p. 42. Type: *Ophisurus spadiceus* RICHARDSON. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 2, p. 271.)

Poecilcephalus KAUP, *loc. cit.*, p. 43. Type: *Poecilcephalus bonaparti* Kaup. Monotypic.

Microdonophis KAUP, *op. cit.*, p. 43. Type: *Microdonophis altipennis* Kaup. Monotypic.

Coecilophis KAUP, *op. cit.*, p. 44. Type: *Coecilophis compar* Kaup. Monotypic.

Herpetoichthys KAUP, *loc. cit.*, p. 44. Type: *Herpetoichthys ornatisissimus* Kaup. (Designated by Jordan, *op. cit.*)

Elapsopsis KAUP, *op. cit.*, p. 45. Type: *Elapsopsis versicolor* Kaup. Monotypic.

Elapsopsis auct.

Muraenopsis (Le Sueur) KAUP, *op. cit.*, p. 46. Type: *Muraenopsis ocellatus* Le Sueur. (Designated by Jordan, *op. cit.*)

Scytalophis KAUP, *op. cit.*, p. 46. Type: *Scytalophis magniocularis* Kaup. (Designated by Jordan, *op. cit.*)

Leptorhinophis KAUP, *op. cit.*, p. 46. Type: *Ophisurus gomesi* Castlenau. (Designated by Jordan, *op. cit.*)

Cryptopterus (not *Kryptopterus* Bleeker, 1858) KAUP, 1860 (1859), Abh. Naturw. Verein Hamburg, IV (2), p. 11. Type: *Cryptopterus puncticeps* Kaup. Monotypic.

Uranichthys POEY, 1867, 'Repert. Fis. Nat. Cuba,' II, p. 256. Type: *Muraena havannensis* Schneider. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 3, p. 347.)

Oxyodontichthys POEY, 1880, Ann. Soc. Españ. Hist. Nat., IX, p. 254. Type: *Ophichthys macrurus* Poey.

Cryptopterenchelys FOWLER, 1925 (March 31), Amer. Mus. Novit., No. 162, p. 1. Type: *Cryptopterus puncticeps* Kaup. (*Cryptopterenchelys* Fowler proposed to replace *Cryptopterus* Kaup.)

Body well elongated, cylindrical. Head moderate, pointed. Snout pointed, generally projects beyond mouth. Eye small, at first third or fourth of head. Mouth cleft reaches below hind eye edge or beyond. Edge of upper lip without a fringe of small barbels. Teeth acute, conic, subequal, without canines, in one or more series in jaws and on vomer. Premaxillary teeth in group or in pairs separated from other teeth. Front nostrils in short tube on edge of snout. Hind nostrils slit on inner side of upper lip, below front border of eye or in advance. Gill openings moderate or small, before and somewhat below pectoral bases. No scales. Lateral line present. Dorsal and anal not confluent, end at short space from point of tail. Dorsal origin above gill openings or slightly behind end of pectoral. Pectorals well developed. Vent somewhat before or much behind middle in length.

Species numerous in tropical seas.

KEY TO THE SPECIES

- a.—Teeth in jaws uniserial or only partly biserial above; dorsal begins well behind head.

- b.—CRYPTOPTERENCHELYS. Color uniform.....*rufus*.
 bb.—OPHICHTHUS. Body with large dark blotches.
 c.—Snout marbled with brown.....*ascensionis*.
 cc.—Head densely spotted with brown.....*regius*.
 aa.—MURAENOPSIS. Teeth at least biserial in both jaws; vomerine teeth uniserial;
 body with dark blotches.....*triserialis*.

Ophichthus rufus (Rafinesque)

Figure 141

Echelus rufus RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 65, Pl. xvi, fig. 2. Sicily.

Ophichthys rufus FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 241 (Mount Coffee, Monrovia, Liberia).

Head $11 \frac{3}{4}$ to $13 \frac{2}{5}$; depth at vent $39 \frac{1}{2}$ to 56; dorsal about 244; anal about 170; snout $4 \frac{1}{2}$ to $5 \frac{3}{4}$ in head; eye $9 \frac{1}{2}$ to 15; mouth $2 \frac{3}{4}$ to $3 \frac{1}{2}$; interorbital $6 \frac{2}{5}$ to 10; head $5 \frac{1}{8}$ to $5 \frac{1}{3}$ to vent, $2 \frac{1}{8}$ to $2 \frac{1}{3}$ to dorsal.

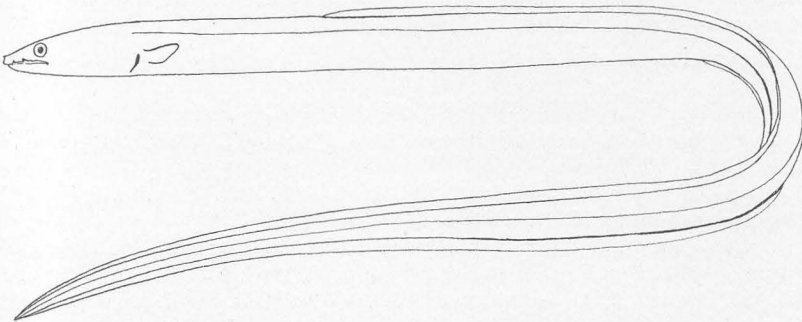


Fig. 141. *Ophichthus rufus*.

Body slender, subcylindrical, sides convex, slender attenuate tail not more compressed. Head long, moderately conic, upper profile a little more convex, width about $3 \frac{1}{3}$ its length. Snout obtusely conic, profile convex, width $1 \frac{1}{4}$ its length. Eye lateral, center near first fourth in head. Mouth moderate, jaws rather strong, horizontal, rictus extended little beyond eye. Jaw teeth uniserial, conic, sharp-pointed, moderate, inclined little posteriorly; premaxillary teeth rather small, separate from vomerine, visible below when mandible closes; upper jaw teeth really begin in a lateral series behind nasal tube and extend back opposite hind eye edge, front ones larger; vomerine teeth uniserial, similar to others in upper jaw, except that some of the larger anterior ones are curved a little forward; mandibular teeth not continued across symphysis, anterior a little enlarged, and there are accessory inner teeth inside, on each side, near symphysis. Tongue thick, fleshy, not free. Mandible firm, low, included within upper jaw. Front nostril in fleshy tube near snout end, opposite tip of closed mandible. Hind nostril large pore, opens close before

eye, with cutaneous outer rim well developed along upper lip. Interorbital evenly convex. There is a deep groove along and above the upper lip from behind the front nasal tube. Gill opening $1\frac{1}{2}$ in snout. Pores rather obsolete on head, a row of 6 along each mandibular ramus; pores in lateral line about 138, of which the first 8 are before the gill opening. Dorsal begins well behind head, extends nearly to tail tip. Pectoral rather low, rounded, $4\frac{1}{3}$ to $5\frac{3}{4}$ in head. Largely uniform brownish. Length 317 to 427 mm.

Eastern Atlantic and Mediterranean. Described above from Italian examples.

Ophichthus ascensionis Studer

Ophichthus ascensionis STUDER, 1889, 'Forschungs. "Gazelle,"' III, p. 48, Pl. XIX, fig. 2. Ascension Island.

Head pointed. Eye midway between snout tip and mouth angle. Jaws widely cleft. Teeth uniserial, pointed. Front nostril a small tube under snout tip. Hind nostril midway between snout tip and eye. Dorsal begins behind gill opening. White, with a row of 18 large reddish-brown rhomboidal blotches on back. Sides with other dark blotches between dorsal blotches. Snout marbled reddish. Length 300 mm. (Studer.)

Ascension Island.

Ophichthus regius (Richardson)

Ophisurus regius (Shaw) RICHARDSON, 1844-1848, 'Voy. "Erebus" and "Terror,"' Ichth., p. 106. St. Helena.

Herpetoichthys regius KAUP, 1856, 'Cat. Apod. Fish. Brit. Mus.,' p. 8 (copied); 1856, Archiv Naturg., XXI, part 1, p. 44 (reference).

Ophichthus regius GÜNTHER, 1869, Proc. Zool. Soc. London, p. 239 (St. Helena).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 66 (type; St. Helena).—MELLISS, 1875, 'St. Helena,' p. 111.—CUNNINGHAM, 1910, Proc. Zool. Soc. London, p. 94 (St. Helena).

Head 4 to vent. Tail rather shorter than body. Eye small, $2\frac{1}{2}$ in snout, at first fourth in head. Mouth cleft very wide, nearly $2\frac{1}{2}$ in head. Teeth sharply pointed, maxillary and front vomerine teeth biserial, others uniserial; inner maxillary, mandibular, and vomerine teeth depressible. Dorsal begins a short space behind end of pectoral. Pectoral 6 in head. Ground color olive, with 18 to 23 large round brown spots, each extending from dorsal fin to abdomen; larger than interspaces, which again are ornamented by a vertical series of small spots, a median series is formed by somewhat larger spots. Head densely spotted with brown. Dorsal with numerous small spots, a series of larger spots marginally. Anal nearly immaculate. Length 813 mm. (Günther.)

Ophichthus triserialis (Kaup)

Figure 142

Muraenophis triserialis KAUP, 1856, 'Cat. Apod. Fish. Brit. Mus.,' p. 12. Pacific Ocean, Voyage of the "Herald."

Ophichthus triserialis OSORIO, 1894 (February), Jorn. Sci. Math. Phys. Nat.,

Acad., Lisboa, (2) III, p. 184 (Bissau); 1898, *op. cit.*, (2) V, p. 200 (Cape Verde, Bissau, St. Thomé).

Head 10; depth at vent $32 \frac{2}{3}$; dorsal about 255; anal about 87; pectoral 15; snout $5 \frac{7}{8}$ in head; eye 9; mouth $2 \frac{3}{4}$; interorbital 8; mandible $2 \frac{1}{6}$.

Body rather slender, with a gradually tapering tail, both subcylindrical. Head rather large, compressed moderately, conic, profiles alike in anterior attenuated contour, width $3 \frac{2}{5}$ its length. Snout conic, little depressed, long as wide. Eye little ellipsoid, superolateral, well anterior, without free eyelids. Mouth moderate, rather narrow, commissure nearly straight and but little inclined. Lips thick, entire, fleshy, rather firm. Teeth conic, sharp-pointed, inclined backward; premaxillary teeth 3, exposed in front of upper jaw; superolateral teeth at first uniserial, after front of eye biserial, those in outer row mostly little larger, at least below eye, and well separated from inner row; mandibular teeth not continued across symphysis, those in outer series much larger than inner, also slightly recurved; vomerine teeth uniserial, not continuous with superolateral or premaxillary series, and front ones largest.

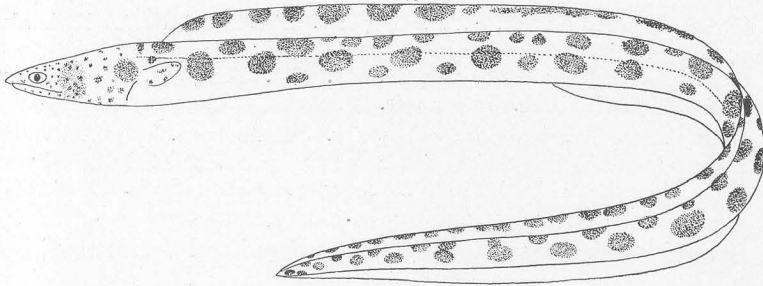


Fig. 142. *Ophichthus triserialis* (type of *Herpetoichthys callisoma* Abbott).

Tongue small, fleshy, not free, smooth. Mandible narrow, small, with snout tip well protruded in front. Front nostril in tube in upper lip about first third in snout length or opposite closed mandible tip. Hind nostril large, opens down in upper lip just before and below eye, with cutaneous valve in front. Interorbital broadly convex. Gill opening about equals interorbital. Each mandibular ramus with 7 pores; on upper lip pore each side of snout tip, one behind front nasal tube, 3 more behind hind nostril; on snout above pair of well separated pores just behind nasal tubes, another pair just before eyes and still another interorbital pair opposite last third in eyes; pores in lateral line 148, first 10 of which before gill opening. Dorsal origin slightly before pectoral tip or distant from gill opening trifle over $\frac{1}{4}$ of head. Anal little lower than dorsal. Tail ends in rather firm tough conic tip. Pectoral small, broadly expanded, $4 \frac{1}{5}$ in head.

Largely dull brownish above, fading almost white below. About 27 pairs of deep blackish-brown blotches on median dorsal line, first over gill opening. Alternating along course of lateral line about as many still larger similar-colored blotches. Occasionally a few irregularities and several smaller accessory dark spots also scattered

in places. Dorsal blotches reflected on dorsal fin, which pale or ochraceous white. Alternating more or less dusky black blotches between reflected dorsal saddles, in size mostly equal to latter and becoming more blackish on edges of fins. Head above more or less finely spotted with dark brownish, though on sides of pharynx more or less nebulous dusky or smutty areas. Spots and these markings continued on head below. Eye pale or whitish. Pectoral pale brownish, deep brown blotch basally, fin also slightly darker distally. Length 1007 mm.

Tropical Atlantic and eastern Pacific. Described above from the type of *Herpetoichthys callisoma* Abbott, No. 38,148, A.N.S.P., obtained by W. G. Burke, labeled "Pacific Ocean."

MYSTRIOPHIS Kaup

Mystriophis KAUP, 1856, Archiv Naturg., part 1, p. 45. Type: *Ophisurus rostellatus* Richardson. (Designated by Bleeker, 1865, Nat. Tijds. Dierk., II, p. 118.)

Crotalopsis KAUP, 1860 (1859), Abh. Naturw. Verein Hamburg, IV (2), p. 12. Type: *Crotalopsis punctifer* Kaup. Monotypic. [Jordan gives *Crotalopsis* in Stanford Publications, 1919, 'Genera of Fishes,' part 3, p. 297.]

Echiopsis KAUP, loc. cit., p. 13. Type: *Ophisurus intertinctus* Richardson. Monotypic.

Macrodonophis POEY, 1867, 'Repert. Fis. Nat. Cuba,' II, p. 251. Type: *Macrodonophis mordax* Poey. Monotypic.

Snout short. Eyes more or less superior. Mouth large. Lips not fringed. Teeth unequal, some as long canines either on vomer or on sides of one or both jaws. Vomerine teeth small and fixed. Tail a little longer than rest of body. Dorsal begins more or less behind gill opening. Anal present. Pectoral well developed.

Several species, darkly spotted, distinguished from *Ophichthus* chiefly by the presence of large canines.

Mystriophis rostellatus (Richardson)

Dian Doujher (Senegambia)

Ophisurus rostellatus RICHARDSON, 1844-1848, 'Voy. "Erebus" and "Terror,"' Ichth., p. 105. Senegal.—KAUP, 1856, Archiv Naturg., part 1, p. 45 (Senegal).

Mystriophis rostellatus KAUP, 1856, 'Cat. Apod. Fish. Brit. Mus.,' p. 10 (Senegal). —DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 264.

Ophichthus rostellatus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 56 (type: Gambia).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 147 (Guet N'Dar, Gambia, Senegal).

Head nearly 3 in space between gill opening and vent. Snout produced, somewhat flattened, contracted behind end. Eye moderate, 2 1/2 to 3 in snout, placed in first fourth of head. Teeth pointed, fixed, unequal; premaxillaries form transverse series of canines; maxillary and mandibular teeth biserial, those in outer row distant and canine; vomerine teeth canines and uniserial. Gill openings wide, close together. Vertical fins moderately developed. Dorsal origin immediately behind end of pectoral, which well developed, about fourth of head. Tail one-fourth longer than body. Brown above. Length 992 mm. (Günther.)

Senegal. One specimen, 860 mm. long, in the Museum of Compara-

tive Zoölogy, from Bathurst, Gambia, received from the Government d'Arc. Barnard reports it from Walfish Bay, South Africa (1925, *Ann. South African Mus.*, XXI, part 1, p. 202).

OXYSTOMUS Rafinesque

Oxystomus RAFINESQUE, 1810, 'Indice Ittiol. Sicil.', pp. 49, 62. Type: *Oxystomus hyalinus* Rafinesque. Monotypic.

Leptognathus SWAINSON, 1838, 'Nat. Hist. Animals,' I, p. 221. Type: *Leptognathus oxyrhynchus* Swainson. Monotypic.

Anepistomon GISTEL, 1848, 'Naturg. Thierr.,' p. ix. Type: *Leptorhynchus capensis* Smith. Monotypic.

Head compressed. Snout very long, attenuate, clavate at tip, more than fourth of head. Eyes lateral. Jaws slender, elongate. Teeth pointed, none molar. Vomerine teeth present. Canine teeth strong. Front nostril in short tube near snout tip. Dorsal and anal fins distinct. Tail much longer than trunk. Pectoral developed, longer than eye.

Oxystomus serpens (Linné)

Figure 143

Muraena serpens LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 224. Southern European Ocean.

Sphagebranchus serpens LOWE, 1839, *Trans. Zool. Soc. London*, III, part 1, p. 17 (Madeira).

Ophichthys serpens GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 65 (Atlantic Ocean, Damara Land).—OSORIO, 1893 (August), *Jorn. Sci. Math. Phys. Nat., Acad., Lisboa*, (2) III, p. 135 (Benguella, Angola); 1898, *op. cit.*, (2) V, p. 200 (Anno Bom).

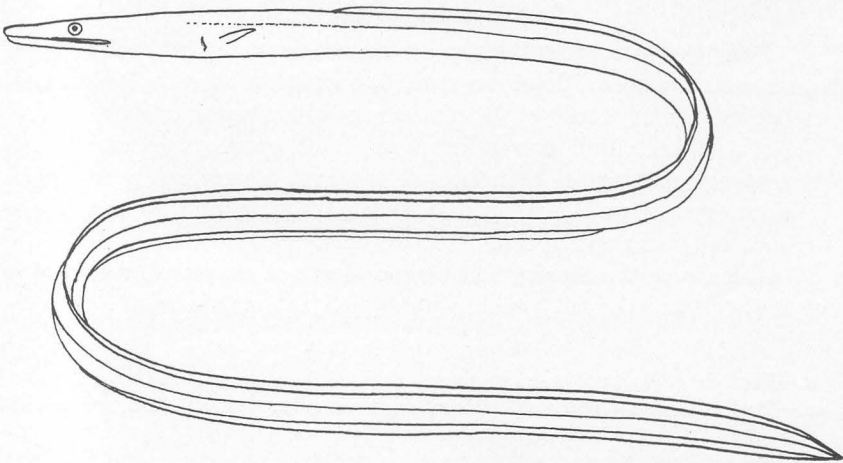


Fig. 143. *Oxystomus serpens*.

Head $12\frac{1}{3}$; depth 69; snout $3\frac{1}{5}$ in head; eye $13\frac{2}{3}$; mouth $1\frac{4}{5}$; mandible $1\frac{3}{4}$; interorbital 14; head $4\frac{2}{3}$ to vent.

Body very long, slender, subcylindrical, tail only tapering at or near tip. Head moderately compressed, greatly elongated, profiles similar, sides rather converging below, width $5\frac{1}{4}$ its length. Snout long, slender, surface convex, profile nearly straight, width $3\frac{1}{2}$ its length. Eye little ovoid, lateral, center about first third in head, without eyeid. Mouth large, commissure not quite halfway in head, though well behind eye. Lips thin, scarcely developed. Jaws with single series of uniformly conic, sharp, posteriorly inclined, close-set outer teeth; row of 4 large conic median premaxillary canines or fangs, well separated and 2 in middle largest; upper jaw tip with 4 canines, outer pair larger; row of small close-set median teeth on vomer; posteriorly lateral upper jaw teeth also with an inner series of similar teeth, these begin little after front of eye; front of mandible with 5 pairs of canines, mostly smaller and closer than premaxillary teeth. Tongue not evident. Mandible slender as rostrum, extending almost as far forward as upper jaw tip, with tough symphyseal conic tip; rami low, slender and gradually tapering to symphysis. Hind nostril rather long slit, near last fourth in snout, in upper lip. Interorbital broadly convex. Gill opening about $2\frac{2}{3}$ in snout. Lateral line with 7 pores on upper side of head before pectoral origin, about 173 in course. Snout with 4 pairs of pores: pair on interorbital; at least 2 pores posteriorly below eye; 2 pores behind eye; median parietal pore; 3 occipital pores. Dorsal origin behind pectoral tip, moderately high, extends almost to tail tip. Anal like dorsal. Pectoral small, $4\frac{4}{5}$ in head.

Brownish above, silvery white below. Iris pale yellowish. Beak whitish. Fins pale, dorsal with narrow dusky margin behind. Length 1105 mm.

Eastern Atlantic and Mediterranean. Described above from an Italian example. Barnard reports it from South Africa to East London (1925, Ann. South African Mus., XXI, part 1, p. 202).

Heterenchelyidae

Body elongate, subcylindrical, tail much longer than trunk. Snout conic, not produced. Eyes very small. Mouth moderate, lateral cleft extending well beyond eye. Teeth conic or granular, biserial or triserial. Nostrils lateral, hind one before eye. Gill openings separate, low. Pharyngeal openings of branchial clefts wide. Heart just behind gills. Palatopterygoid well developed. Body naked. Vertical fins well developed only near end of tail. No pectorals.

Allied with the Moringuidae, but differing in the advanced position of the heart and the tail, which is greatly longer than the trunk.

KEY TO THE GENERA

- a.*—Teeth biserial; trunk nearly twice length of head. HETERENCHELYS.
aa.—Teeth triserial; trunk less than length of head. PANTAURICHTHYS.

HETERENCHELYS Regan

Heterenchelys REGAN, 1912, Ann. Mag. Nat. Hist., London, (8) X, p. 323. Type: *Heterenchelys microphthalmus* Regan. Monotypic.

Mouth cleft moderate. Teeth conic, biserial in jaws and on vomer. Tongue not free. Pharyngeals covered with small teeth. Dorsal and anal long, very low, rays concealed in skin, higher at end of tail and confluent with caudal.

***Heterenchelys microphthalmus* Regan**

Figure 144

Heterenchelys microphthalmus REGAN, 1912, Ann. Mag. Nat. Hist., London, (8) X, p. 323. Mouth of Congo.—PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 154 (Banana, Congo); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 23, Pl. I, fig. 4a (Banana).—REGAN, 1915, *op. cit.*, (8) XV, p. 125 (Lagos).

Heterenchelys macrurus REGAN, *loc. cit.* Lagos and Elobi.—EHRENBAUM, 1915, 'Ueber Küstenfische von Westafrika,' p. 77.—MONOD, 1927, 'Faune Colon. françaises,' p. 678 (Cameroon).

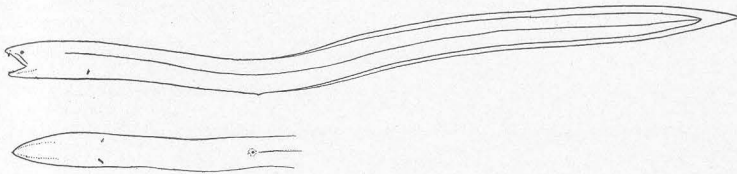


Fig. 144. *Heterenchelys microphthalmus*, from Pellegrin.

Depth 22 to 27. Tail 2 to 3 times long as rest of fish. Head $2\frac{1}{3}$ to 3 to vent. Eye midway in mouth, little nearer mouth angle in smaller examples. Mouth little over 3 in head, little less in smaller examples. Uniform. Length 300 to 460 mm. (Regan.)

Heterenchelys macrurus differs very little from the original account of *Heterenchelys microphthalmus*, except in differences which may be attributed to age. For this reason they are here united.

***Heterenchelys longus* Ehrenbaum**

Heterenchelys longus EHRENBAUM, 1915, 'Ueber Küstenfische von Westafrika,' p. 77. Cameroon.—MONOD, 1927, 'Faune Colon. françaises,' p. 678 (Cameroon).

This species I have not found and know only from the above quotations.

PANTAUROICHTHYS Pellegrin

Pantaurichthys PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. (116) 117. Type: *Pantaurichthys mauritanicus* Pellegrin. Monotypic.

Tail extraordinarily developed. Mouth cleft small. Teeth triserial in jaws and on vomer, conic in upper jaw and in outer mandibular row, granular on vomer and 2 inner mandibular rows. Tongue not distinctly free. Frontals united, with median suture. Dorsal and anal long, very low, except behind where joined with caudal as single fin around end of tail.

Pantaurichthys mauritanicus Pellegrin

Figure 145

Pantaurichthys mauritanicus PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. (116) 118. Baie du Lévrier, Côte de Mauritanie; 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 25, Pl. I, fig. 5a (Baie du Lévrier, Côte de Mauritanie).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 250 (Baie du Lévrier, type).

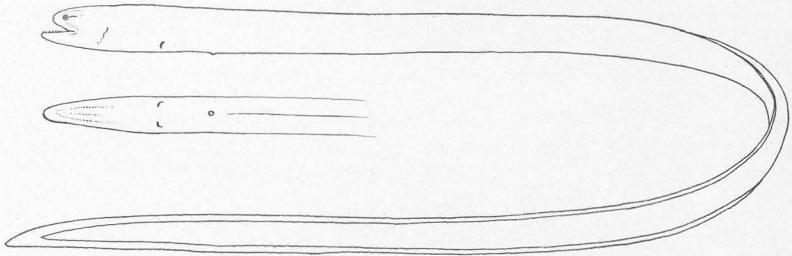


Fig. 145. *Pantaurichthys mauritanicus*, from Pellegrin.

Head $1\frac{1}{2}$ to vent; depth 42 in total length. Snout obtusely conic. Eye little nearer mouth corner than snout tip, 3 in snout. Lower jaw prominent, protruded. Front nostril tubular, slightly behind snout tip and above upper lip. Dorsal begins over gill opening. Caudal long as snout. Uniform maroon-brown above, clear gray below. Length 840 mm. (Pellegrin.)

Mauritania coast.

Echidnidae

Morays

Body compressed or cylindrical. Head conic. Mouth terminal, with lateral cleft reaching beyond eye. Maxillary articulates with ethmo-vomer some distance from snout end. Teeth strong, acute or obtuse, in one or more rows. Nostrils lateral. Gill openings well separated. Pharyngeal apertures of gill clefts restricted. Upper and lower pharyngeals with strong, curved teeth in double row, elongate, supported by enlarged epi- and ceratobranchials of fourth arch. Frontal paired. Palatopterygoid very slender, almost vestigial. Short laminar neural spines developed in caudal region only. Caudal vertebrae with lateral transverse processes. Skin naked, thick, usually tough. Vertical fins various. No pectorals.

A large family of tropical and subtropical waters, found especially

among rocks and coral reefs. Many are very predatory and savage, reach a large size, and are striking in color.

KEY TO THE GENERA

- a.—ECHIDNINAE. Vertical fins well developed, dorsal beginning before vent.
 b.—Hind nostril oblong slit, front one in short tube; teeth all pointed, canines strong; dorsal begins above gill opening. ENCHELYCORE.
 bb.—Hind nostril circular, with or without tube.
 c.—Teeth all or nearly all acute, no molars.
 d.—Hind nostril without tube, edge sometimes slightly raised.
 LYCODONTIS.
 dd.—Both front and hind nostrils equally tubular. . . . MURENOPHIS.
 cc.—Teeth mostly obtuse, molar-like; only front nostril tubular; mouth cleft rather short; dorsal begins before gill opening. ECHIDNA.
 aa.—UROPTERYGINAE. Vertical fins rudimentary or absent, when present terminal on tail; teeth rather small, pointed, subequal, in several rows; hind nostril round, with or without short tube.
 e.—Tail about long as trunk; snout moderate, about half of gape; mouth cleft short, not half length of the head.
 UROPTERYGIUS.
 ee.—Tail very short, about half rest of body; snout very short, less than 1/4 gape; mouth cleft long, nearly half of head.
 CHANNOMURAENA.

ENCHELYCORE Kaup

Enchelycore KAUP, 1856, *Archiv Naturg.*, part 1, p. 60. Type: *Enchelycore euryrhina* Kaup. Monotypic.

Enchelycotte (Kaup) DUMÉRIL, 1856, *Mém. Acad. Sci. Paris*, XXVII, p. 200. Type: *Enchelycore euryrhina* Kaup. (Slip for *Enchelycore*.)

Teeth all pointed, canines strong. Front nostril in a short tube. Hind nostril an oblong slit. Vertical fins well developed. Dorsal begins above gill opening.

One species, distinguished especially by the slitlike hind nostril.

Enchelycore nigricans (Bonnaterre)

Muraena nigricans BONNATERRE, 1788, 'Encycl. Ichth.,' p. 34. South America. (On Gronow.)

Enchelycore nigricans OSORIO, 1894 (February), *Jorn. Sci. Math. Phys. Nat., Acad., Lisboa*, (2) III, p. 182 (St. Thomas Island); 1898, *op. cit.*, (2) V, p. 200 (St. Thomé).

Head, 8; depth 17; snout $5\frac{1}{5}$ in head measured from upper jaw tip; eye $10\frac{1}{3}$; mouth cleft $2\frac{1}{5}$; interorbital $10\frac{1}{2}$.

Body compressed; tail long and tapering, little longer than combined head and trunk. Head width $3\frac{3}{4}$ in total length. Snout conic, width $1\frac{2}{3}$ in its length. Eye ellipsoid, midway in length of upper jaw; diameter $1\frac{4}{5}$ in snout, about equals interorbital. Mouth large, jaws not completely closing, mandible protruding. Teeth compressed, pointed, row of even moderate ones along edge of each jaw; 6 enlarged canines above forward, then inner pair each side before eye, and 4 from after middle of eye; 3 pairs of lower canines anteriorly; row of 3 median canines on vomer.

Front nostril in short tube near snout tip; hind nostril horizontal slit, length $\frac{3}{4}$ of eye, and its hind end opposite front eye edge. Interorbital broadly convex. Gill opening $\frac{3}{4}$ of eye. Skin smooth. Dorsal begins over gill opening, greatest height little less than snout. Anal much lower and, like dorsal, confluent with small, short caudal fin.

Nearly uniform burnt umber. Length 667 mm.

Tropical Atlantic. Described above from the type of *Gymnothorax nigrocastaneus* Cope, obtained in the West Indies (St. Martins).

LYCODONTIS McClelland

Lycodontis McCLELLAND, 1845, Jour. Nat. Hist. Calcutta, V, No. 18, pp. 173, 185. Type: *Lycodontis literata* McClelland. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 2, p. 220.)

Thaerodontis McCLELLAND, *op. cit.*, pp. 174, 187. Type: *Thaerodontis reticulata* McClelland. Monotypic.

Siderea KAUP, 1856, Archiv Naturg., part 1, p. 58. Type: *Muraena pfeifferi* Bleeker. (Designated by Jordan, *op. cit.*, p. 271.)

Sidera auct.

Eurymyctera KAUP, *op. cit.*, p. 59. Type: *Eurymyctera crudelis* Kaup. Monotypic.

Polyuranodon KAUP, *op. cit.*, p. 65. Type: *Polyuranodon kuhlii* Kaup. Monotypic.

Taeniophis KAUP, 1859 (1860), Abh. Naturw. Verein Hamburg, IV (2), p. 1. Type: *Taeniophis westphali* Kaup. (Designated by Jordan, 1919, *op. cit.*, part 3, p. 297.)

Priodontophis KAUP, *op. cit.*, p. 22. Type: *Muraena ocellata* Agassiz. Monotypic.

Priodontophis auct.

Neomuraena GIRARD, 1858 (1859), Proc. Acad. Nat. Sci. Philadelphia, p. 171. Type: *Neomuraena nigromarginata* Girard. Monotypic.

Pseudomuraena JOHNSON, 1860, Proc. Zool. Soc. London, p. 167. Type: *Pseudomuraena maderensis* Johnson. Monotypic.

Rabula JORDAN AND DAVIS, 1888 (1892), Rept. U. S. Fish Comm., VIII, p. 589. Type: *Muraena aquaedulcis* Cope. Orthotypic.

Ahynodontophis FOWLER, 1912, Proc. Acad. Nat. Sci. Philadelphia, p. 25. Type: *Gymnothorax stigmanotus* Fowler. Monotypic.

Body not excessively elongate. Tail moderate, not twice length of trunk. Teeth mostly acute, none in jaws obtuse or molar-like. Vomerine teeth in 1 or 2 rows. Lips continuous with skin of head. Front nostrils tubular, hind ones as simple pores. Vertical fins well developed, dorsal beginning on head considerably before gill opening.

The typical morays are everywhere abundant in warm seas, some reaching a large size. They are among the strongest, most active, and voracious of the eels, and often show great pugnacity. Many live in shallow waters about rocks and reefs.

KEY TO THE SPECIES

- a.*—RABULA. Dorsal begins little behind gill opening. *longicauda*.
aa.—LYCODONTIS. Dorsal begins before gill opening.

- b.—Body without small round bluish-white or yellowish-white spots, which if present blackish or dull gray.
- c.—Dorsal with distinct pale margin..... *unicolor*.
- cc.—Dorsal without paler edges, or with merely the very edge narrowly whitish.
- d.—Dorsal with distinct black edge; anal with pale edge... *vicinus*.
- dd.—Dorsal without darker edge, border colored like fin, slightly darker in deeply colored examples.
- e.—Color olivaceous or blackish, with conspicuous markings, either paler or darker than ground color.
- f.—Ground color yellowish or brownish, reticulated, marbled, or spotted with brown or black; anal narrowly yellowish, obscure in dusky examples... *moringua*.
- ff.—Dark brown variously speckled, reticulated or undulated with yellowish lines, more or less as vertical or cancellate bands, gill slit not in black spot, fins without light edging..... *undulatus*.
- fff.—Ground color brownish black, with irregular pale grayish spots; anal without distinct pale edge. . . *anatinus*.
- ee.—Dark brown, dark green or blackish, either plain or with faint markings; dorsal and anal with dark longitudinal lines..... *afēr*.
- bb.—Body with distinct small blue, white, or yellow spots..... *flavopictus*.

Lycodontis longicauda (Peters)

Muraena longicauda PETERS, 1876 (1877), Monatsb. Akad. Wiss. Berlin, p. 850. Atlantic Ocean (southeast of Leton Rock, N. lat. 15° 40' 1", W. long. 23° 5' 8", in 39 fathoms).

Gymnothorax longicauda JORDAN AND DAVIS, 1888 (1892), Rept. U. S. Fish Comm., part 16, pp. 590, 599 (unknown locality).

Head $8\frac{2}{3}$ in total, $3\frac{3}{4}$ to vent. Tail about half again as long as the rest of the body. Snout short, bluntish. Eye large. Gape short, jaws straightish and close completely. Teeth entire; upper teeth biserial, inner row larger and movable; outer upper teeth bluntish and turned backward; front canines enlarged; vomerine teeth slender, rather long. Dorsal begins little behind gill opening. Purplish brown, finely mottled with darker, markings faint. (Jordan and Davis.)

Tropical Atlantic. The type was 110 mm. in length.

Lycodontis unicolor (De La Roche)

Morrião (Madeira), Morena, Morion (male) (Canaries)

Figure 146

Muraenophis unicolor DE LA ROCHE, 1809, Ann. Mus. Paris, XIII, pp. 319, 359, Fig. 15. Ivica.

Muraena unicolor VALENCIENNES, 1836–1844, 'Hist. Nat. Canaries,' II, part 2, p. 92 (Canaries).—LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 192 (Madeira).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 125 (Madeira, St. Helena).—MELLISS, 1875, 'St. Helena,' p. 110.—VINCIGUERRA, 1882 (1883), Ann. Mus. Civ.

Storia Nat. Genova, XVIII, p. 620 (Santa Cruz di Tenériffa); 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 333 (Teneriffe).—CUNNINGHAM, 1910, Proc. Zool. Soc. London, p. 93 (St. Helena).

Thyrsoidea unicolor KAUP, 1856, Archiv Naturg., part 1, p. 64 (Madeira).—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 264 (Gorée).—ROCHEBRUNE, 1883–1885, 'Faune Sénégalie,' Poiss., p. 149 (Gorée).

Moroena nigricans unicolor POGGI, 1881, (article in 'Guidebook of Canary Isls.')

'Guia de Santa Cruz de Teneriffe,' [p. d. 35].

Gymnothorax unicolor ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 100 (south-west of St. Lucia, Cape Verde Islands, 20 m.).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 135 (Villa do Porto, Santo Marie Island).

Pseudomuraena maderensis JOHNSON, 1860, Proc. Zool. Soc. London, p. 167, Fig. Madeira.

Muraena maderensis GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 125 (type).

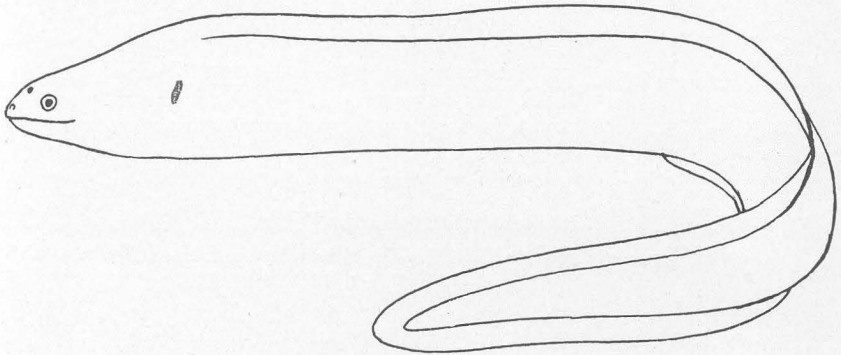


Fig. 146. *Lycodontis unicolor*.

Head $8 \frac{1}{3}$; depth at gill opening about $12 \frac{1}{2}$; snout $6 \frac{1}{2}$; mouth $2 \frac{7}{8}$; interorbital 9; eye $2 \frac{1}{4}$ in snout; head $3 \frac{7}{8}$ to vent.

Body elongate, well compressed, tapers gradually back from head in a long and rather slender tail. Head large, compressed, width about 3 in its length. Snout short, width $\frac{7}{8}$ its length. Eye small, midway in mouth, trifle above middle in snout depth. Mouth moderate, nearly horizontal, jaws about even. Lips thick, tough, moderately free. Upper teeth strongly conic, not very sharp-pointed and not long, strong, mostly firm and erect, with stout bases; outer series of erect conic upper teeth, smaller than others in jaw, subequal; in premaxillary region of upper jaw, inside smaller teeth of outer series an area of rather large short conic teeth with broad bases, these moderately large posteriorly and all at least partly depressible, though posterior more depressible than anterior; vomer with an irregular or double series of short convex molar teeth of moderate size; below and extending little beyond hind eye edge short inner series of conic and rather slender depressible teeth, close to outer upper series, a little longer than latter and inclined trifle back; mandible with outer

series of teeth like upper, and anteriorly inside an area of moderate conic teeth, similar, though erect and smaller than those in front of upper jaw. No tongue. Front nostril in short tube at snout end each side; hind nostril with slight cutaneous rim, above front eye edge in front interorbital space. Interorbital evenly convex. Gill opening $1\frac{1}{3}$ in snout. Snout with 3 pairs of pores, first on upper lip, next close behind nasal tubes, and third about midway in snout length; 5 pores along side of upper lip and same on each mandibular ramus. Dorsal origin about last third between hind eye edge and gill opening, fin moderately high. Caudal $1\frac{2}{3}$ in eye. Anal like dorsal. Nearly uniform pale brown. Fins like back, with dark submarginal and very narrow pale edge. Edge of gill opening deep brown. Deep brown spot little above and behind eye on upper side of head, about snout's length from eye. Behind this broad pale transverse band. Eye slaty gray. Rictus deep brown, darker than general color. Length 688 mm.

Eastern Atlantic and Mediterranean. Described above from an Italian example. *Pseudomuraena maderensis* Johnson was redescribed from the types by Günther, two very old examples, one 41 inches long. He says that it apparently differed in the dentition, the not numerous uniserial teeth slightly serrated behind. Possibly this is a variant with age?

An adult example in the U. S. National Museum from Madeira, obtained by Captain William Stimpson.

***Lycodontis vicinus* (Castelnau)**

Dian deichjh (Senegambia)

Figure 147

Murenophis vicina CASTELNAU, 1855, 'Anim. Amér. Sud.,' XXI, p. 81, Pl. XLII, fig. 4. Bahia.

Lycodontis vicinus JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 340 (Canaries).

Muraena vicina METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 211 (Cape Blanco).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 250 (Cape Blanco).

Thyrsoidea maculipinnis KAUP, 1856, 'Cat. Apod. Fish.,' p. 83. Western tropical Africa, Gold Coast; 1856, Archiv Naturg., part 1, p. 61 (Gold Coast).—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 264, Pl. XXIII, fig. 1, *a-d* (Gold Coast).—TROSCHER, 1866, Archiv Naturg., p. 237 (Cape Verde).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 149 (Guet N'Dar, Barbarie, Cape Verde, Gorée).

Taeniophis maculipinnis BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, (2) XVIII, p. 129, Pl. XXVII (Guinea).

Muraena maculipinnis GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 124 (Cape Verde Islands, Fernando Po).—OSORIO, 1894 (February), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 181 (St. Thomas Island); 1898, *op. cit.*, (2) V, p. 200 (Cape Verde, St. Thomé).—BOULENGER, 1903 (1905), Mem. Soc. Españ. Hist. Nat., Madrid, I, p. 187 (Rio Benito, Spanish Guinea).

Thyrsoidea marginata KAUP, 1859, Abh. Naturw. Verein Hamburg, IV (X), p. 24, Pl. IV, fig. 1. West Africa; *op. cit.*, Nachtrag, p. 4.

Head half of trunk. Snout narrow, produced, pointed. Eye large, 2 in snout. Mouth cleft wide, 2 to $2\frac{1}{3}$ in head. Teeth uniserial, sometimes with additional

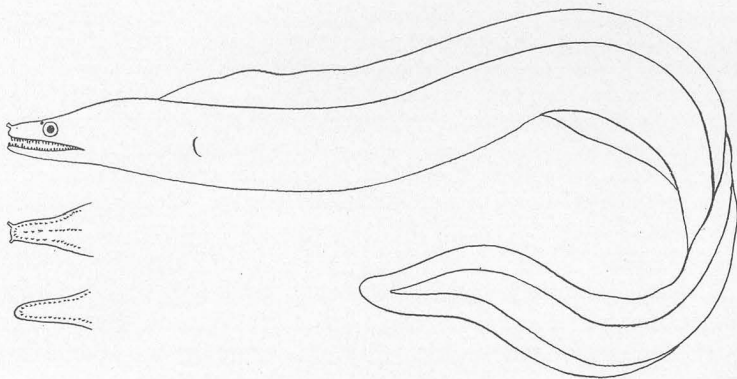


Fig. 147. *Lycodontis vicinus*, from Bleeker.

maxillary tooth; mandibular teeth about 22 each side; canines well developed, jaws nearly completely closing. Gill opening narrower than eye. Uniform blackish brown. Dorsal with black, anal with narrow white edge. (Günther.)

Tropical Atlantic. Reaches 409 mm.

***Lycodontis moringua* (Cuvier)**

Figure 148

Muraena moringua CUVIER, 1829, 'Règne Animal,' II, 2d Ed., p. 352. Antilles (on Catesby).—GÜNTHER, 1869, Proc. Zool. Soc. London, p. 239 (St. Helena); 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 120 (St. Helena).—MELLISS, 1875, 'St. Helena,' p. 110.—GÜNTHER, 1880, 'Rept. Voy. "Challenger,"' I, p. 5 (Ascension Island).—CUNNINGHAM, 1910, Proc. Zool. Soc. London, p. 94 (St. Helena).—CLARK, 1913, Proc. Roy. Phys. Soc. Edinburgh, XIX, p. 384 (Ascension Island).

Gymnothorax moringua FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 275 ("West Africa," Angola).

?*Thyrsoidea cancellata* (not Richardson) KAUP, 1856, Archiv Naturg., part 1, p. 60 (Madeira).

Head $6\frac{1}{2}$ to $7\frac{7}{8}$; depth 13 to 22; snout $4\frac{1}{2}$ to $5\frac{2}{3}$ in head; eye 7 to 12; mouth 2 to $2\frac{2}{3}$; interorbital 10 to $11\frac{1}{2}$; head 3 to $3\frac{1}{3}$ to vent.

Body robust, well compressed, deepest anteriorly, tapering back from vent in long rather slender acuminate tail. Head large, well compressed, width 3 in its length. Snout elongate, width $1\frac{2}{5}$ its length. Eye midway in upper jaw length. Mouth large, horizontal, jaws equal, Lips thick, rather free, fleshy. Teeth compressed, conic, sharp-pointed, inclined little back, mostly uniform in series in jaws; outer premaxillary and front mandibular teeth enlarged, conic, inclined slightly back, compressed, erect; upper laterals little larger than lateral mandibulars, former

slightly uneven in places and latter longer than mandibulars; premaxillary teeth medianly series of 3 large conic depressible fangs, vomer toothless; mandibular teeth laterally uniform, close set, small. No tongue. Front nostril near snout tip, in tube about half length of eye; hind nostril pore on front of interorbital over front eye edge. Interorbital convex. Gill opening nearly horizontal, about equals eye. Along each upper lip 4 pores, same along lower surface of each mandibular ramus. Dorsal origin little nearer rictus than gill opening, fin high. Caudal small. Anal like dorsal.

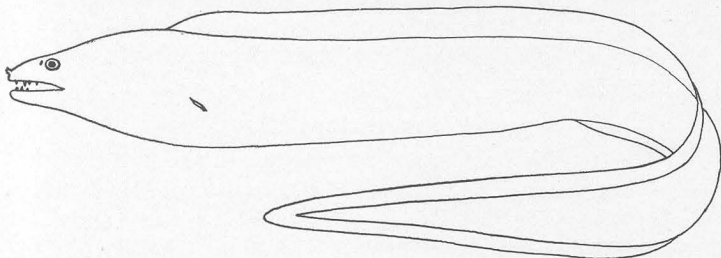


Fig. 148. *Lycodontis moringua*, from Jordan and Davis.

Dusky brown, everywhere with broken fine marblings of blackish and creamy-white reticulations, giving finely vermiculated appearance. Head more brownish than rest of body, though with equally distinct vermiculations. Last 2 pores on lower surface of mandible each side in large whitish blotch. Gill opening edged with dusky. Dorsal and anal both blackish marginally. Hind edge of caudal narrowly creamy. Length 171 to 997 mm.

Tropical Atlantic. Described above from West Indian (Bermuda) examples.

***Lycodontis undulatus* (Lacépède)**

Ngunu a tubé, Mgunu a mango, Molumbi (Cameroon)

Muraenophis undulatus LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, pp. 629, 644, Pl. LXIV, fig. 2. No type locality. (On Commerson.)

Muraena undulata PIETSCHMANN, 1913, Jahrb. Nassau. Ver. Naturk., Wiesbaden, LXVI, p. 180 (Bibundi, Cameroon).

Gymnothorax undulatus MONOD, 1927, 'Faune Colon. françaises,' p. 679 (Kribi).

Head $5 \frac{4}{5}$ to $7 \frac{1}{2}$; depth $12 \frac{1}{3}$ to 13; snout $5 \frac{3}{4}$ to 6 in head from upper jaw tip; eye 11 to $11 \frac{1}{2}$; mouth $2 \frac{1}{5}$; interorbital $8 \frac{3}{4}$ to $9 \frac{7}{8}$; head 3 to $3 \frac{2}{3}$ to vent.

Head large, well compressed, flattened sides little convergent below. Snout conic, width $1 \frac{1}{2}$ its length. Eye little nearer snout tip than rictus, without free lids. Mouth largely closes, nearly horizontal. Teeth strong, conic, entire, compressed, uniserial; below eye 1 or 2 large canines in upper jaw, also 3 or 4 large depressible front canines, 3 or 4 pairs of rather large canines in front of mandible; vomer with row of small conic teeth, begin opposite eye, sometimes biserial. Interorbital convex. Gill opening equals eye. About 6 longitudinal grooves on each side of pharynx.

Dorsal origin midway between rictus and hind eye edge, fin high. Caudal $1\frac{1}{2}$ in eye. Anal lower than dorsal. Rich brown, with numerous reticulating pale or creamy lines, forming about 3 lateral series entire length of broken spots of ground color. Narrow lines more or less thickly speckled with ground color form 3 longitudinal series of spots on the dorsal similar to those on the trunk. Abdomen and lower surface of head paler than sides, also with pale markings or none. Iris brown. Tip of tail creamy. Gill opening sometimes edged dusky, also mouth corners. Length 825 mm.

Indo-Pacific. Described above from Hawaiian specimens. Coloration very variable, the young variously spotted with white or blackish. Barnard reports it from Natal (1925, Ann. South African Mus., XXI, part 1, p. 211).

Lycodontis anatinus (Lowe)

Moreia Serpente, Serpente (Madeira)

Muraena anatina LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 192. Madeira.—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 115 (Madeira).

Muraena sanctae-helenae GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 115. St. Helena; 1869, Proc. Zool. Soc. London, p. 239 (St. Helena; no description).—MELLISS, 1875, 'St. Helena,' p. 110.—CUNNINGHAM, 1910, Proc. Zool. Soc. London, p. 93, Pl. iv, fig. 2 (St. Helena).

Head little less than half of trunk. Tail rather longer than body. Snout produced, narrow, subspatulate. Eye moderate, nearer end of snout than mouth angle. Mouth cleft exceedingly wide, more than half of head, jaws not completely closing. Teeth irregularly biserial, inner series long and slender; vomerine teeth uniserial. Nasal tubes short. Gill opening narrower than eye. Dorsal rather low. Brownish black, with small, irregular, pale grayish spots in moderate number and longitudinally arranged. Largest ones sometimes twice eye, smallest ones mere dots. Each spot again marbled with darker. Head brownish yellow, with indistinct yellowish dots above. (Günther.)

Eastern Atlantic. There is little in the account of *Muraena sanctae-helenae* to distinguish it from *Muraena anatina*.

Lycodontis afer (Bloch)

Muraena (Cape Blanco)

Gymnothorax afer BLOCH, 1795, 'Naturg. Ausl. Fische,' IX, p. 85, Pl. ccccxvii. Guinea.

Muraena afra GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 123 (type of *Muraena tristis* Kaup).—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV (1), p. 49 (Rufisque).—OSORIO, 1895 (March), Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 247 (Anno Bom Island); 1898, *op. cit.*, (2) V, p. 200 (Anno Bom).—BOULENGER, 1903 (1905), Mem. Soc. Españ. Hist. Nat., Madrid, I, p. 187 (Rio Benito, Spanish Guinea).—PELLEGRIN, 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanco, Cape Verde); 1905, Act. Soc. Linn. Bordeaux, LX, p. 28 (Cape Blanco); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 27 (Cape Blanco).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 250 (Cape Blanco).

Muraena tristis KAUP, 1856, 'Cat. Apod. Fish.,' p. 62. Niger River.

Thyrsoidea lineopinnis DÜMERIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 263 (St. Jago, Cape Verde).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalaise,' Poiss., p. 148 (Cape Verde, Casamance).

Gymnothorax funebris RANZANI, 1860, Nov. Comm. Acad. Sci. Inst. Bonon., IV, p. 76. Brazil.—FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 208 (Porto Grande, Cape Verde Islands).

Head $6\frac{1}{2}$ to 8; depth 11 to $11\frac{1}{2}$; snout $5\frac{1}{3}$ to $5\frac{2}{5}$ in head; eye 12 or 13; mouth $2\frac{1}{8}$ to $2\frac{2}{5}$; interorbital $7\frac{7}{8}$ to 9; head $3\frac{1}{3}$ to $3\frac{4}{5}$ to vent.

Body rather deep, compressed, trunk robust, tail tapering rather gradually in long slender point. Head compressed, width $2\frac{1}{2}$ to $3\frac{2}{5}$ in its length. Snout conic, width $1\frac{1}{3}$ its length. Eye about midway in mouth length. Mouth large, nearly horizontal, quite closes, jaws even. Teeth uniserial, conic, subequal, anterior enlarged and more canine-like, all erect in jaws, laterals slightly inclined back; about 3 median anterior or premaxillary depressible conic canines, last longest; 2 series of small conic vomerine teeth begin about opposite the front pupil edge, directed a little back and much smaller than all other teeth; mandibular teeth erect, uniserial, front 3 pairs or so well enlarged. No tongue. Front nostril, in short, fleshy tube on each side of snout tip, about $2\frac{1}{2}$ in eye; hind nostril simple pore over front eye edge on interorbital. Interorbital well convex. Gill opening nearly horizontal, about $1\frac{2}{3}$ in snout. Along upper lip 5 pores on each side, first before tubular nostril, second behind tubular nostril, third about midway in snout length, fourth below front eye edge, and fifth below hind eye edge; there is a pair of pores near snout tip between nasal tubes and another pair on snout above, about midway in its length; along each mandibular ramus 5 pores, the first 2 closer together than others. Dorsal origin little nearer rictus than gill opening, fin rather high, thick, fleshy. Caudal $1\frac{1}{3}$ in eye. Anal lower than dorsal.

Uniform chocolate-brown, belly and lower surface of head paler or more brownish. Rictus and gill opening not darker than rest of head. Dorsal with numerous fine oblique lines sloping up from base, none much darker than general body color. Anal with similar lines, only more longitudinal. Inside of mouth brown. Length 903 to 1067 mm.

Tropical Atlantic. Described above from West Indian (Santa Domingo) material and an example without data.

***Lycodontis flavopictus* (Kaup)**

Muraena (Cape Blanco)

Thyrsoidea flavopicta KAUP, 1856, 'Cat. Apod. Fish. Brit. Mus.,' p. 90. Brazils.

Muraena flavopicta GÜNTHER, 1869, Proc. Zool. Soc. London, p. 29 (St. Helena); 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 101 (St. Helena).—MELLISS, 1875, 'St. Helena,' p. 110.

Muraena dinocephala METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 211, Fig. 58. Cape Blanco.—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 250 (Cape Blanco).

Head $3\frac{1}{2}$ to vent; tail rather longer than body. Snout of moderate length. Eye small, less than half the length of snout. Mouth cleft wide. Teeth biserial, except on vomer and side of mandible; canines small; mouth not closing completely. Hind nostrils not tubular. Gill opening rather wider than eye. Tail black, with in-

numerable round yellow spots smaller than the eye; toward the trunk are yellow spots more densely crowded and irregular in shape; toward and on the head, yellow becomes the ground color and black appears in the form of reticulated lines. (Günther).

Tropical Atlantic. Kaup gives the length as 388 mm. Apparently *Muraena dinocephala* Metzelaar, based on an example of but 105 mm., is this species.

MURENOPHIS Cuvier

Morays

Murenophis CUVIER, 1798, 'Tabl. Élémentaire Hist. Nat.,' p. 329. Type: *Muraena helena* Linné. Monotypic.

Muraenophis LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V. p. 627. Type: *Muraena helena* Linne.

Limomuraena KAUP, 1856, Archiv Naturg., part 1, p. 65. Type: *Muraena guttata* Risso. Monotypic.

Lips continuous with skin of head. Teeth acute, sharp. Vomerine teeth in 1 or 2 series. Both nostrils in conspicuous long tubes. Tail moderate, not twice as long as trunk. Vertical fins well developed, the dorsal beginning before the vent.

Morays are easily distinguished by their tubular nostrils; usually with variegated colors. Species rather few.

KEY TO THE SPECIES

- a.—Gill opening within a dark blotch; body mostly with pale spots, often with dark centers.
- b.—Gill opening in a large black blotch; mouth angle with a black spot; tail edges not pale. *melanotis*.
- bb.—Gill opening in a dark blotch; mouth angle without a dark spot; tail with a narrow white edge. *helena*.
- aa.—Gill opening not in a dark blotch; tail with numerous bluish-white dark-edged minute dots, absent from the front parts of the body. *augusti*.

Murenophis melanotis (Kaup)

Limomuraena melanotis KAUP, 1858, Abh. Naturw. Verein Hamburg, IV (2), p. 27, Pl. iv, fig. 3. No locality.

Muraena melanotis GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 98 (Cape Verde Islands).—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV (1), p. 49 (Gorée).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 148 (Cape Verde).—OSORIO, 1890 (September), Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, (2) II, p. 58 (Loando, Angola); 1895 (March), *op. cit.*, (2) III, p. 247 (Anno Bom Island); 1898, *op. cit.*, (2) V, p. 200 (Cape Verde, St. Thomé, Anno Bom, Angola).—JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 340 (Canary Islands).—FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 208 (Porto Grande, Cape Verde Islands).

Muraena helena (not Linné) TROSCHER, 1866, Archiv Naturg., part 1, p. 237 (Cape Verde Islands).

Head 8; depth 9 1/2 to 12 1/2; snout 5 to 6 in head; mouth cleft 2 1/2; interorbital 7 1/4 to 9; eye 2 1/6 to 2 4/5 in snout, 2 1/4 to 2 1/2 in interorbital.

Body rather deep, well compressed, tail deep and longer than rest of body by space 1 1/3 to 1 3/5 in head. Head compressed, width little less than 1/3 its length. Snout conic, width 1 1/4 its length. Eye about midway in upper jaw length. Mouth moderate, lower jaw slightly shorter than upper. Teeth uniserial, strongly compressed, entire; short inner upper series, below lower of 5 depressible similar-shaped teeth; 2 depressible canines at front above, hind one larger; row of 9 median lower movable vomerine teeth; outer front lower teeth short, irregular, with larger firm inner canine on each side; also a pair of inner depressible canines on each side anteriorly and 2 median ones, of which the hind one is a little larger. Nostrils tubular, front ones close behind snout tip; hind ones much larger, about 4/5 of eye, opposite front eye edge within interorbital. Interorbital narrowly convex. Gill opening horizontal, 1 1/2 in snout. Pores on head rather inconspicuous, a row along each lip, along lower face of each mandibular ramus. Dorsal begins before gill opening, about last fourth in space between rictus and gill opening, much higher than anal. Caudal very short, about 2/3 of eye.

Deep brown, marked with numerous round pale spots, giving place on lower surface of head and trunk to a uniform pale tint. Pale spots on head and front of trunk all close set, smaller and more numerous; on lower surface of tail larger, less defined and more irregular, extending in a similar fashion over anal; on dorsal spots small and distinct, as on back. Rictus with black spot and broad black blotch, enclosing gill opening. Inside of mouth mottled with grayish. Length 660 mm.

Tropical Atlantic. Two from the mouth of the Congo, obtained by the Congo Expedition. Reaches 1373 mm.

***Murenophis helena* (Linné)**

Muraena (Cape Blanco)

Morena negra, Morena pintada, Morena (Canaries, Spanish Sahara), Moreia (Madeira)

Figure 149

Muraena helena LINNÉ, 1758, 'Syst. Nat.', 10th Ed., p. 244. Europe, American Ocean.—BOWDICH, 1825, 'Excurs. Madeira,' p. 125 (Madeira).—LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 192 (Madeira).—TROSCHER, 1866, Archiv Naturg., part 1, p. 237 (Cape Verde Islands).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 96 (Madeira, Lanzarote).—STASSANO, 1890, Annali di Agricoltura, Roma, p. 32 (Spanish Sahara).—VINCIGUERRA, 1890, Lo Spallanzani, Roma, (2) XIX, p. 467 (Spanish Sahara); 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 332 (Grand Canary).—JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 340 (Canary Islands).—RICHARD, 1904 (October 15), Bull. Inst. Océanogr. Monaco, No. 19, p. 9 (Banc Gorringe, N. lat. 36°, W. long. 11°), p. 29 (N. lat. 36° 31', W. long. 11° 32', 90 m.); 1905 (June 25), *op. cit.*, No. 41, p. 5 (Banc Gorringe).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 100 (Baie de Tarrafal at São Antão, Cape Verde Islands).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 210 (Canary Islands, Gorée).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 250 (Rio de Oro; West Africa).

Head 8 1/3 to 8 7/8; depth 15 to 16 1/8; snout 5 in head; eye 9 1/3 to 10 1/4; mouth 1 7/8 to 2 1/8; interorbital 9 to 9 1/5; head 4 1/8 to 4 1/4 to vent.

Body elongate, compressed, sides convex, tail tapering well behind. Head compressed, width about $2 \frac{1}{3}$ in its length. Snout compressed, width $1 \frac{1}{4}$ its length. Eye center at about first fourth in head. Mouth large, narrow, commissure nearly straight, jaws equal. Lips thin, firm, tough, edges minutely papillose. Teeth sharp-pointed, subconic, slightly compressed, inclined slightly posteriorly; jaw teeth uniserial, enlarged slightly forward; 2 enlarged conic depressible premaxillary fangs, one following the other, continuous behind in single row of vomerine teeth, much smaller than in sides of jaws. Tongue not evident. Nostrils all tubular, anterior ones on each side of snout tip, posterior ones close above eye front, high on frontal region. Interorbital convex. Gill opening $\frac{4}{5}$ in eye. Pores on head rather inconspicuous, 4 pairs along upper jaw edge with last 2 below eye and same number on mandible. Dorsal origin at about last fifth in head, fin moderately high. Caudal small. Anal like dorsal. Rich brown, marbled with buff and dusky, in many places forming small

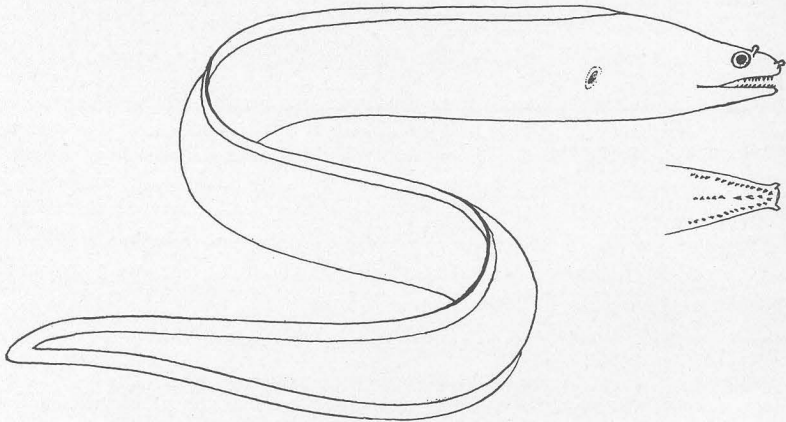


Fig. 149. *Murenophis helena*, modified from Day.

light and dark spots or even ocelli. Head brownish above, marbled with darker, lower surface pale brown and unspotted. Abdomen and breast below uniform and unspotted. Length 539 to 622 mm.

Eastern Atlantic and Mediterranean. Described above from Italian examples.

Two half-grown examples in the U. S. National Museum from Madeira, received from Captain William Stimpson.

One 559 mm. long from Fayal, Azores, in the Museum of Comparative Zoölogy.

***Murenophis augusti* (Kaup)**

Thyrsoidea agusti KAUP, 1856, 'Cat. Apod. Fish. Brit. Mus.,' p. 88. Madeira.

Muraena augusti GÜNTHER, 1870, 'Cat. Fish. Brit. Mus., VIII, p. 97 (Madeira; type of *Thyrsoidea atlantica* Johnson).—VINCIGUERRA, 1882 (1883), Ann. Mus. Civ. Storia Nat. Genova, XVIII, p. 619 (Santa Cruz di Teneriffa); 1892, Atti Soc. Ital.

Sci. Nat., XXXIV, p. 332 (Teneriffe).—JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 340 (Canary Islands).

Muraena guttata LOWE, 1837, Trans. Zool. Soc. London, II, part 3, p. 192 (Madeira).—RICHARDSON, 1844–1848, 'Voy. "Erebus" and "Terror,"' Ichth., p. 70 (Madeira).

Limamuraena guttata KAUP, 1856, 'Cat. Apod. Fish. Brit. Mus.,' p. 96 (Madeira).

Thrysoidea atlantica JOHNSON, 1860, Proc. Zool. Soc. London, p. 168. Madeira.

Head $3\frac{1}{2}$ to vent. Tail longer than body. Snout pointed, narrow. Eye small, $2\frac{1}{2}$ in snout, little nearer mouth angle than snout end. Mouth cleft very wide, width $2\frac{1}{3}$ in head, not shutting completely. Maxillary teeth biserial, teeth in inner series longer than in outer; other teeth uniserial; sometimes 2 or 3 long teeth forming an inner mandibular series; front vomerine teeth longest, nearly twice as long as the others. Hind nostrils tubular, tubes only half as long as the anterior, which is equal vertical eye diameter. Gill opening narrow, not wider than eye. Brownish black. Tail with numerous bluish-white dark-edged dots the size of a pin-head, disappearing on front parts of body. Inside of mouth brown, with similar white dots. Fins without light margin. (Günther.)

Eastern Atlantic. Reaches 1015 mm.

ECHIDNA Forster

Echidna FORSTER, 1777, 'Icon. Ined. Bibl. Banks,' p. 181. Type: *Echidna variegata* Forster.—FORSTER, 1778, 'Enchirid.,' p. 31. Type: *Echidna variegata* Forster = *Muraena echidna* Gmelin. Tautotypic.

Gymnothorax BLOCH, 1795, 'Naturg. Ausl. Fische,' IX (12), p. 83. Type: *Gymnothorax catenata* Bloch. (Designated by Bleeker, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, (2) XVIII, p. 130.)

Gymnomuraena LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 648. Type: *Gymnomuraena doliata* Lacépède. (Designated by Bleeker, 1865, Ned. Tijds. Dierk., II, p. 122.)

Gymnopsis RAFINESQUE, 1815, 'Analyse de la Nature,' p. 93. Type: *Gymnomuraena doliata* Lacépède. (*Gymnopsis* Rafinesque proposed to replace *Gymnomuraena* Lacépède.)

Megaderus RAFINESQUE, *op. cit.* Type: *Echidna variegata* Forster. (*Megaderus* Rafinesque proposed to replace *Echidna* Forster.)

Molarii RICHARDSON, 1844–1848, 'Voy. "Erebus" and "Terror,"' Ichth., p. 79. Type: *Muraena ophis* Rüppell = *Muraena nebulosa* Ahl.

Molarius auct.

Poecilophis KAUP, 1856, Archiv Naturg., p. 66. Type: *Gymnothorax catenata* Bloch. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 2, p. 272.)

Mouth cleft rather short. Teeth mostly obtuse, molar-like. Only front nostril tubular. Hind nostril circular. Dorsal begins before gill opening. Tail moderate, not twice the length of the trunk.

Tropical morays, referable to rather few species and distinguished chiefly by their molar-like teeth.

KEY TO THE SPECIES

a.—Yellowish, with large black spots, which usually are so large that the ground color appears merely as a network of more or less narrow white lines. . . *catenata*.

aa.—Ground color dark.

b.—Dark brown, with white ocelli, about as large as the eye, arranged in transverse series. *lecomtei*.

bb.—Blackish, with innumerable yellowish-brown freckles on the dorsal fin and along the back. *pelei*.

***Echidna catenata* (Bloch)**

Gymnothorax catenata BLOCH, 1795, 'Naturg. Ausl. Fische,' IX, p. 84, Pl. ccccxv, fig. 1. Surinam.

Echidna catenata FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 275 ("West Africa," Angola).

Head 7 to 7 7/8, to vent 3 7/8 to 4 1/2; depth 11 1/2 to 21 in total; tail 1 1/4 to 1 1/3 in combined head and trunk; snout 5 7/8 to 7 in head; eye 10 to 12, in snout 1 1/2 to 1 3/5; mouth 2 4/5 to 3 1/8 in head; interorbital 9 4/5 to 11 1/2.

Body well compressed, trunk of about uniform depth, tail moderately tapering back behind. Head width 3 to 3 3/4 its length. Snout conic, width 1 to 1 1/6 its length. Eye with front pupil edge midway in mouth, more advanced in young. Upper teeth before eye large, obtusely conic, forming an outer and a median series, all erect and strong; 2 median rows of somewhat irregular, obtuse, short, though large, molar-like teeth on vomer; lateral outer teeth below and behind the eye are small, erect, molar-like; close inside these is a short series of about 5 longer and more slender conic erect teeth; mandibular teeth obtuse, molar-like, biserial, anteriorly a little enlarged. Snout tip protrudes slightly beyond the mandible. Front nostril is in a short fleshy tube near the snout tip, hind one about 2/3 as high, with a slight cutaneous rim, and placed above the front eye edge. Interorbital convex.

Gill opening about as long as eye. Along each lip 5 pores, also 5 pores along each mandibular ramus; a pair of pores near the snout tip, another pair between the front nostrils and still another pair on the snout, above midway between the front and hind pairs. Dorsal origin about midway between rictus and gill opening, fin moderately high. Caudal 1 3/4 in eye. Anal lower than dorsal.

Deep brown, with about 38 to 40 more or less regular blotches or deep saddles over the back of whitish or creamy narrow streaks, these are broken or reticulated in places and especially well below the median body axis. In each of the pale lines are fine dots or dustings of deep brownish scattered about. On belly and lower surface of tail the reticulations are more or less complete and form numerous smaller blotches. Pale reticulations on the trunk and tail are also reflected on fins, which are of similar ground color. Mandible pale, with several or few small spots of dark brown along the lip. Mouth corners, inside mouth and gill opening are all pale. Length 152 to 450 mm.

Tropical Atlantic. Described above from West African and West Indian examples.

***Echidna lecomtei* (Kaup)**

Dianbajh (Senegambia)

Poecilophis lecomtei KAUP, 1856, 'Cat. Apod. Fish. Brit. Mus.,' p. 103. Gaboon, West Africa.

Poecilophis lecomtei KAUP, 1856, Archiv Naturg., XXII, part 1, p. 67. Gaboon.—

DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 264, Pl. xxiii, fig. 2a-d (Gaboon).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 149 (Casamence).

Muraena lecomtii GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 131 (copied).

Head $7 \frac{1}{3}$; depth $13 \frac{1}{2}$; snout 6 in head; mouth cleft $1 \frac{4}{5}$; head $3 \frac{9}{10}$ to vent. Snout about as broad as long. Hind eye edge a little before the middle in mouth cleft; 2 in snout. Upper jaw slightly protrudes. Teeth biserial molars in jaws; inner upper smaller than outer, reverse in mandible; premaxillary teeth triserial, with 4 teeth in median series resolving behind to biserial vomerines. Front nostril in a short tube on each side of snout tip; hind nostril is a simple pore above the front eye edge within the interorbital. Interorbital is a little broader than eye. Gill opening little less than snout. Pair of pores on snout above, between nostrils, a pair below on the upper lip behind snout tip, and 5 pores along each mandibular ramus. Dorsal begins a little nearer vent than gill opening. Caudal small and pointed. Anal slightly lower than dorsal. Dark brown, with white ocelli, about as large as eye, in about 43 transverse series, also extending on the vertical fins. (Duméril.)

West Africa.

Echidna peli (Kaup)

N'dia (Senegambia)

Figure 150

Poecilophis peli KAUP, 1856, 'Cat. Apod. Fish. Brit. Mus.,' p. 102, Fig. 68. Gold Coast; 1856, Archiv Naturg., part 1, p. 67 (Gold Coast).—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 264 (Gold Coast).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 150 (Casamence).—OSORIO, 1890 (September), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) II, p. 58 (Angola); 1898, *op. cit.*, (2) V, p. 200 (Angola).

Gymnothorax peli BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Haarlem, XVIII, No. 2, p. 130, Pl. xxviii (Guinea).

Muraena peli GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 132 (copied).

Muraena peli PIETSCHMANN, 1913, Jahrb. Nassau Ver. Naturk., Wiesbaden, LXVI, p. 179 (Bibundi, Cameroon).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 212 (Cape Blanco, St. Louis).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Océ. française, p. 250 (Cape Blanco).

Echidna peli PETERS, 1876 (1877), Monatsb. Akad. Wiss. Berlin, p. 251 (Cameroon).—FOWLER, 1912, Proc. Acad. Nat. Sci. Philadelphia, p. 27 (Monrovia, Liberia); 1919, Proc. U. S. Nat. Mus., LVI, p. 241 (Monrovia examples).—MONOD, 1927, 'Faune Colon. françaises,' p. 679 (compiled).

Head $7 \frac{1}{3}$ to $7 \frac{3}{5}$; depth 15 to $16 \frac{1}{3}$; snout $6 \frac{1}{8}$ to $7 \frac{1}{2}$ in head; eye 11 to $13 \frac{1}{3}$; mouth 3 to $3 \frac{1}{2}$; interorbital $7 \frac{1}{4}$ to $8 \frac{1}{4}$; head $3 \frac{2}{3}$ to $4 \frac{1}{4}$ to vent.

Body long, well compressed, trunk of about uniform depth, tail gradually tapering in a rather long point. Head width 4 to $4 \frac{1}{5}$ in its length. Snout width $\frac{4}{5}$ its length. Eye about midway in upper jaw length. Lips moderately thick, finely papillose. Mandible a little shorter than snout tip. Teeth enlarged in upper jaw anterior to eye, mostly with broad conic or robust bases, tips sharply pointed, forming a single outer erect series all around jaw edges, and inner series of 3 gradually larger teeth slightly depressible, latter largest of all; the lateral upper teeth behind front of eye with an inconspicuous outer series of small short erect conic teeth and closely parallel

inside another series of much longer, more slender, conic and depressible teeth; vomerine teeth small, conic, molar-like, erect, irregularly biserial; mandibular teeth with an outer series of small close-set conic erect teeth, and in front of jaw about 3 pairs of enlarged conic, robust teeth. No tongue. Front nostril in fleshy tube each side of snout tip and its length is about 2 in eye; hind nostril with slightly elevated cutaneous rim, little less than half height of anterior. Interorbital convex. Gill opening nearly horizontal, about equals eye. About 4 distinct pores along each upper lip and 5 along each mandibular ramus; 2 pairs of well separated pores on snout above, first pair between front nostril and second pair about midway between front and hind nostrils. Dorsal origin opposite last fourth between hind eye edge and gill opening, fin well elevated. Caudal $\frac{2}{3}$ of eye. Anal much lower than dorsal.

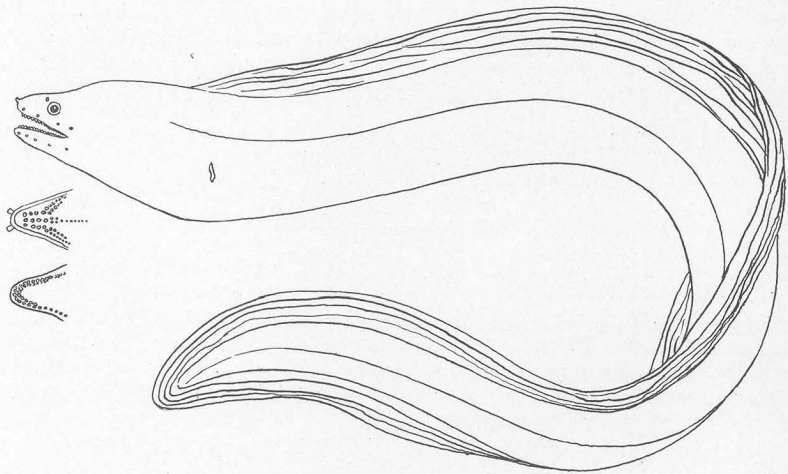


Fig. 150. *Echidna peli*, from Bleeker.

Uniform dusky or chocolate-brown, mouth corners and gill openings similar. Mouth pale inside. Each pore along upper lip and mandible in slightly paler spot. Length 274 to 504 mm.

West Africa. Described above from 3 examples in the Academy, from Monrovia, Liberia.

UROPTERYGIUS Rüppell

Uropterygius RÜPPELL, 1835, 'Neue Wirbelth.,' Fische, p. 83. Type: *Uropterygius concolor* Rüppell. Monotypic.

Scutica JORDAN AND EVERMANN, 1896, Bull. U. S. Nat. Mus., No. 47, part 1, p. 403. Type: *Gymnomuraena nectura* Jordan and Gilbert. Monotypic.

Scuticaria JORDAN AND SNYDER, 1901, Proc. U. S. Nat. Mus., p. 886. Type: *Ichthyophis trigrinus* Lesson. Monotypic.

Snout moderate, about half the length of the gape. Mouth cleft moderate, not

half of head. Teeth small, subequal, pointed, in several series. Tail about as long as trunk. Vertical fins rudimentary, confined to end of tail. No pectoral.

Small morays, represented by few species, with apparent absence of fins.

Uropterygius grassi Roule

Figure 151

Uropterygius grassi ROULE, 1916 (May 20), Bull. Inst. Océanogr. Monaco, No. 320, p. 6. Three-quarters mile southwest of St. Lucia, Cape Verde Islands, 52 m.

Uropterygius grassii ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 101, Pl. vi, fig. 2, a-c (types).—ROULE AND ANGEL, 1921 (August 1), Bull. Inst. Océanogr. Monaco, No. 397, p. 8 (Cape Verde Islands, 52 m.).

?*Uropterygius atlanticus* VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 135. Off Azores, N. lat. 38° 3' 40", W. long. 28° 35', in 98 m. (No description or figure.)

Head $5 \frac{4}{5}$ in total. Snout a little over half of mouth cleft. Eye with hind edge about midway in mouth cleft; $2 \frac{1}{2}$ in snout. Maxillary teeth biserial forward; 1 or

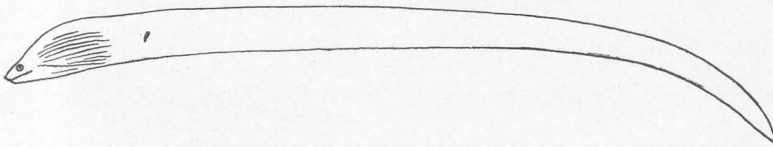


Fig. 151. *Uropterygius grassi*, from Roule.

2 vomerine teeth, more than twice front maxillary teeth. Front nostril in short tube; hind nostril pore, placed above eye. Vertebrae 117, of which 79 are caudal. Upper labial pores 4 or 5; lower labial pores 4; 4 median pores on snout; pore below eye close to hind nostril; lesser pores in linear rows, occupy upper surface of snout, around eyes, around mouth cleft and lower lip. General color russet or brownish, sometimes with whitish or yellowish-white marblings. Length 192 to 252 mm. (Roule.)

CHANNOMURAENA Richardson

Channo-muraena RICHARDSON, 1844-1848, 'Voy. "Erebus" and "Terror,"' Ichth., p. 96. Type: *Ichthyophis vittatus* Richardson. Monotypic.

Snout very short, less than $\frac{1}{4}$ of gape. Mouth cleft long, nearly half of head. Teeth rather small, pointed, partly equal, in several series. Hind nostril is a short round tube or simple pore. Vertical fins rudimentary, confined to end of tail. Tail very short, about half rest of body.

Species few, brightly colored.

Channomuraena vittata (Richardson)

Figure 152

Ichthyophis vittatus RICHARDSON, 1844, 'Voy. "Sulphur,"' Fishes, p. 114, Pl. LIII, figs. 7-9. "China."

Gymnomuraena vittata OSORIO (1894, February), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 181 (Rolas Island); 1898, *op. cit.*, (2) V, p. 200 (Rolas Island).

Head about 4 in trunk, $2\frac{2}{3}$ in tail; snout $4\frac{1}{2}$ in mouth gape; eye $1\frac{1}{2}$ in snout, in first third of gape; mouth 2 in head. Lower jaw protrudes. Teeth slender, subequal, directed backward; teeth below biserial, pointed backward, inner larger and movable, upper teeth triserial, 2 inner series larger and more or less movable; vomerine teeth in band, thick set anteriorly, posteriorly biserial. No fins. Pale yellowish-

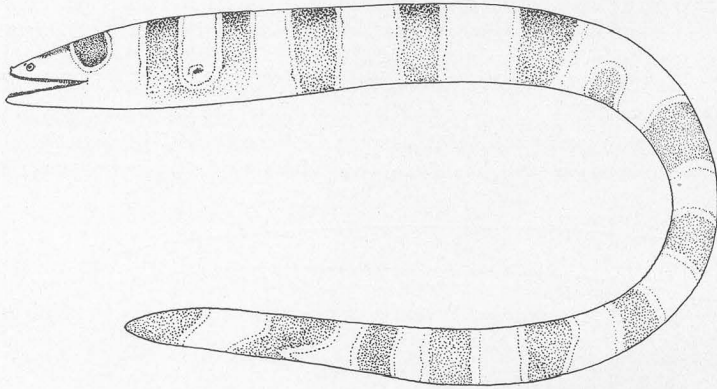


Fig. 152. *Channomuraena vittata*, from Jordan and Davis.

brown, with about 15 irregular broad chocolate crossbands, varying in width, sometimes interrupted, sometimes bifurcated, some forming complete rings, pale interspaces usually edged with lighter yellowish. Length 800 mm. (Jordan and Davis.)

Tropical Atlantic. The above description based on a West Indian (Havana) example.

ORDER LYOMERI

Gulpers

Body with a long slender tail. Mouth very large and with pharynx very distensible. No opercles. Gill openings small, separate. Branchiostegals vestigial. Branchial arches and pectoral arch far behind the head, with the skele on reduced and little ossified. Skull with much cartilage, membrane bones very thin. No ribs or air vessel. Gonaducts normal. Singular pedunculated appendages in place of lateral line. Body scaleless. Fins soft rayed, dorsal and anal long. No caudal. Pectorals present or absent. No ventrals.

Two families.

KEY TO THE FAMILIES

- a.*—Trunk much longer than head; teeth moderately large in both jaws; dorsal and anal obsolete. SACCOPHARYNGIDAE.
aa.—Head much longer than trunk; teeth minute in both jaws; dorsal and anal moderately high. EURYPHARYNGIDAE.

Saccopharyngidae

Gulpers

Trunk moderate, vent at its end. Tail greatly elongate, tapering to a point. Head enormous, with a short cranial portion. Snout very short. Eyes anterolateral. Mouth large. Maxillaries moderately extended backward, apparently not closing against each other. Jaws with slender, curved, pointed teeth. A single nostril on each side before the eye. Gill openings much nearer the end of snout than vent. Stomach very distensible. Skull longer than broad. Frontal bones larger than parietals. Dorsal and anal feeble, rudimentary. Pectoral present. One genus. Piscivorous.

SACCOPHARYNX Mitchill

Gulpers

Saccopharynx MITCHILL, 1824, Ann. Lyc. Nat. Hist. New York, I, p. 82. Atypic. Type: *Saccopharynx flagellum* Cuvier, 1829, 'Règne Animal,' 2d Ed., II, p. 355.

Ophiognathus HARWOOD, 1827, Philos. Trans., p. 277. Type: *Ophiognathus ampullaceus* Harwood. Monotypic.

Tail bandlike. Snout pointed, flexible. Eyes very small. Jaws very long. Maxillary and mandible slender, armed with feeble teeth in 1 or 2 more or less complete series. Palate toothless. Gill openings close together. Branchial arches 5. Gills very short, extremely small. Dorsal and anal low. Pectoral very small, broad.

Saccopharynx ampullaceus (Harwood)

Figure 153

Ophiognathus ampullaceus HARWOOD, 1827, Philos. Trans., p. 52, Pl. VII. Atlantic, N. lat. 62°, W. long. 57°.

Saccopharynx ampullaceus JOHNSON, 1862, Ann. Mag. Nat. Hist., London, X, p. 277 (off Madeira).

Saccopharynx flagellum GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 22 (Madeira); 1887, 'Rept. Voy. "Challenger,"' XXII, p. 256, Pl. LXVI (Madeira).

Both jaws with slender, curved, widely set teeth, irregularly uni- or biserial, their points directed inward. Jaws 3 to 7 to vent. Gill opening an elongate slit. Dorsal begins a long way behind the head, short distance before vent; like anal may or may not reach end of tail, which terminates in extremely delicate and thin filament. Pectoral small with some 30 very thin rays. Bluish-white line on back along each side of dorsal base, and similar line sometimes distinct along anal fin. Length 292 to 1830 mm. (Günther.)

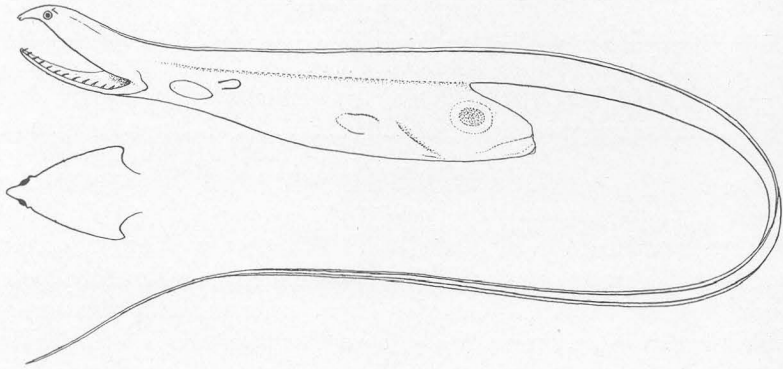


Fig. 153. *Saccopharynx ampullaceus*, modified from Günther.

Bathypelagic in tropical Atlantic.

Eurypharyngidae

Combined pharynx and trunk much shorter than jaws. Head flat above, with transverse rostral margin containing eyes at outer angles. Mouth enormous. Maxillaries excessively elongated backward, parallel, closing against each other as far as articulation of 2 suspensorial bones. Both jaws with minute teeth, mandibles sometimes with a pair of symphyseal canines. Stomach not especially distensible. Gill openings much nearer vent than end of snout. Skull not longer than broad. Parietals larger than frontals. Dorsal and anal well developed, extend nearly to end of tail. Pectoral minute.

One genus.

EURYPHARYNX Vaillant

Eurypharynx VAILLANT, 1882, Compt. Rend. Acad. Sci. Paris, XCV, p. 1226. Type: *Eurypharynx pelecanooides* Vaillant. Monotypic.

Gastrostomus GILL AND RYDER, 1883, Proc. U. S. Nat. Mus., VI, p. 271. Type: *Gastrostomus bairdii* Gill and Ryder. Monotypic.

Megalopharynx BRAUER, 1900, 'Schilder. Deutsche Tiefsee-Exped.,' Jena, p. 521. Type: *Megalopharynx longicaudatus* Brauer. Monotypic.

Macropharynx BRAUER, 1902, Zool. Anzeiger, XXV, p. 290. Type: *Megalopharynx longicaudatus* Brauer. Monotypic.

Rouleina (not Jordan, 1923) FOWLER, 1925 (March 31), Amer. Mus. Novit., No. 162, p. 2. Type: *Eurypharynx richardi* Roule. Orthotypic.

Jordanites FOWLER, 1925 (Nov. 19), Copeia, No. 147, p. 75. Type: *Eurypharynx richardi* Roule. (*Jordanites* Fowler proposed to replace *Rouleina* Fowler).

Dentigerous jaws about 7 times longer than cranium. Minute, acute, conic teeth, depressed inward, in a very narrow band in jaws. No enlarged teeth at end of mandible.

Several species. Food chiefly small invertebrates.

KEY TO THE SPECIES

- a.—EURYPHARYNX. About 10 dorsal rays before vent; snout pointed at tip.
pelecanoides.
- aa.—JORDANITES. Thirty dorsal rays before vent; snout obtusely truncate at tip.
richardi.

Eurypharynx pelecanoides Vaillant

Figure 154

Eurypharynx pelecanoides VAILLANT, 1882, Compt. Rend. Acad. Sci. Paris, XCV, p. 1226. Off Morocco.—RICHARD, 1905 (June 25), Bull. Inst. Océanogr. Monaco, No. 41, p. 3 (off Teneriffe, N. lat. 28° 4', W. long. 16° 49' 30", 1340 to 1530 m.).—ROULE, 1916 (May 20), Bull. Inst. Océanogr. Monaco, No. 320, p. 2 (near Teneriffe, 1340 to 1530 m.; between Azores and Portugal, 2100 to 2600 m.).

Saccopharynx pelecanoides GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 262 (Mogador, Morocco).

Gastrostomus bairdi ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 88, Pl. IV, fig. 3, a-e (N. lat. 31° 21', W. long. 19° 9', 4000 m., west of Madeira).

Gastrostomus bairdii PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 185 (southwest of Ascension Island, S. lat. 11° 19', W. long. 18° 34', 1200 m.).

Megalopharynx longicaudatus BRAUER, 1900, 'Schilder. Deutsche Tiefsee-Exped.,' Jena, p. 521. Gulf of Guinea.

Macropharynx longicaudatus BRAUER, 1902, Zool. Anzeiger, XXV, p. 290 (Gulf of Guinea, 3500 m.); 1906, 'Wiss. Ergebn. "Valdivia,"' XV, p. 134, Pl. VIII, fig. 2 (Gulf of Guinea, N. lat. 1° 14' 2", W. long. 2° 10', 3500 m.).

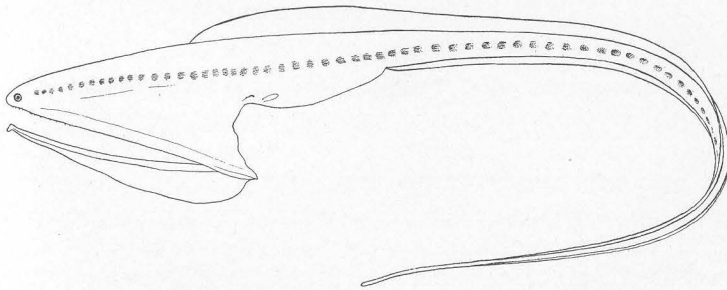


Fig. 154. *Eurypharynx pelecanoides*, modified from Zugmayer.

Dorsal 160 to 215; anal 110 to 190; pectoral 14 or 15. Jaws 4 4/5 in total length; depth at gill opening 19. Interorbital 8 in upper jaw. Pale organ at end of tail. Pores in lateral line 110. Black; side below terminal caudal organ white. Inside of pharynx bluish gray. Length 530 mm. (Zugmayer.)

Bathypelagic.

Eurypharynx richardi Roule

Figure 155

Eurypharynx richardi ROULE, 1914, Compt. Rend. Acad. Sci. Paris, p. 1821.

Madeira, 1500 m.; 1914, Bull. Inst. Océanogr. Monaco, No. 292, p. 1821; 1916 (May 20), *op. cit.*, No. 320, p. 3 (type); 1919 Rés. Camp Sci. Inst. Monaco, LII, p. 94, Pl. VI, fig. 1; 1, *a-c* (south of Madeira, 1500 m.).

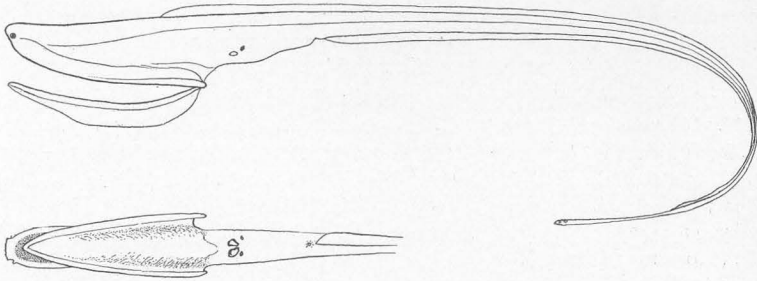


Fig. 155. *Eurypharynx richardi*, modified from Roule.

Dorsal 150, of which 30 are before vent. Anal 110. Pectoral very small, of 8 or 9 rays, most bifid. Snout short, very obtuse, truncate before the eyes. Teeth very small, several rows on edges of jaws. Lateral line incomplete behind the vent. Dorsal and anal low, subequal. Black. Length 353 mm. (Roule.)

Eastern Atlantic.

ORDER NEMATOGNATHI

Catfishes

Mouth not protractile. Premaxillary forms upper border of mouth, with rare exceptions. No parietals, symplectic, or subopercles. Basis of cranium and pterotic simple. Subopercle absent or formed as the uttermost branchiostegal. Branchiostegal rays often numerous. Third upper pharyngeal absent or small, rests on fourth, second directed backward. One or 2 pairs of basal branchiyls. Two pairs of branchiyls. Second, third, and fourth vertebrae united to form a complex, with fifth also rigidly attached. Parapophyses firmly joined with centra, epipleurals and epineurals absent. Mesocoracoid present, also interclavicles. No scales, skin naked or with bony plates.

A great group of carnivorous fishes, mostly fresh-water, living on or about the bottom.

I have preferred to exclude the following siluroids, as they belong to genera normally fresh-water in distribution.

Clarias senegalensis Valenciennes

Clarias senegalensis VALENCIENNES, 1840, 'Hist. Nat. Poiss.,' XV, p. 279 (376). Pays des Oualofs, Senegal.

Clarias anguillaris (not Linné) OSORIO, 1898, *Jorn. Sci. Math. Phys. Nat.*, Acad., Lisboa, (2) V, p. 199 (Dahomé).

***Chrysichthys nigrodigitatus* (Lacépède)**

Pimelodus nigrodigitatus LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, pp. 95, 103, "la collection du Muséum national d'histoire naturelle."

Chrysichthys nigrodigitatus OSORIO, *loc. cit.* (Bissau; Dahomé).—PELLEGRIN, 1914, *Ann. Inst. Océanogr. Monaco*, VI (4), p. 21 (Senegal; Grand-Bassam).—EHRENBAUM, 1914, *Fischerbote*, VI, p. 18 (Cameroon).

Tachysuridae

Sea Cats

Body moderately long. Mouth terminal. Teeth in jaws and often on palate. Maxillary and lower jaw with a pair of barbels, latter sometimes with 2 pairs. Gill membranes united to form fold over isthmus. Vertebrae 48 to 58, of which 27 to 33 are caudal. Air vessel large, free, normal. Dorsal fin forward, with spine. Adipose dorsal present. Anal short or moderate. Pectoral with spine. Ventral rays 6.

Large group of tropical fishes, marine or living about estuaries and shores. A number of species carry their eggs about in the mouth until hatched. Others build nests in streams.

TACHYSURUS Lacépède

Tachysurus LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 150. Type: *Tachysurus sinensis* Lacépède. Monotypic.

Galeichthys VALENCIENNES, 1840, 'Hist. Nat. Poiss.,' XV, p. 28. Type: *Galeichthys feliceps* Valenciennes. (Designated by Bleeker, 1863, *Ned. Tijds. Dierk.*, I, p. 90.)

Arius VALENCIENNES, *op. cit.*, p. 53. Type: *Pimelodus arius* Buchanan-Hamilton. Tautotypic.

Notarius GILL, 1863, *Proc. Acad. Nat. Sci. Philadelphia*, p. 171. Type: *Arius grandicassis* Valenciennes. Monotypic.

Body elongate. Eye largely free. Mouth moderate, upper jaw longer. Teeth in villiform bands in jaws. Vomer with 1 or 2 patches of granular teeth, also palatines sometimes confluent as 1 band. Barbels 6, close together, usually short maxillary pair terete or compressed. Dorsal buckler sparingly granular. Skull with fontanel. Skin smooth, naked, on occipital nuchal region covering bony bucklers. Dorsal fin short, before ventrals, with pungent spine and 7 rays. Adipose fin well developed, free behind. Anal short. Caudal deeply forked. Pectoral with spine. Ventral rays 6.

Marine catfishes, with numerous species on sandy tropical shores, but not about coral reefs.

KEY TO THE SPECIES

a.—TACHYSURUS. No teeth on vomer, present only on pterygoids.

b.—Teeth on palate in 2 very large groups, formed of a front transverse portion narrowly separated from its fellow on the median line and a posterior triangular portion, which is longer than broad. *gambensis*.

bb.—Teeth on palate in 2 rather small widely separated oval or subtriangular groups.

- c.—Dorsal spine with granular tubercles anteriorly and small serrae posteriorly.....*heudelotii*.
 cc.—Dorsal spine with antrorse serrae on both front and hind edges.
capellonis.
 aa.—GALEICHTHYS. Teeth on vomer and pterygoids; dorsal spine very feebly serrated in front and behind.....*feliceps*.

***Tachysurus gambensis* (Bowdich)**

Figure 156

Pimelodus gambensis BOWDICH, 1825, 'Excurs. Madeira,' p. 234, Fig. 50. Gambia.
Arius latiscutatus GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 151, Fig. (predorsal plate). West Africa.—STEINDACHNER, 1879, Sitzs. Akad. Wiss. Wien, LXXX (1), p. 171 (Sierra Leone, Liberia, Loango).—BOULENGER, 1903 (1905), Mem. Soc. Españ. Hist. Nat., Madrid, I, p. 187 (Rio Benito, Spanish Guinea); 1911, 'Cat. Fresh-water Fishes Africa, II, p. 385, Fig. 297 (Fernando Po, Cameroons, Niger, Gambia).—PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 154 (Libreville, Gaboon; Banana, Congo); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 22 (Libreville, Banana).—EHRENBAUM, 1914, Fischerbote, V, p. 53 (Cameroon); 1915, 'Ueber Küstenfische von Westafrika,' p. 30, Fig.—MONOD, 1927, 'Faune Colon. françaises,' p. 674 (Louelaba, Cameroon).

Galeichthys latiscutatus FOWLER, 1917 (June 24), Copeia, No. 45, p. 53 (Great Batanga, Cameroon); 1919, Proc. U. S. Nat. Mus., LVI, p. 288 (Freetown, Sierra Leone); p. 260 (Great Batanga).

Arius parkii GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 154, Fig. (predorsal plate). Niger River.

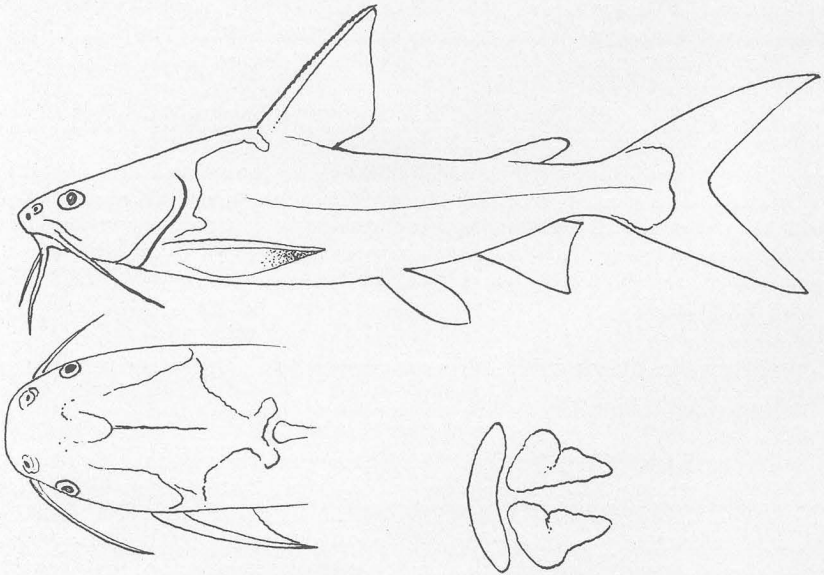


Fig. 156. *Tachysurus gambensis*, from Boulenger.

Head $3\frac{2}{5}$; depth $4\frac{3}{4}$; dorsal I, 7; anal iv, 14; snout $2\frac{3}{5}$ in head measured from upper jaw tip; eye $6\frac{2}{3}$; mouth width $2\frac{1}{4}$; interorbital $2\frac{1}{5}$.

Body compressed, flattened below in front. Caudal peduncle compressed, least depth 4 in head. Head wide, depressed, upper profile evenly though slightly convex. Snout broad, length $1\frac{3}{4}$ its width. Eye moderate, advanced, hind edge midway in head length. Mouth broad, slightly inferior. Teeth in wide bands in jaws, fine, ends of bands rounded; palatine teeth in 2 large patches, fine, and each patch of rounded design. Maxillary barbel nearly to end of pectoral ray; outer mental to pectoral ray base and inner mental $1\frac{1}{2}$ to pectoral base. Nostrils large, close, near snout edge; hind one with a well-developed flap, about an eye diameter directly before the eye. Fontanel on head narrow, reaches occipital buckler. Bones of head, occipital buckler, and front of dorsal spine strongly rugose. Opercles moderately striate. Gill rakers about 4+8, lanceolate, a little shorter than gill filaments. Lateral line complete, distinctly arched at first. Humeral process about as long as snout, with few striae. Dorsal origin slightly behind pectoral center; first branched ray $1\frac{1}{5}$ in head. Adipose fin rounded, about as long as snout. Caudal well forked, lobes about equal; lower lobe $1\frac{2}{5}$ in head. Pectoral reaches $\frac{7}{8}$ to ventral, $1\frac{1}{5}$ in head. Ventral inserted midway between caudal base and hind nostril, fin reaching first fifth of anal, $1\frac{1}{2}$ in head.

Brown above, whitish on belly and under surfaces. Dorsal, anal, pectoral, and ventral with dusky on median terminal portions. Maxillary barbel brownish, other barbels pale. Iris brownish. Length 267 mm.

West Coast of Africa, from the Gambia to the Congo. Described above from an example obtained at Great Batanga, Cameroon. Two examples in the United States National Museum, obtained by the 'Eclipse' Expedition at Sierra Leone, have the maxillary barbels extending very little beyond the pectoral origin.

Pimelodus gambensis Bowdich is doubtless the present species. Though the figure is crude, so far as its details are presented, it agrees. The original account is as follows:

This fish had been long out of the water when we saw it, so that we could only ascertain the existence of the dentated spine of the first dorsal, and of the pectoral fin; and that the second dorsal and anal fins were fleshy. The head, as far as the nape of the neck, was shagreened; there were but few visible scales, and the whole body was of a dull grayish-brown, approaching to black upon the back. It had six barbillion, and was found in the Gambia.

***Tachysurus heudelotii* (Valenciennes)**

Sabado (Cape Blanco), Sumé, Suma, Humé (Cameroon)

Figure 157

Arius heudelotii VALENCIENNES, 1840, 'Hist. Nat. Poiss.,' XV, p. 73, Pl. CCCXXVIII. Senegal.—PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 116 (Baie du Lévrier); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 22 (Baie du Lévrier, Senegal).

Arius heudeloti BOULENGER, 1911, 'Cat. Fresh-water Fishes Africa, II, p. 387 (Niger, Lagos, Cameroon).—REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV,

p. 125 (Lagos).—BOULENGER, 1916, *op. cit.*, IV, p. 315 (Lagos example).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 205 (Cape Blanco).—MONOD, 1927, 'Faune Colon. françaises,' p. 674 (Louelaba, Cameroon).

Arius parkii (part) GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 154 (Lagos example).—STEINDACHNER, 1894, Notes Leyden Mus., XV, p. 61 (Grand Cape Mount).—REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 125 (note).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 206 (Cape Blanco).

Arius granulatus PETERS, 1868, Monatsb. Akad. Wiss. Berlin, p. 454. Lagos.

Head $3\frac{1}{2}$ to 4; depth 5 to 6; dorsal I, 7; anal v or vi, 12 to 14; eye 5 to 6 in head. Head width $1\frac{1}{4}$ to $1\frac{1}{2}$ its length. Snout short, wide, projects very feebly beyond mouth. Eye lateral, oval, 1 to $1\frac{1}{2}$ in snout, $2\frac{1}{2}$ to 4 in interocular width.

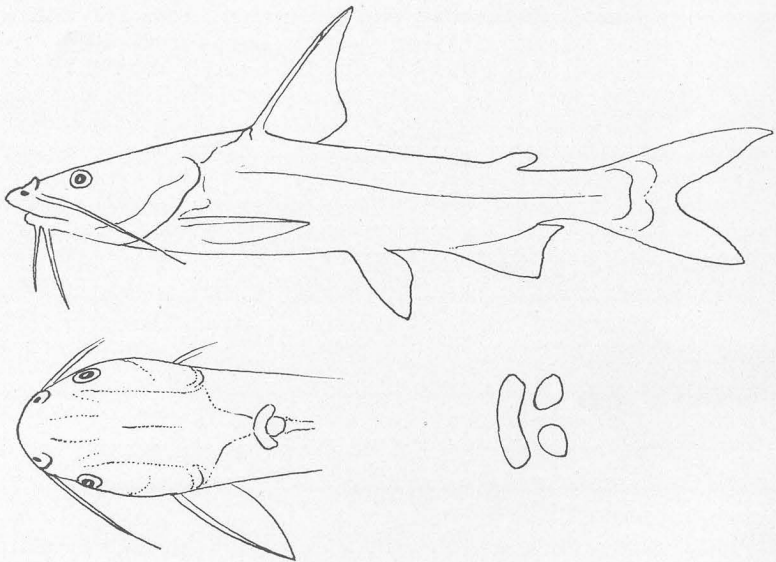


Fig. 157. *Tachysurus heudelotii*, from Boulenger.

Premaxillary band of teeth short, 4 times as long as broad; palate with 2 rather small, widely separated, oval or subtriangular groups of villiform teeth. Maxillary barbel little shorter or equals head; outer mandibular $\frac{1}{2}$ to $\frac{2}{3}$ length of head; inner mandibular $\frac{1}{4}$ to $\frac{2}{5}$. Occiput rough with pearl-like granules; occipital process tectiform, as long as broad at base, in contact with interneural shield, which is small, crescentic, and studded with granules as on skull. Gill rakers 8 or 9 on lower part of anterior arch, moderately long. Dorsal spine $\frac{2}{3}$ to $\frac{5}{6}$ length of head, with granular tubercles anteriorly and small serrae posteriorly. Adipose dorsal small, base $\frac{1}{2}$ to $\frac{2}{3}$ of rayed dorsal base, about twice as distant from latter as from caudal. Caudal deeply forked, with long, pointed lobes. Pectoral spine like dorsal spine. Ventral nearly or quite reaching anal origin. Brownish above, silvery on sides, white beneath. Outer half of paired fins and anal brown. Length 500 mm. (Boulenger.)

West African coast, from the Senegal to the Cameroons.

The imperfect account of *Arius granulatus* Peters seems to apply to this species. He gives the following:

Depth 6 in total; head $4\frac{1}{3}$. Maxillary barbels reach over pectoral base, other barbels reach to gill opening with the inner ones $\frac{1}{3}$ shorter than the outer ones. Palatine teeth conic, in 2 large oval, anteriorly converging oblique patches. Head strongly granular above. Dorsal spine a little shorter than pectoral, which equals body depth. Adipose fin over front $\frac{2}{3}$ of anal. Caudal forked, upper lobe longer. Pectoral reaches behind dorsal base. Ventral $\frac{1}{3}$ nearer anal than pectoral.

Near *Arius heudelotii* but differs in having a smaller head, longer fin spines, longer adipose fin, and larger patches of palatine teeth.

Tachysurus capellonis (Steindachner)

Arius capellonis STEINDACHNER, 1867, Sitzs. Akad. Wiss. Wien, LV (1), p. 525, Pl. II, figs. 1-2. Monrovia.—OSORIO, 1898, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 199 (Cape Verde, Anno Bom).

Head $3\frac{2}{3}$; depth $3\frac{4}{5}$; dorsal 1, 7; anal 18 (figure shows but 2 simple); pectoral 1, 13; ventral 1, 5; snout (in profile) $3\frac{3}{5}$ in head; eye $5\frac{1}{2}$; mouth width $2\frac{3}{4}$; interorbital 2.

Head width $1\frac{1}{5}$ its length. Snout broad, depressed, length $\frac{2}{3}$ its width. Eye with hind edge slightly before middle in head length; $3\frac{1}{4}$ in interorbital. Mouth broad, upper jaw protruded. Lips swollen. Teeth fine, closely crowded; palatine teeth in 2 rounded groups, separated by a wide interspace. Maxillary barbel reaches little beyond the middle of pectoral; outer mental barbel $1\frac{1}{2}$ in head, reaches pectoral origin; inner mental barbel $2\frac{2}{5}$ in head, reaches hind edge of branchiostegal membrane. Nostrils large, together, about first third in snout. Interorbital broadly convex. Occipital fontanel extends from opposite hind eye edge halfway to dorsal origin, narrow. Upper surface of head finely granular, smooth before interorbital. Occipital process is as long as wide, surface granular. Lateral line complete, parallel with dorsal profile, extends from shoulder to caudal base medianly on side. Above lateral line are 20 vertical rows of pores. Dorsal spine with a row of antrorse barbs on both front and hind edges, $1\frac{1}{3}$ in head. First dorsal ray equals head. Adipose fin large, $2\frac{2}{3}$ in head, above middle of anal. Anal with first branched ray $1\frac{2}{3}$ in head. Caudal deeply forked, equals head. Pectoral not reaching ventral, $1\frac{1}{8}$ in head; spine with a row of antrorse barbs on outer edge. Ventral inserted midway between front eye edge and caudal base.

Upper side of body blue-gray, with a brilliant steel-blue sheen, sprinkled with violet dots. Belly Isabella color. Lips rusty yellow. Fins grayish black, only base of anal and inner ventral and pectoral rays smutty reddish-yellow. Length 230 mm. (Steindachner.)

Coast of Liberia. One example known.

Tachysurus feliceps (Valenciennes)

Galeichthys feliceps VALENCIENNES, 1840, 'Hist. Nat. Poiss.,' XV, p. 22, Pl. CCCXXIV. Near Cape of Good Hope.—BOULENGER, 1911, 'Cat. Fresh-water Fishes Africa,' II, p. 381 (Damaraland).—LAMPE, 1914, 'Deutsche Südpolar Exped.,' XV, p. 217 (Ponta Delgada, Azores).

Head $3\frac{1}{2}$ to 4; depth 4 to $4\frac{2}{3}$; dorsal I, 7; anal vi, 11 to 13; eye $4\frac{1}{2}$ to 8 in head. Head as long as broad or a little longer than broad, moderately depressed. Snout broad, rounded, projects feebly beyond mouth. Eye lateral, oval, $1\frac{1}{2}$ (young) to $2\frac{1}{2}$ in snout, 2 to 4 in interocular width. Premaxillary band of teeth 4 to 5 times long as wide, broader than crescentic band on palate. Barbels rather flattened, maxillary $1\frac{1}{2}$ in head (equal head in young); outer mandibular $\frac{1}{2}$ to $\frac{2}{3}$ length of head; inner mandibular $\frac{1}{3}$ to $\frac{1}{2}$. Head smooth above or feebly striated on occiput and opercle; occipital process long, narrow, in contact with small inter-neural shield. Gill rakers 8 or 9 on lower part of first arch, rather short. Dorsal $1\frac{1}{2}$ to $1\frac{3}{4}$ times as distant from snout end as from caudal base; spine $1\frac{1}{2}$ to 2 in head. Adipose dorsal $1\frac{1}{4}$ to $1\frac{1}{2}$ times long as rayed dorsal, $1\frac{3}{4}$ to $2\frac{1}{2}$ times its distance from the latter. Caudal deeply forked, lobes pointed, upper lobe longer. Pectoral spine like dorsal spine, usually a little longer. Olive-brown above, yellowish on sides, pinkish white beneath. Fins grayish. Length 420 mm. (Boulenger.)

Azores to Damaraland and Natal. Included on Lampe's record for an example obtained at Ponta Delgada 335 mm. long. So far as his table of measurements and formulae show, it agrees with four other specimens he compares from Simonstown.

ORDER INIOMI

Lantern Fishes

Premaxillary well developed, excluding maxillary from edge of upper jaw. Opercular apparatus sometimes incomplete. Gill openings wide. Gills 4, a slit after the fourth. Pharyngeal bones unmodified. Air vessel small or absent, with duct when present. Ovaries with oviducts. Skeleton mostly weakly ossified. Front vertebrae simple, unmodified, without auditory ossicles; vertebral centra coössified with arches. Mesocoracoid arch usually absent or atrophied. Shoulder girdle with post-temporal not normally united with skull, though touches it at or near the nape. Scales mostly cycloid, often absent. Photophores usually present. Dorsal and anal fins without true spines. Ventrals, when present, are abdominal. Adipose fin variously present or absent.

Marine fishes, mostly bathypelagic. Though allied with the herring and sa mon-like groups, they differ in the absence of the mesocoracoid bone and the connection of the shoulder girdle with the skull imperfect.

KEY TO THE FAMILIES

a.—Eyes large, seldom small; teeth various, seldom or not at all coarsely granular; gill openings moderate or large.

b.—MYCTOPHOIDEA. Mouth not or but little protractile; inter-

opercle not reduced; clavicle attached to supraclavicle at lower end of latter.

c.—No photophores.

d.—Pectorals normal.

e.—Teeth in jaws in bands of several series.

f.—Dorsal postmedian; rays of some fins filamentous; maxillary well developed, dilated behind. AULOPIIDAE.

ff.—Dorsal premedian; rays of fins not filamentous.

g.—Maxillary very narrow, rudimentary or obsolete. SYNODONTIDAE.

gg.—Maxillary well developed, dilated behind. CHLOROPHTHALMIDAE.

ee.—Teeth uniserial in jaws; some of the lower and palatine teeth fanglike; maxillary long, slender, closely adherent to premaxillary.

h.—Body slender; head attenuated; teeth moderate; scales small, thin, deciduous. SUDIDAE.

hh.—Body oblong; head large; teeth large, some fanglike; no scales.

EVERMANNELLIDAE.

dd.—Pectorals not normal.

i.—Pectoral rays elongate, arranged in 2 groups.

BATHYPTEROIDAE.

ii.—Pectorals subhumeral.

BENTHOSAURIDAE.

cc.—Photophores present; ventral inserted usually close before or below dorsal, which is median or advanced; adipose fin usually present. MYCTOPHIDAE.

bb.—ALEPIDOSAUROIDEA. Mouth not protractile; dentition strong; interopercle reduced; clavicle attached to supraclavicle at or near upper end of latter, which extends downward and backward and has upper postclavicle attached to its terminal end.

j.—Dorsal moderate, postmedian; ventral opposite dorsal.

OMOSUDIDAE.

jj.—Dorsal very large, high, premedian; ventral nearer pectoral than anal.

ALEPISAUROIDAE.

aa.—CETUNCULI. Eyes small or minute; teeth granular; mouth very large, not protractile; gill openings enormous; dorsal and anal posterior, opposite; ventrals small or absent. . . CETOMIMIDAE.

Aulopidae

Mouth moderate, little compressed. Eyes lateral. Mouth terminal, slightly protractile, rather wide. Maxillary reaches eye or beyond, dilated posteriorly and bears 2 supplemental maxillaries. Teeth small, conic, in narrow bands in jaws and on palate. Branchiostegals, 10 to 16. No air vessel. Vertebrae 52. Scales moderate. Dorsal advanced until close behind head, rather elongate. Pectoral rather low down on side. Ventrals widely separated, rays 9, inserted below or a little behind pectoral.

Two genera.

AULOPUS Cuvier

Aulopus CUVIER, 1817, 'Règne Animal,' II, p. 170. Type: *Salmo filamentosus* Bloch. Monotypic.

Hime STARKS, 1924 (March 29), Copeia, No. 127, p. 30. Type: *Aulopus japonicus* Günther. Orthotypic.

Body rather elongate, slightly compressed. Eye moderate. Mouth cleft wide. Teeth in jaws, on vomer, palatines, pterygoids, and tongue. Gill opening very wide. Pseudobranchiae well developed. Pyloric caeca 5 or 6. Orbitosphenoid well developed, or no ossification in front interorbital region (*Hime*). Adipose fin small. Anal moderate. Caudal forked.

Species few.

Aulopus filamentosus (Bloch)

Lagarto, Lagarto do mar (Madeira)

Lagarto, Carajo real, Lagarto real (Canaries)

Figure 158

Salmo filamentosus BLOCH, 1791, Schrift. Gesell. Naturforsch. Freunde Berlin, X, p. 424, Pl. IX, fig. 2. Livorno, Italy.

Aulopus filamentosus VALENCIENNES, 1849, 'Hist. Nat. Poiss.,' XXII, p. 381 (Canaries).—GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 402 (Madeira).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 329 (Grand Canary).—FOWLER, 1923, Proc. Acad. Nat. Sci. Philadelphia, p. 33 (Praia Formosa, Madeira).

Autopus filamentosus STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1), p. 730 (Teneriffe).

Aulopus filifer VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II, part 2, p. 73, Pl. xv, fig. 2. Canary Islands.—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 403 (Santa Cruz, Teneriffe).

Aulopus maculatus VALENCIENNES, *op. cit.*, p. 74, Pl. xv, fig. 3. Canary Islands.—STEINDACHNER, *loc. cit.* (Santa Cruz de Teneriffe).

Saurus lacerta LOWE, 1837 (1841), Trans. Zool. Soc. London, II, p. 188 (Madeira); 1843, Proc. Zool. Soc. London, XI, p. 88 (Madeira).

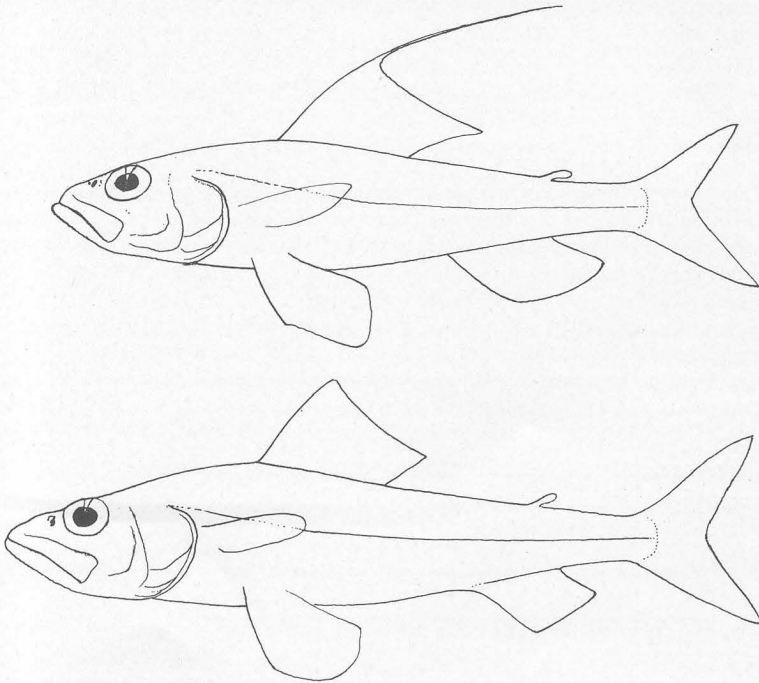


Fig. 158. *Aulopus filamentosus*.

Head 3 to 3 1/2; depth 5 to 7 4/5; dorsal II, 13, 1, varies II, 12, 1 to II, 14, 1; anal II, 9, 1; scales 48 to 53 in lateral line to caudal base and 3 or 4 more on latter; 5 scales above lateral line, 4 or 5 below; 13 to 18 predorsal scales; snout 3 1/3 to 3 2/3 in head measured from upper jaw tip; eye 3 7/8 to 4 2/5; maxillary 1 7/8 to 2; interorbital 4 2/3 to 6.

Body slender, slightly compressed, deepest about dorsal origin, and tapering backward. Caudal peduncle compressed, least depth 2 1/5 to 3 in its length or 5 to 5 1/5 in total head length. Head rather deep and robust, width 1 9/10 to 2 1/4 in its length. Snout convex, length 5/6 to 1 in its width. Eye slightly impinging on upper profile, about first 2/5 in head. Mouth moderately inclined, lower jaw slightly longer. Premaxillary extends back not quite opposite hind eye edge, expansion 1 3/5

to 2 in eye. Teeth in jaws conic, numerous, slightly curved inward, triserial; outer series smallest and firmly erect; innermost series longest and depressible; outer series of both jaws often largely irregular or double. Palatine teeth biserial, slope inward, depressible, moderate. Transverse row of similar teeth across vomer in front. Tongue with a small median patch of minute asperities. Nostrils together, posterior larger and anterior ends in long cutaneous flap behind. Interorbital slightly concave. Preorbital little longer than eye.

Gill rakers iv or v, 2 or 3 + 10 or 11, iii, firm, rather slender, $1/3$ longer than gill filaments or $2\ 2/3$ in eye. Scales with 93 to 117 basal circuli; 39 to 51 apical denticles; no basal striae. Cheek with 3 rows of scales. Small scales on caudal base. Lateral line little high, median along side of caudal peduncle; tubes simple, large. Dorsal origin a little nearer mandible tip than origin of adipose fin, second simple ray $1\ 2/5$ to $1\ 4/5$ in total head length; second simple anal ray $3\ 1/5$ to $3\ 1/4$; caudal forked, $1\ 1/3$ to $1\ 1/2$; pectoral $1\ 7/8$ to 2; third branched ventral ray $1\ 1/2$; vent close behind depressed ventral tip.

Dull brownish generally, with 5 slightly darker saddle-like bands transversely and down on sides until level with lower basal pectoral edge. Scattered and irregular blotches of more or less similar color in intermediate areas on side. Dark transverse bands with each scale above lateral line more or less dusky to dusky black, as if emphasized, and whole pattern of back with more or less longitudinal dark streaks. Dorsal and caudal nearly pinkish buff, with obscure dull dusky transverse streaks or bands on dorsal, the summit of which is black; caudal with about 6 dark transverse bands. Pectoral and anal uniform pale brownish. Ventral with pale edges, median rays with about 5 transverse dusky bands. Lower surface of head and body pale to whitish. Iris pale slaty. Length 203 to 435 mm.

Eastern Atlantic and Mediterranean. Described above from a series of examples from Madeira and the Mediterranean.

Synodontidae

Lizard Fishes

Body oblong or elongate, little compressed. Mouth very wide, entire upper jaw with the edge formed by long slender premaxillaries; with slender, mostly rudimentary or obsolete maxillaries closely adherent and never expanded terminally. Teeth usually cardiform in both jaws, on tongue and palatines. Canines rarely present and large teeth usually depressible. No barbels. Opercles complete, usually thin. Gill membranes separate, free from isthmus. Gill rakers tubercular or obsolete. Pseudobranchiae present. Branchiostegals usually numerous. Skeleton rather well ossified. Air vessel small or absent. Intestinal canal short. Eggs enclosed in sacs of ovary and extruded through an oviduct. Body covered with cycloid scales, rarely naked. Lateral line present. Sides sometimes with phosphorescent spots or photophores. Dorsal fin short, of soft rays only. Adipose fin present, rarely obsolete. Anal moderate or long. Caudal forked. Pectorals and ventrals present.

Mostly shore fishes, some living in great depths. Not used as food and their habits little known.

KEY TO THE GENERA

- a.*—SYNODONTINÆ. Eyes normal, though sometimes small; dentition developed.
b.—Premaxillary teeth simple, compressed, not barbed, in 1 or 2 rows; broad band of similar teeth on palate.
c.—Head short, blunt, compressed; vent slightly nearer caudal base than pectoral axil. TRACHINOCEPHALUS.
cc.—Head depressed, with flat triangular snout; vent much nearer caudal base than ventral base. SYNODUS.
bb.—Premaxillary teeth in very broad band, curved, unequal, barbed at ends; similar bands on palatines. BATHYSAURUS.
aa.—BATHYMICROPSINÆ. Eyes vestigial, whole upper surface of head covered by scales; dentition feeble. BATHYMICROPS.

TRACHINOCEPHALUS Gill

Trachinocephalus GILL, 1861, Proc. Acad. Nat. Sci. Philadelphia ('Cat. Fish. East Coast'), p. 53. Type: *Salmo myops* Schneider. Monotypic.

Goodella OGILBY, 1897, Proc. Linn. Soc. New South Wales, XXII, p. 249. Type: *Goodella hypozona* Ogilby. Monotypic.

Body compressed, elongate, robust. Head deep, laterally compressed, large. Snout very blunt, shorter than eye. Teeth simple, slender, small, close set; palatines with single band of teeth on each side. Lower jaw protrudes. Anal longer than dorsal. Vent well advanced, under tip of last dorsal ray.

One species.

Trachinocephalus myops (Schneider)

Ground Sparring (St. Helena)

Figure 159

Salmo myops SCHNEIDER, 1801, 'Syst. Ichth. Bloch.,' p. 421. St. Helena. (On Forster).—LICHTENSTEIN, 1844, 'Descript. Animal. Forster,' p. 412 (St. Helena).

Saurus myops CUVIER, 1829, 'Règne Animal,' II, 2d Ed., p. 268 (on Schneider).—VALENCIENNES, 1849, 'Hist. Nat. Poiss.,' XXII, p. 360 (St. Helena).—BLEEKER, 1863, 'Nat. Verh. Holl. Maatsch. Wetensch., Haarlem,' XVIII, No. 2, p. 127 (Apomeiti, Ashantee).—GÜNTHER, 1869, Proc. Zool. Soc. London, p. 239 (St. Helena).—MELLISS, 1875, 'St. Helena,' p. 110, Pl. XXI, fig. 5.—OSORIO, 1898, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 199 (St. Thomé).—CUNNINGHAM, 1910, Proc. Zool. Soc. London, p. 95 (St. Helena).

Trachinocephalus myops CLARK, 1913, Proc. Roy. Phys. Soc. Edinburgh, XIX, p. 304 (Ascension Island).

Head $3\frac{3}{4}$; depth $5\frac{1}{2}$; dorsal II, 11, 1; anal 15, 1; scales 54 in lateral line to caudal base and 5 more on latter; 3 scales above lateral line, 6 below; 16 predorsal scales; snout $6\frac{3}{4}$ in head; eye $6\frac{1}{4}$; premaxillary $1\frac{7}{8}$; interorbital $6\frac{1}{2}$.

Body slender, well compressed, deepest opposite pectoral origin, then tapering backward. Caudal peduncle well compressed, least depth $1\frac{4}{5}$ in its length or $3\frac{4}{5}$ in head. Head width 2 in its length. Snout short, obtuse, surface unevenly convex,

length $\frac{3}{5}$ its width. Eye high, close to upper profile, a trifle before first fifth in head. Mouth large, slightly inclined, jaws firm and subequal. Premaxillary expanded until as wide as pupil, reaches beyond eye for a space equal to combined eye and snout. Upper teeth extend over greater part of premaxillary, conic, slender, firmly erect, rather unequal, mostly so short as to appear hidden in lip; an inner series of similar enlarged depressible teeth show tips below lip. Very small, short teeth in front of upper jaw. Mandible with more irregular and broader bands of conic teeth than upper ones, all more or less exposed, irregularly graduated from much shorter outer to larger inner and mostly with a triserial aspect; inner mandibular teeth all depressible. Palatine teeth much smaller than in jaws, similar, somewhat depressible, mostly biserial. Strong, conic, recurved teeth triserial on tongue and each pharyngeal with large patch of small conic teeth. Nostrils are simple pores, close together before eye, anterior with cutaneous flap ending above in slight fringe. Interorbital well concave, and like rest of unscaled surface of head posteriorly, rugose. Front supraorbital ridge with edge slightly serrated, extended down quite conspicuously behind the eye.

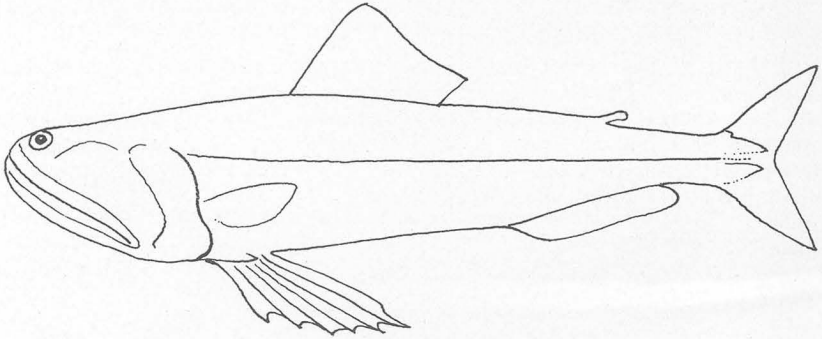


Fig. 159. *Trachinocephalus myops*.

Gill rakers are asperous clusters of small sharp denticles, all much less than gill filaments, which $1\frac{3}{4}$ in eye. Scales with 3 basal radiating striae. Cheek with 5 rows of scales; preopercle flange behind ridge with row of moderate scales, also some large ones on opercle. Ventral axillary scale $3\frac{1}{2}$ in fin. Caudal base scaly. Scales in lateral line with exposed edges concave; tubes indicated usually by a basal adherent crimped accessory scale. First branched dorsal ray $1\frac{2}{5}$ in head; last anal ray $3\frac{1}{5}$; caudal forked, $1\frac{2}{5}$; first branched pectoral ray $2\frac{1}{6}$; sixth ventral ray $1\frac{1}{10}$. Vent close before anal.

Largely pale brownish, paler to whitish below. Back and side of body with slightly wavy to irregular longitudinal deep brown lines, usually following courses of scales and enclosing a gray band about equal in width to interspace between each succeeding band. Scapular region deep brownish. Nape and top of head irregularly mottled with deep brown lines, streaks, and blotches. Iris pale brown. Fins very pale brownish. Length 213 mm.

Circumtropical. Though I have examined many Pacific examples, the only one at hand is from Japan, and that is described above.

SYNODUS Gronow

Lizard Fishes

Synodus GRONOW, 1763, 'Zoophylac.,' II, p. 112. Type: *Esox synodus* Linné. Tautotypic.

Soarus LINCK, 1790, Mag. Neuste Phys. Naturges., Gotha, VI (3), p. 37. Atypic. Type: *Salmo saurus* Linné. Tautotypic. (*Soarus* Linck evident slip for *Saurus*.)

Saurus CUVIER, 1817, 'Règne Animal,' II, p. 169. Type: *Salmo saurus* Linné. Tautotypic.

Tirus RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 56. Type: *Tirus marmoratus* Rafinesque. Monotypic.

Alipismaris RISSO, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 458. Type: *Stolephorus risso* Risso. (Designated by Jordan and Evermann, 1917, Stanford Publications 'Genera of Fishes,' part 1, p. 120.)

Laurida SWAINSON, 1838, 'Nat. Hist. Animals,' I, pp. (43) 242, 246. Type: *Laurida mediterranea* Swainson. Monotypic.

Body elongate, partly terete. Head pointed, depressed. Snout triangular, rather pointed. Eye large, advanced. Mouth very wide. Premaxillaries not protractile, very long, strong, more than half length of head. Maxillaries closely connected with premaxillaries, very small or obsolete. Premaxillaries with 1 or 2 series of large compressed knifelike teeth, the inner and larger ones depressible. Palatine teeth similar, smaller, in a single broad band. Lower jaw nearly equal with upper, with a band of rather large teeth, the inner and larger ones depressible. A patch of strong depressible teeth on tongue in front, and a long row along hyoid bone. Supraorbital forms projection over eye. Interorbital transversely concave. Gill membranes slightly connected. Gill rakers very small and spinelike. Pseudobranchiae well developed. Branchiostegals 12 to 16. Skeleton rather firm. Stomach with a long blind sac and many pyloric caeca. Vent posterior, much nearer anal than ventrals. Top of head naked, cheeks and opercles scaled like body. Body covered with small adherent cycloid scales. No photophores. Dorsal fin short, rather advanced. Anal short. Caudal narrow and forked. Pectorals moderate, inserted high. Ventrals advanced, not far behind pectorals, large, inner rays longer than outer.

Fishes of small or moderate size, very voracious and numerous on the sandy bottoms of shallow seas.

Twenty or more species.

KEY TO THE SPECIES

- a.—Scales 48 to 53 in median lateral series; anal rays 11. *intermedius*.
 aa.—Scales 60 to 71 in median lateral series.
 b.—Anal rays 10 to 12. *saurus*.
 bb.—Anal rays 9 or 10. *synodus*.

Synodus intermedius (Agassiz)

Saurus intermedius (Spix) AGASSIZ, 1829, 'Pisc. Brasil. Spix,' p. 81, Pl. XLIV.

Atlantic Ocean, Brazil.—OSORIO, 1894 (February), *Jorn. Sci. Math. Phys. Nat.*, Acad. Lisboa, (2) III, p. 179 (St. Thomas) Island; 1898, *op. cit.*, (2) V, p. 199 (St. Thomas).

Head $3\frac{3}{4}$; depth about $6\frac{1}{5}$; dorsal $\text{II}, 10, 1$; anal $\text{II}, 9, 1$; scales 49 in lateral line to caudal base and 4 more on latter; 4 scales above lateral line, 7 below; 18 predorsal scales; snout 4 in head measured from upper jaw tip; eye $6\frac{4}{5}$; premaxillary $1\frac{2}{3}$; interorbital $4\frac{3}{4}$.

Body depressed, cylindrical, deepest about opposite the middle of the pectoral, trunk tapering back. Caudal peduncle cylindrical, its least depth 2 in its length or $4\frac{1}{5}$ in total head length. Head well depressed, width $2\frac{1}{4}$ in its length. Snout broadly depressed, length $\frac{3}{4}$ its basal width. Eye impinging on upper profile, near first third in head. Mouth large, with strong jaws, lower jaw slightly protruding. Premaxillary extends beyond eye $\frac{7}{8}$ an eye diameter, greatest median expansion $2\frac{1}{8}$ in eye. Premaxillary with outer row of firm, compressed, sharp-pointed teeth, all but their tips concealed by a broad thin lip; inside there is another similar series of longer teeth, evidently depressible; mandible with outer series of erect teeth like premaxillary and mostly concealed by the wide lip; inside mandible with 2 series of longer and evidently depressible teeth, inner row larger; palatine teeth quadriserial, inner evidently largest and depressible; tongue with 5 or 6 series of conic teeth. Nostrils together, at about the last third in snout. Interorbital rather evenly concave. Postorbital width narrow, roughened and few rather low ridges and rugosities on upper surface of head. Upper suprascapular edge finely serrate.

Scales large, cycloid, mostly uniform, except the smaller ones on breast and caudal base; cheek with 7 rows of scales; large scales on opercle, subopercle and interopercle; free axillary ventral scaly flap $\frac{1}{3}$ of fin. Lateral line slopes gently from shoulder to median caudal base; tubes as small, crimped accessory scale basally. Along most courses of scales an obsolete longitudinal keel. First branched dorsal ray $1\frac{4}{5}$ in total head length; first branched anal ray 3; caudal deeply forked, $1\frac{2}{5}$; pectoral $2\frac{1}{3}$, extends a little beyond ventral origin though not quite to dorsal; ventral $1\frac{1}{3}$.

Pale brown generally, paler below. Back mottled with darker, formed by a deep brown blotch at the base of each scale. About 10 obscure brownish blotches along side. Scapular arch above with a large dusky blotch. Fins all pale brown, each dorsal ray with about 5 deeper brownish diffuse blotches and each caudal lobe with about 6 transverse bars of same shade, these are narrow on upper and lower edges of fin and broadly expanding toward the inner edges of lobes. Other fins unicolor. Iris brownish. Length 350 mm.

Tropical Atlantic. Described above from a West Indian (Santa Cruz) example.

Synodus saurus (Linné)

Lagarto de rolo, Lagarto da costa (Madeira), Lagarto (Canaries)

Figure 160

Salmo saurus Linné, 1758, 'Syst. Nat.,' 10th Ed., p. 310. Europe.

Synodus saurus JORDAN AND GUNN, 1898, *Proc. Acad. Nat. Sci. Philadelphia*, p. 340 (Canary Islands).

Saurus saurus ROULE, 1919, *Rés. Camp. Sci. Monaco*, LII, p. 33 (Villafranca,

Azores, in 20 m.).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (Povocão, Azores, 10 m.).

Saurus griseus LOWE, 1837 (1849), Trans. Zool. Soc. London, II, part 3, p. 188. Madeira.—GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 394 (Madeira, St. Vincent).—STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1), p. 728, Pl. vi, fig. 2 (Teneriffe).—VINCIGUERRA, 1882 (1883), Ann. Mus. Civ. Storia Nat. Genova, XVIII, p. 619 (Santa Cruz di Teneriffa, Madeira); 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 329 (Grand Canary).

Saurus trivirgatus VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II, part 2, p. 72, Pl. xv, fig. 1. Canary Islands.—STEINDACHNER, 1865, *op. cit.*, LI (1), p. 403 (Santa Cruz, Teneriffe).

Saurus lacerta (not Risso) VALENCIENNES, 1849, 'Hist. Nat. Poiss.,' XXII, p. 344 (Canaries).

?*Laurus viridis* POGGI, 1881, (article in 'Guidebook of Canary Isls.'). 'Guia de Santa Cruz de Teneriffe,' [p. d. 35].

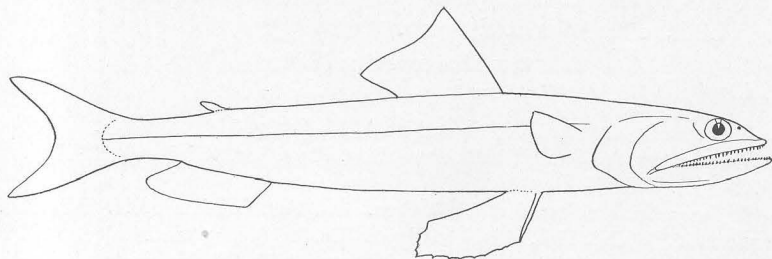


Fig. 160. *Synodus saurus*, from Steindachner.

Head 4 to 4 1/4; depth 6 2/3 to 8 1/8; dorsal 11, 10, 1; anal 10, 1 to 12, 1; scales 57 to 66 in lateral line to caudal base and 3 to 5 more on latter; 3 or 4 scales above lateral line, 5 or 6 below; 19 to 21 predorsal scales; snout 4 to 5 in head; eye 5 3/4 to 6 1/2; premaxillary 1 2/5 to 1 3/4; interorbital 4 1/2 to 5.

Body elongated, nearly cylindrical, deepest at dorsal origin. Caudal peduncle cylindrical, least depth 2 in its length, which is 4 1/5 to 4 2/5 in head. Head depressed above, width 1 4/5 to 2 1/10 in its length. Snout depressed, sharply pointed, length 2/3 to 3/4 its basal width. Eye well elevated, close to upper profile, advanced. Mouth cleft nearly straight, slightly inclined, jaws subequal. Premaxillary expanded medianly 2/5 of eye diameter, reaches beyond the eye about the length of snout. Upper teeth irregularly biserial, in premaxillary shorter than inner series and largely concealed by lip; inner series similar, rather slender, larger ones depressible; mandibular teeth triserial, outer smallest, firmly erect; palatine with 3 or 4 irregular series of conic, sharp-pointed, slender, depressible teeth, innermost series much largest; tongue has a patch of fine teeth. Nostrils together, at about the last third in snout, upper nostrils with cutaneous edge ending in several short filaments above. Interorbital concave, like rest of unscaled surface posteriorly, and infraorbital ridge is rugose.

Gill rakers small spinescent clusters, all much shorter than gill filaments, latter $1\frac{1}{3}$ in eye. Scales with 3 basal radiating striae, edge scalloped. Cheek with 4 rows of scales; preopercle flange behind ridge with row of scales and rest of opercular region mostly scaly. Ventral axillary scale 3 in fin and caudal base scaly. Lateral line median; tubes indicated by crimped basal scale and show through scale behind latter. First branched dorsal ray $1\frac{3}{5}$ to $1\frac{2}{3}$ in head; last anal ray $3\frac{1}{2}$ to $3\frac{3}{5}$; caudal well-forked, $1\frac{2}{5}$ to $1\frac{1}{2}$; pectoral $2\frac{1}{8}$ to $2\frac{1}{5}$; ventral $1\frac{1}{10}$ to $1\frac{1}{6}$.

Pale brown, paler or whitish below. Back, down over sides to lateral line is mottled finely with deeper brown reticulations and wavy lines formed around or over inconspicuous narrow pale longitudinal bands, mostly broken and ill defined, though the one above the lateral line is most distinct. Head above is all mottled with deep brownish lines. Fins are plain pale brownish-white. Iris is silvered. Length 188 to 264 mm.

Tropical Atlantic and Mediterranean. Described above from a series of Italian examples.

One specimen in the Agassiz Museum from Fayal, Azores, 210 mm. long, obtained by Miss O. Dabney.

Synodus synodus (Linné)

Lagarto (Canaries)

Esox synodus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 313. America.

Synodus synodus CLARK, 1913, Proc. Roy. Phys. Soc. Edinburgh, XIX, p. 389, Figs. 2-4 (St. Helena).

Saurus atlanticus JOHNSON, 1863, Proc. Zool. Soc. London, p. 41. Madeira.—GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' part 5, p. 395 (type; Madeira); 1869, Proc. Zool. Soc. London, p. 238 (St. Helena).—MELLISS, 1875, 'St. Helena,' p. 110.—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 329 (Grand Canary).

Head $3\frac{1}{2}$ to $3\frac{4}{5}$; depth $4\frac{2}{5}$ to $5\frac{3}{5}$; dorsal 14 or 15; anal 9 or 10; scales 60 to 62 in lateral line, 5 above; snout $1\frac{1}{2}$ to $1\frac{3}{4}$ long as eye diameter, which $5\frac{4}{5}$ to $6\frac{3}{5}$ in head; premaxillary $1\frac{2}{5}$ to $1\frac{1}{2}$; interorbital $7\frac{1}{2}$ to $8\frac{1}{2}$. Upper jaw projects slightly. Teeth in both jaws biserial, lanceolate, with tendency to arrow shape; alternately long and short, especially above; palatine teeth much more slender, in several rows with inner rows longer, anterior teeth largest; tongue covered with retrorse teeth. Top of head striated; striations few and very pronounced. Supra-orbital bones prominent, slightly striated. Gill rakers reduced to rows of minute, teeth. Dorsal equidistant from snout tip and caudal base, fourth ray $2\frac{1}{5}$ in head; first ray $\frac{2}{3}$ length of fourth; subsequent rays diminish in length; fin origin just behind ventral base. Adipose fin very small. Length of anal base half of dorsal. Caudal forked. Pectorals $2\frac{4}{5}$ in head. Ventrals with 8 rays, sixth longest, or $\frac{7}{8}$ of head. Body and fins speckled dark gray on silvery background. Black spot on shoulder and on tip of snout. Several indistinct and irregular crossbars on body. Length 244 to 274 mm. (Clark.)

Tropical Atlantic.

Saurus atlanticus Johnson, as described from the type by Günther, differs only in minor details. He says, however, of the body, "its greatest depth equals its width, and is one-half of the length of the head,

which is one-fourth of the total (without caudal).” The type, according to Johnson, is 280 mm. long, and its depth is given as 7 times in its length. The lowest of Clark’s 3 figures shows the body depth about $6\frac{1}{8}$.

BATHYSAURUS Günther

Bathysaurus GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 182.
Type: *Bathysaurus ferox* Günther. (Designated by Jordan, 1919, Stanford Publications, ‘Genera of Fishes,’ part 3, p. 395.)

Body subcylindrical, elongate. Head depressed. Snout produced, flat above. Eyes moderate, lateral. Mouth cleft very wide, lower jaw projecting. Premaxillary very long, styliform, tapering, not movable. Teeth in jaws in broad bands, not covered by lips, curved, unequal in size, and barbed at the end; there is a series of similar teeth along whole length of each side of palate; a few teeth on tongue and groups of small ones on hyoid. Gill openings very wide, gill membranes separate from one another and from isthmus. Gill rakers tubercular. Gill filaments well developed, also pseudobranchiae. Branchiostegals 11 or 12. No air vessel. Scales small. Dorsal in middle of body length, rays 18. Adipose fin present or absent. Anal moderate. Caudal emarginate. Pectoral moderately long. Ventral rays 8, inserted behind pectoral.

KEY TO THE SPECIES

- a.*—Body very slender; snout width at front of eyes equals its length; branched dorsal rays 16.....*ferox*.
aa.—Body less slender; snout width at front of eyes greater than its length; branched dorsal rays 13.....*mollis*.

Bathysaurus ferox Günther

Figure 161

Bathysaurus ferox GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 182. East coast of New Zealand, in 1100 fathoms.—MURRAY AND HJORT, 1912, ‘The Depths of the Ocean,’ p. 396 (N. lat. $35^{\circ} 46'$, W. long. $8^{\circ} 16'$, 2055 m.; N. lat. $27^{\circ} 27'$, W. long. $14^{\circ} 52'$, 2603 m.; N. lat. $34^{\circ} 59'$, W. long. $33^{\circ} 1'$, 2615 to 2865 m.).

Bathysaurus agassizii VAILLANT, 1888, ‘Expéd. Sci. “Travailleur” et du “Talisman,”’ Poiss., p. 139, Pl. x, fig. 1, *a-b* (Morocco coast, 2200 m.).

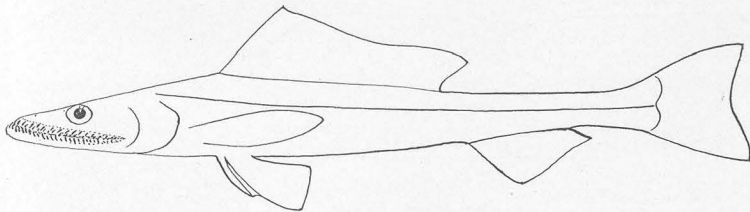


Fig. 161. *Bathysaurus ferox*, from Günther.

Head $3\frac{1}{2}$; depth $9\frac{1}{4}$; dorsal II, 16, I; anal III, 10; scales 70 in lateral line, of which about 5 on caudal base; snout 3 in head measured from upper jaw tip; eye 10; premaxillary $1\frac{2}{3}$; interorbital $5\frac{1}{2}$.

Body slender, deepest at dorsal origin, tapering slightly posteriorly. Least depth of caudal peduncle $1\frac{2}{3}$ in its length or $5\frac{1}{5}$ in total head length. Head conic, width $2\frac{1}{2}$ in its length. Eye with front edge at first third in head measured from snout tip; diameter about 3 in snout, $1\frac{2}{5}$ in interorbital. Mouth large, mandible well protruded. Premaxillary extends nearly 2 eye diameters beyond the hind edge of eye. Nostrils together, near last $\frac{2}{5}$ in snout. Interorbital level. Scales of lateral line enlarged. Dorsal origin slightly before first third in total length; second simple ray $1\frac{7}{8}$ in total head length; base of dorsal 3 in combined head and trunk. No adipose dorsal. Anal begins well behind dorsal, at last third of trunk, excluding head; second branched ray $2\frac{2}{3}$ in head. Caudal $1\frac{1}{2}$; pectoral with fifth and seventh rays ending in filaments, latter extending nearly to base at last dorsal ray. Ventral inserted close behind dorsal origin, fin $2\frac{3}{4}$ to anal or $2\frac{1}{10}$ in head. Length 520 to 530 mm. (Vaillant.)

Off New Zealand and warmer Atlantic. Barnard reports it off Cape Point and Table Bay, South Africa, in 600 to 1400 fathoms (1925, Ann. South African Mus., XXI part 1, p. 229).

Bathysaurus mollis Günther

Figure 162

Bathysaurus mollis GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 182. Middle of South Pacific in 2385 fathoms; off Yeddo in 1873 fathoms.—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (N. lat. $39^{\circ} 50'$, W. long. $17^{\circ} 58'$, in 4360 m., east of Azores).

Bathysaurus obtusirostris VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 136, Pl. x, fig. 2, a-g; Pl. xvi, fig. 3. Off Cape Verde in 3655 m.

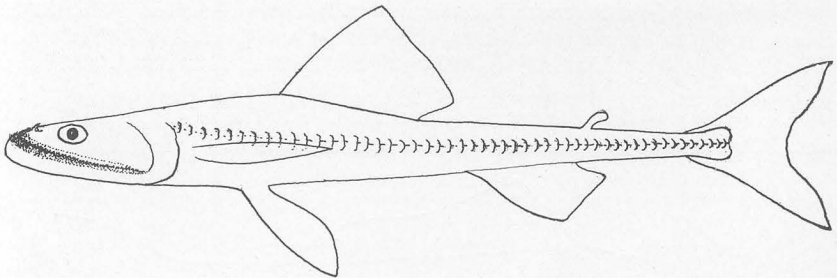


Fig. 162. *Bathysaurus mollis*, from Günther.

Head $3\frac{7}{8}$; depth $7\frac{1}{2}$; dorsal II, 13; anal, III, 9; scales 61 in lateral line, of which last 2 on caudal base; snout $4\frac{1}{2}$ in head measured from upper jaw tip; eye $8\frac{3}{4}$; premaxillary $1\frac{3}{5}$; interorbital $4\frac{1}{6}$.

Body slender, deepest at dorsal origin, tapering slightly posteriorly. Least depth of caudal peduncle 2 in its length or $3\frac{4}{5}$ in total head length. Head rather robust, width $2\frac{1}{4}$ in its length. Eye with front edge at first fifth in head length measured

from snout tip; diameter 2 in snout, 2 in interorbital. Mouth moderately large, mandible protruded. Premaxillary extends nearly 2 eye diameters beyond hind eye edge. Nostrils together, front one midway in snout length, intermediate filament a little longer than eye. Interorbital level or very slightly convex. Scales of lateral line enlarged. Dorsal origin at first third in total length; third branched ray $1\frac{7}{8}$ in total head length; base of dorsal $5\frac{1}{6}$ in combined head and trunk. Adipose dorsal $\frac{5}{6}$ of eye. Anal begins far behind dorsal, at last $\frac{2}{7}$ of combined head and trunk; first branched ray $2\frac{4}{5}$ in head. Caudal $1\frac{2}{5}$; pectoral $1\frac{3}{4}$; ventral inserted slightly before dorsal, $1\frac{2}{5}$ in head, or reaching halfway to anal. Length 600 mm. (Vaillant.)

Off Cape Verde Islands and Azores, Japan and South Pacific Ocean.

BATHYMICROPS Murray and Hjort

Bathymicrops MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' pp. 416, 686. Type: *Bathymicrops regis* Hjort. Monotypic.

Whole head covered with scales, including the eyes, which are only faintly visible through the covering as minute black dots.

One genus.

Bathymicrops regis Murray and Hjort

Figure 163

Bathymicrops regis MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' pp. 396, 416, Fig. 305. N. lat. $28^{\circ} 54'$, W. long. $24^{\circ} 14'$, west of the Canaries.

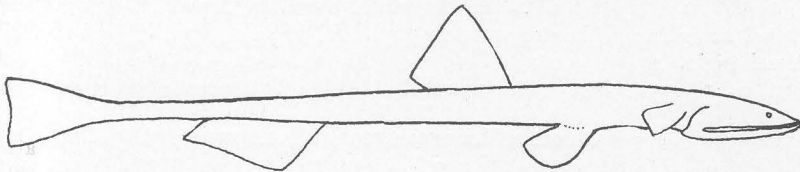


Fig. 163. *Bathymicrops regis*, from Murray and Hjort.

Head $5\frac{1}{2}$; depth $13\frac{1}{2}$; dorsal 1, 9; anal 14; pectoral 8; ventral 1, 8; scales about 75 (?) in median lateral series as counted from above gill opening; transversely about 7 scales at dorsal origin; maxillary $1\frac{1}{5}$ in head.

Body very elongate, slender, tapering slenderly behind. Head small, attenuated. Caudal peduncle slender, as long as head, and its least depth is about 6 in its length. Mouth very large, lower jaw projecting. Maxillary long, slender, not much dilated posteriorly. Scales small, well exposed. Dorsal origin about midway between snout tip and base of last anal ray, first ray $1\frac{1}{3}$ in head. Anal inserted well behind dorsal or midway between ventral and caudal bases, first ray $1\frac{7}{8}$ in head and fin base about as long as head. Caudal $1\frac{1}{2}$ in head, hind edge slightly concave. Pectoral inserted high, close behind gill opening, $2\frac{2}{3}$ in head, reaches about halfway to ventral. Ventral origin about midway between that of pectoral and dorsal, fin not quite reaching dorsal, $1\frac{7}{8}$ in head.

About 7 slightly darker transverse obscure narrow bars or blotches. Fins all apparently paler than body. Length 111 mm. (From Hjort's figures.)

West of the Canaries.

Chlorophthalmidae

Body elongate, subcylindrical or compressed. Head depressed or as wide as deep. Snout spatulate or obtusely rounded when viewed from above. Eye large. Mouth terminal. Maxillary reaches to or beyond eye. Teeth fine, in narrow bands in jaws and on palate and tongue. Gill opening wide. Skeleton weakly ossified. Dorsal short, rays 9 to 12. Ventrals below or before dorsal.

Two genera.

CHLOROPHTHALMUS Bonaparte

Chlorophthalmus BONAPARTE, 1840, 'Fauna Ital.,' Pesci, I, fasc. xxvii. Type: *Chlorophthalmus agassizi* Bonaparte. Monotypic.

Hyphalonedrus GOODE, 1881, Proc. U. S. Nat. Mus., III, p. 483. Type: *Hyphalonedrus chalybeius* Goode. Monotypic.

Parasudis REGAN, 1911, Ann. Mag. Nat. Hist., London, (8) VII, pp. 127-128. Type: *Chlorophthalmus truculentus* Goode and Bean. Monotypic.

Body rounded, terete. Snout conic, rather short. Mouth wide. Maxillary long, dilated posteriorly, reaches below front or middle part of eye; supplemental maxillary single. Vomerine teeth minute, form 2 separate patches; palatines and tongue toothed. Branchiostegals 10. Pseudobranchiae well developed. Scales pectinate. Dorsal premedian, without filamentous rays. Adipose fin present. Ventral behind dorsal origin.

Bathypelagic.

Chlorophthalmus agassizi Bonaparte

Figure 164

Chlorophthalmus agassizi BONAPARTE, 1840, 'Fauna Ital.,' Pesci, I, fasc. xxviii; 1839, Pl., fig. 2. Italy.

Aulopus agassizi VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 121, Pl. XII, fig. 3 a-c (Cape Verde Islands, Sargasso Sea, Azores, 405 to 1440 m.).

Head $2\frac{4}{5}$ to $3\frac{1}{3}$; depth $5\frac{3}{4}$ to $6\frac{3}{4}$; dorsal II, 9, I, varies II, 8, I; anal II, 6, I, varies II, 5, I; scales 42 to 49 in lateral line to caudal base and 3 or 4 more on latter; 4 to 6 scales above lateral line, 5 below; 11 to 14 predorsal scales; snout $3\frac{1}{8}$ to $3\frac{7}{8}$ in head measured from upper jaw tip; eye 2 to $2\frac{4}{5}$; maxillary 2 to $2\frac{3}{5}$; interorbital 8 to 11.

Body elongate, nearly cylindrical anteriorly, becoming compressed behind or along side of caudal peduncle, greatest depth about pectoral origin. Caudal peduncle well compressed, least depth 2 to $2\frac{1}{4}$ in its length or $4\frac{1}{2}$ to $4\frac{4}{5}$ in total head length.

Head well depressed, width $1\frac{9}{10}$ to 2 in its length. Snout broadly depressed, rather obtuse in front as seen from above, length $\frac{3}{5}$ to $\frac{2}{3}$ its basal width. Eye

large, impinging on upper profile, about midway in head. Mouth rather large, well inclined, wide, mandible well protruded. Maxillary reaches opposite first $2/5$ in eye, expansion $2\ 7/8$ to 3 in eye. Teeth minute, in narrow bands in jaws, on vomer, palatines, and tongue, medianly along maxillary nearly to its hind end. Nostrils small, together, superior, at about last third in snout. Interorbital very narrowly constricted, slightly concave.

Gill rakers 4+18, lanceolate, slender, inner edges finely asperous, 3 in eye. Gill filaments 4 in eye, equal pseudobranchiae. Scales with 10 to 18 basal obtuse points marginally; circuli 52 to 70 apically. Scales a little smaller on breast, before pectoral base and caudal base; cheek with large scales, in 2 rows; axillary free-pointed scale about 6 in fin. Lateral line complete, median; each tube as a small basal anterior adpressed scale. Dorsal origin a little nearer snout tip than origin of adipose fin; second simple ray $1\ 2/3$ to 2 in total head length; adipose dorsal over anal; caudal forked, $1\ 4/5$ (?); first branched anal ray $2\ 1/2$ to $3\ 1/8$; pectoral $1\ 2/5$ to $1\ 3/4$; ventral $1\ 2/5$ to $1\ 3/5$.

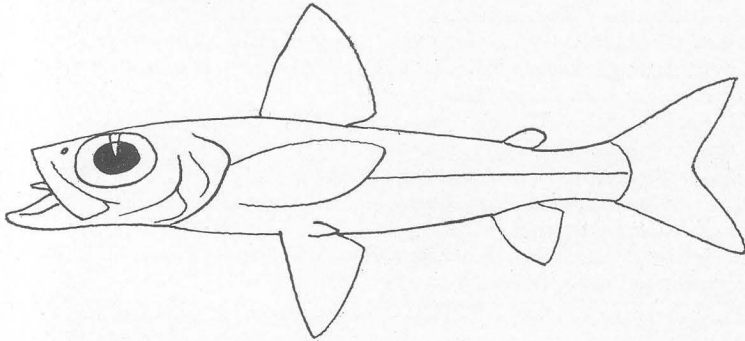


Fig. 164. *Chlorophthalmus agassizi*, from Bonaparte.

Largely dull brownish a little paler below. Iris silvery. Fins pale or uniform. Length 77 to 128 mm.

Warmer Atlantic. Described above from an Italian series of 16 examples, the types of *Chlorophthalmus agassizi*.

Sudidae

Barracudinas

Body well elongated, somewhat compressed. Eye large. Mouth large, lower jaw protruding. Premaxillary not protractile, very long and slender. Maxillary long, slender, closely adherent to premaxillary. Teeth rather strong, pointed, uniserial in jaws and on palatines; some lower teeth, and the palatine teeth are sometimes very long and fanglike, most freely depressible. Opercular bones thin. Gill membranes separate, free from isthmus. Gill rakers short, sharp, spinelike. Pseudobranchiae present. Branchiostegals 7. No pyloric caeca. Photophores

few or absent. No air vessel. Body covered with cycloid scales, moderate or rather large, sometimes absent. Head usually scaly on sides. Lateral line present, its scales usually enlarged. Dorsal fin short, small, behind the middle of the body, nearly or quite over the ventrals. Adipose fin present. Anal fin low, rather long. Caudal fin short, narrow, forked. Pectorals rather small, placed low.

Voracious fishes, bathypelagic.

KEY TO THE GENERA

- a.*—Body covered with minute or moderate scales. *SUDIS*.
aa.—Body largely naked, except for a row of scales along lateral line. *LESTIDIUM*.

SUDIS Rafinesque

Barracudinas

Sudis RAFINESQUE, 1810, 'Caratteri Nouv. An. Sicil.,' p. 60. Type: *Sudis hyalina* Rafinesque. Monotypic.

Paralepis OKEN, 1817, *Isis*, p. 1782. Type: *Paralepis coregonoides* Risso. [On Cuvier, 1817, 'Règne Animal,' II, p. 289. Type: *Coregone paralepis* (Risso) Cuvier = *Paralepis coregonoides* Risso. Tautotypic.]

Synproptopterus (Cocco) BONAPARTE, 1846, 'Cat. metod. pesc. Europ.,' p. 35. Atypic. Type: *Paralepis coregonoides* Risso.

Synproptopterus (Cocco) FACCIOLA, 1885, 'Nat. Sicil.,' V, pp. 14, 147. Atypic.

Arctozenus GILL, 1864, Proc. Acad. Nat. Sci. Philadelphia, XVI, p. 188. Type:

Paralepis borealis Reinhardt. Orthotypic.
Notolepis DOLLO, 1908, Proc. Roy. Soc. Edinburgh, XXVIII, p. 58. Type: *Notolepis coatsi* Dollo. Orthotypic.

Body elongate, compressed. Head attenuate, compressed. Eye large. Mouth widely cleft. Maxillary developed, closely adherent to premaxillary. Teeth unequal, some in mandible and on palatines rather enlarged; uniserial on premaxillary, mandible, palatine, and pterygoid. Gill opening very wide. Gill rakers short and spinelike. Pseudobranchiae well developed. Branchiostegals 7. No air vessel. Pyloric caeca absent. Body covered with deciduous scales, those of lateral line largest. Dorsal fin short, on hind part of body. Adipose fin small. Anal elongate, occupies end of tail. Caudal emarginate. Pectoral well developed. Ventral small, inserted at great distance from the pectoral, below, immediately behind or in front of dorsal.

About six species in the Mediterranean and Atlantic. The vernacular barracudina is used, as these fishes greatly suggest diminutive barracudas.

KEY TO THE SPECIES

- a.*—Body deeper, depth 7 1/2; anal rays 23. *coregonoides*.
aa.—Body longer, depth 10 1/2; anal rays 30. *sphyraenoides*.

Sudis coregonoides (Risso)

Figure 165

Paralepis coregonoides Risso, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 472, Pl. VII, fig. 15. Nice.

Paralepis brevis ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 4. N. lat. $37^{\circ} 10'$, W. long. $11^{\circ} 48'$, in 4750 m., off Portugal; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 61, Pl. II, fig. 7 (type).

Head 4; depth $7 \frac{1}{4}$; dorsal 10; anal 23; pectoral 17; ventral 9; scales 60 in lateral line. Snout attenuate, about half of head. Eye $6 \frac{3}{5}$ in head, $3 \frac{1}{4}$ in snout. Mouth large, mandible slightly protruding. Dentition feeble, a row of minute teeth in each jaw, with 4 or 5 teeth slightly enlarged on each side of the mandible. A few teeth on the front of each palatine. Scales very caducous, those of lateral line persistent, narrowed in front and widened behind to contain a single pore. Dorsal origin midway between hind edge of eye, and caudal base. Adipose fin inserted about midway above anal length. Anal origin nearer that of dorsal than caudal base, front lobe

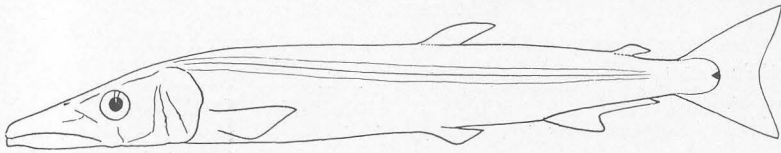


Fig. 165. *Sudis coregonoides*, from Zugmayer.

slightly over half of fin length. Caudal emarginate behind. Pectoral less than half-way to ventral, length about 2 in head. Ventral inserted a little behind dorsal origin, reaches $2 \frac{1}{3}$ to anal. Neutral brown. Length 348 mm. (Zugmayer.)

Eastern Atlantic.

***Sudis sphyraenoides* (Risso)**

Paralepis sphyraenoides RISSO, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 473, Pl. VII, fig. 16. Nice.—VALENCIENNES, 1836–1844, 'Hist. Nat. Canaries,' II, part 2, p. 18 (Canaries).—GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' p. 418 (Madeira).—VINCI-GUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 330 (Canaries).

Paralepis sphyrenoides PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 192 (east of Trinidad Island, S. lat. $23^{\circ} 33'$, W. long. $20^{\circ} 51'$, in 3000 m.).

Paralepis coregonoides (not Risso) JOHNSON, 1862, Ann. Mag. Nat. Hist., London, X, p. 283 (Madeira).—COLLETT, 1895, Rés. Camp. Sci. Monaco, X, p. 119 (note).—RICHARD, 1905 (October 15), Bull. Inst. Océanogr. Monaco, No. 46, p. 31 (N. lat. 38° , W. long. 1° to 2° ; N. lat. 40° to 41° , W. long. 3° to 4°).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (from Germon between Portugal and Azores, N. lat. $38^{\circ} 25'$, W. long. $20^{\circ} 59' 45''$; off Madeira, N. lat. 32° , W. long. 16° to 17° , in 2480 m.).

Head $3 \frac{7}{8}$; depth 13; dorsal II, 8, I; anal III, 26?; pectoral I, 10?; ventral I, 8; scales 60? in lateral line to caudal base, counted according to pockets; snout $2 \frac{1}{8}$ in head measured from tip of upper jaw; eye $5 \frac{1}{3}$; maxillary $2 \frac{1}{6}$; interorbital $8 \frac{1}{4}$.

Body slender, well compressed, edges convex. Caudal peduncle length about equals its least depth, which $8 \frac{1}{2}$ in total head length. Head attenuated, slender, well compressed, profiles alike or nearly straight, width $4 \frac{1}{2}$ in its length. Snout long, depressed. Eye close to upper profile, at least $\frac{2}{5}$ in head. Mouth terminal inferiorly, moderately long, gape rather short. Maxillary thin, rather narrow, reaches

4/5 to eye. Jaws with uniserial minute teeth, obsolete in front; uniserial teeth on each palatine, some as enlarged canines. Interorbital depressed, slightly concave medianly. Gill rakers 6+15, as small obsolete lumps, finely asperous. Gill filaments 1/3 of eye. Dorsal origin is a trifle behind the last third between snout tip and caudal base. Adipose fin is about over the last anal rays. Anal origin midway between that of dorsal and caudal base. Caudal small. Pectoral low. Ventral inserted behind dorsal origin or about opposite base of fifth branched dorsal ray. Vent near depressed ventral tips.

Dull brownish. Iris dull slaty. Length 114 mm.

Mediterranean and eastern Atlantic. Described above from an Italian example, in the Bonaparte collection as *Paralepis coregonoides*.

LESTIDIUM Gilbert

Lestidium GILBERT, 1903 (1905), Bull. U. S. Fish Comm., XXIII, p. 607. Type: *Lestidium nudum* Gilbert. Monotypic.

Lestidiops HUBBS, 1916, Univ. California Pub., Zool., XVI, p. 154. Type: *Lestidiops sphyraenops* Hubbs. Orthotypic.

Bathysudis PARR, 1928 (December), Bull. Bingham Oceanogr. Collection, III, Art. 3, p. 41. Type: *Paralepis speciosus* Bellotti. Monotypic.

Body naked, except for a series of scalelike structures along lateral line.

Lestidium speciosum (Bellotti)

Figure 166

Paralepis speciosus BELLOTTI, 1877, Atti Soc. Ital. Sci. Nat., Milano, XX, pp. 54, 57, Fig. Nice.

Omosudis elongatus BRAUER, 1906, 'Wiss. Ergebn. "Valdivia," XV (1), p. 140, Fig. 68. Gulf of Guinea (N. lat. 2° 36' 5", E. long. 3° 27' 5", in 1200 m.; N. lat. 0° 26', E. long. 7°, in 2000 m.; S. lat. 3° 55', E. long. 7° 48' 5", in 3000 m.); Indian Ocean; north of Cocos Islands; Bay of Bengal; south of Ceylon; Chagos Archipelago; Seychelles, 1900 to 2500 m.—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 18, Pl. I, fig. 6 (off Canaries, N. lat. 32° 18', W. long. 23° 58', in 1000 m.).

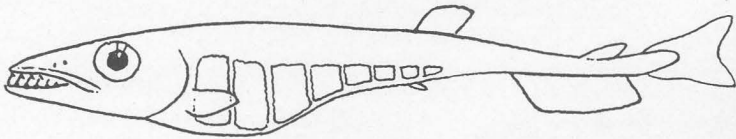


Fig. 166. *Lestidium speciosum*, from Brauer.

Head 4 1/3; depth 7; dorsal 10; anal 25 or 26; pectoral 12. Eye round, 2 in snout, 4 in head. Mouth cleft reaches opposite eye. Some large and many small teeth in jaws, 5 below moderate and 3 or 4 small; on palatines 3 or 4 moderately long. Small nostrils midway in snout length. Low groove each side of forehead. Interorbital 2/3 of eye. Stomach greatly distensible.

Dorsal fin begins close behind ventral origin, behind the middle of the body, short. Adipose fin above the hind end of the anal. Anal begins behind dorsal fin, in

last third of body length, ends somewhat before caudal. Pectoral short, low. Ventral rudimentary. Peritoneum with black pigment, blotches in 8 series. Back dotted brownish black, under side of tail clear. Length 30 mm. (Brauer.)

Atlantic and Indian Oceans.

Evermannellidae

Body oblong to elongate, compressed. Head large. Eye large, orbital cavity expanded downward. Mouth large, widely cleft. Teeth unequal, usually long, slender, depressible fangs in jaws and on palate. Gill opening very wide. Pseudobranchiae well developed. Branchiostegals 8. No air vessel. Scales absent. No luminous organs. Dorsal advanced, origin over or before that of ventrals, rays 7 to 14. Adipose fin small. Anal long, rays 25 to 35. Caudal forked. Paired fins well developed.

Genera few. Bathypelagic.

KEY TO THE GENERA

- a.—SCOPELARCHINAE. Body little compressed; tongue with feeble teeth or none; adipose fin large; unpaired fins low; pectoral rays 19. SCOPELARCHUS.
 aa.—EVERMANNELLINAE. Body strongly compressed; tongue strongly toothed; adipose fin small; unpaired fins high; pectoral rays 9 to 12. . . EVERMANNELLA.

SCOPELARCHUS Alcock

Scopelarchus ALCOCK, 1896 (October 1), Jour. Asiatic Soc. Bengal, LXV, part 2, p. 306. Type: *Scopelarchus guentheri* Alcock. Monotypic.

Dissomma BRAUER, 1902, Zool. Anzeiger, XXV, p. 278. Type: *Dissomma anale* Brauer. Monotypic.

Body elongate, strongly compressed. Snout conic. Eyes telescopic, placed laterally, looking upward. Mouth cleft wide. Premaxillary large. Maxillary, if present, very small. Teeth on premaxillaries, mandible, vomer, palatines, and tongue, depressible and unequal. Gill opening wide. Gill rakers small. Pseudobranchiae present. Gills 4. Gill membranes separate. No scales or luminous organs. Short dorsal before ventrals. Anal long, behind middle of body. Rather high adipose fin above the hind half of anal. Caudal forked. Ventral premedian.

Scopelarchus analis (Brauer)

Figure 167

Dissomma anale BRAUER, 1902, Zool. Anzeiger, XXV, p. 278 (eye). Atlantic, Antarctic, and Indian Oceans, in 600 to 4000 m.; 1899, 'Wiss. Ergebn. "Valdivia,"' XV, p. 138, Pl. x, figs. 1-2 (south of the Canaries, N. lat. 24° 43' 4", W. long. 17° 1' 3", in 2000 m.; Gulf of Guinea, N. lat. 0° 26' 3", W. long. 6° 32', in 4000 m.; N. lat. 2° 36' 5", W. long. 3° 27' 5", in 600 m.).

Odontostomus perarmatus ROULE, 1916 (May 20), Bull. Inst. Océanogr. Monaco, No. 320, p. 25. West of the Azores, 2100 to 2600 m.

Odontostomus (Dissomma) perarmatus ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 32, Pl. v, fig. 2a (types).

Head $4 \frac{1}{5}$; depth $6 \frac{1}{2}$; dorsal 7; anal 25; snout $2 \frac{4}{5}$ in head; orbit length $3 \frac{1}{2}$; mouth cleft $1 \frac{1}{3}$.

Body elongate, tapers slenderly back from head, which forms the greatest body depth posteriorly. Caudal peduncle with its least depth about equal to its length or $3 \frac{1}{8}$ in head. Head rather small. Snout conic. Eye lateral, directed upward, telescopic, large, $1 \frac{1}{5}$ in snout. Mouth cleft reaches opposite hind eye edge, lower jaw not protruding. Teeth in both jaws small; below 3 small anterior ones, behind them 4 large ones; a few large ones on vomer and palatines; a series of 4 to 6 large ones on tongue. Nostrils nearer snout tip than eye. Interorbital with 2 grooves longitudinally. Dorsal premedian, base entirely before ventral origin, height about 3 in head. Adipose fin larger than dorsal, $1 \frac{2}{3}$ in head, over last half of anal. Anal postmedian, length 4 in combined head and trunk, height a little less than that of adipose

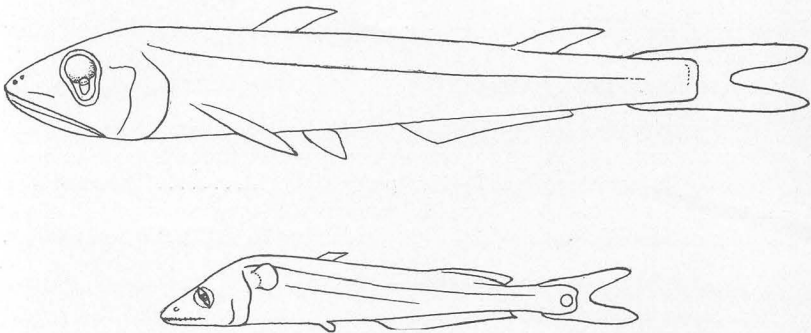


Fig. 167. *Scopelarchus analis*, from Brauer.

fin. Caudal with rudimentary rays greatly developed, fin $1 \frac{2}{5}$ in head. Pectoral wide, long, reaches little beyond ventral origin, $1 \frac{1}{3}$ in head. Ventral premedian, short, $1 \frac{3}{4}$ to vent, 3 in head. Vent somewhat before anal.

Color pale. Pectorals dusky. Length 70 to 200 mm. (Brauer.)

Eastern Atlantic, Indian, and Antarctic Oceans.

EVERMANNELLA Fowler

Evermannella FOWLER, 1901, Proc. Acad. Nat. Sci. Philadelphia, LIII, p. 211. Type: *Scopelus balbo* Risso. Orthotypic.

Odontostomus (not Beck, 1837) Cocco, 1838, Nuovi Ann. Sci. Nat., Bologna, II, p. 192. Type: *Odontostomus hyalinus* Cocco. Monotypic.

Body oblong, compressed. Head compressed. Snout short. Eye greatly enlarged, directed upward or lateral. Mouth large, premaxillaries and maxillaries slender, former with a series of very small equal teeth, their points directed backward. Lower jaw, vomer, and palatines with a few very large curved lanceolate teeth, barbed at the tips, curved and depressible backward. Gills 4, outer arch with small filaments and no rakers. Branchiostegals 8. Body naked. Dorsal fin median in body. Adipose fin small, posterior. Anal long. Caudal forked. Pectoral and ventral well developed, latter inserted below the dorsal some distance behind pectoral.

Evermannella balbo (Risso)

Figure 168

Scopelus balbo Risso, 1820, Mem. Accad. Sci. Nat. Torino, XXV, p. 268, Pl. x, fig. 3. Nice.

Odontostomus balbo SCHMIDT, 1918 (March 15), 'Rept. Danish Oceanogr. Exped. Medit.,' No. 4, A5, p. 30 (off Azores, Cape Verde Island, Madeira, Soudan, 0 to 188 m.).

Head $4\frac{1}{2}$; depth $6\frac{1}{3}$; dorsal 12; anal 34; pectoral 12; ventral 9. Eye large, shorter than snout, less than 4 in head; turned upward, separated from its fellow by an extremely narrow interorbital space; the lateral wall is formed by a transparent membrane, so, by rotating eyeball behind membrane outward for 90° , it can place eye in usual position on side of head, thus seeing either sideways or upward. Infraorbital ring very narrow, bent in strong curve, within which the transparent orbital membrane is extended. Mouth widely cleft, oblique, extends far beyond eye, not reaching preopercle angle. Mandible broad, not attenuated in front,

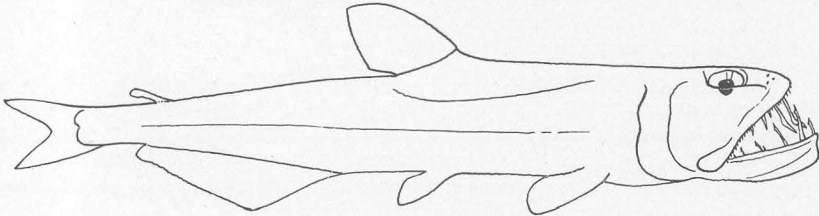


Fig. 168. *Evermannella balbo*, from Günther.

projects beyond mouth. Large fangs depressed upward, always depressed when mouth closes, much compressed and sharp edged in front and behind. Longest on palate with their ends curiously bent forward.

Dorsal origin little nearer end of snout than caudal base. Anal begins some space behind vent, which is midway between ventrals and anal, somewhat behind vertical from last dorsal ray; fin lower than dorsal, ends close to front rudimentary rays of caudal. Adipose fin a small narrow lobe. Pectoral inserted close to ventral profile, truncated behind, ends some distance from ventral. Ventrals inserted somewhat behind vertical from dorsal fin origin, shorter than pectorals, extend to vent. Colorless in alcohol, covered all over with brown pigment spots. Length 165 mm. (Günther.)

Mediterranean and eastern Atlantic.

Bathypteroidae

Body rather elongate. Head moderate. Eye very small. Mandible large, protrudes. Maxillary well developed, very movable, expanded behind. Teeth in villiform bands. Gill openings wide. Gill rakers long. Gill filaments well developed. No pseudobranchiae. Branchiostegals 12. Scales cycloid. Dorsal median, above or immediately behind base

of ventral. Adipose fin present or absent. Anal short. Caudal forked or emarginate. Some of upper pectoral rays greatly elongate, separated from the rest of the fin and form a distinct division. Ventral with 8 rays, abdominal, outer prolonged.

Bathypelagic. Genera few.

BATHYPTEROIS Günther

Bathypterois GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 183. Type: *Bathypterois longifilis* GÜNTHER. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 3, p. 395.)

Synapterelmus GOODE AND BEAN, 1895, 'Ocean. Ichth.,' p. 64. Type: *Bathypterois quadrifilis* Günther. (Designated by Jordan, 1923, Stanford Publications, 'Class. Fishes,' p. 154.)

Hemipterois REGAN, 1911, Ann. Mag. Nat. Hist., London, (8) VII, p. 127. Type: *Bathypterois guentheri* Alcock. Orthotypic.

Belonepterois ROULE, 1916, Bull. Inst. Océanogr. Monaco, No. 320, p. 13. Type: *Belonepterois viridensis* Roule. Monotypic.

Body elongate, compressed. Head depressed forward. Mouth cleft wide. Maxillary not reaching eye. Teeth in narrow bands in jaws; each side of wide vomer small patch of similar teeth; no teeth on palatines or tongue. Scales moderate, adherent. Dorsal moderate. Lower caudal ray not excessively prolonged. Pectoral of 2 well separated divisions, upper very long bifid ray, usually with 1 or 2 short rays in its axil, lower of from 8 to 14 simple filamentous rays. Outermost ventral ray usually bifid, or 2 branches may coalesce, if short, thick, and flattened terminally, if prolonged, more slender and less distinctly flattened.

Species about 13.

KEY TO THE SPECIES

- a.*—BATHYPTEROIS. Only 4 rays or less in upper portion of pectoral fin.
b.—Anal begins behind dorsal base; lower half of pectoral with 10 rays.*dubius*.
bb.—Anal begins below middle of dorsal base; lower half of pectoral with 7 or 8 rays.*longipes*.
aa.—HEMIPTEROIS. Upper portion of pectoral with 6 or more rays.*viridensis*.

Bathypterois dubius Vaillant

Figure 169

Bathypterois dubius VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 124, Pl. IX, fig. 1, *a-f*; Pl. XII, figs. 4, *4a*; Pl. XIV, fig. 4; Pl. XV, fig. 4, *a-b*. Off Morocco, Canaries, Soudan, Banc d'Arguin, Azores, in 834 to 1635 m.—COLLETT, 1896, Rés. Camp. Sci. Monaco, X, p. 105, Pl. IV, fig. 19 (off Flores and between Pico and São Jorge, 1300 to 1384 m.).—RICHARD, 1910 (February), Bull. Inst. Océanogr. Monaco, No. 162, p. 149 (Azores, 1372 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 396, Fig. 266 (N. lat. 35° 32', W. long. 7° 7', 1215 m.; N. lat. 28° 8', W. long. 13° 35', 365 m.).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 16 (N. lat. 45° 9', W. long. 30° 18', in 1804 m., north of Azores; N. lat. 40° 5', W. long. 9° 54', in 1241 m. off Portugal).—ROULE, 1919, Rés. Camp.

Sci. Monaco, LII, p. 34 (off Pico, Azores, in 1550 m.; 7 miles southwest of Île de Sal, Cape Verde Islands, 1477 m.; 30 miles east of Terceira, Azores, 1805 m.).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (N. lat. $37^{\circ} 42' 40''$, W. long. $25^{\circ} 5' 5''$, 1385 m.; N. lat. $38^{\circ} 26'$, W. long. $26^{\circ} 30' 45''$, 1165 m.; N. lat. $39^{\circ} 22'$, W. long. $26^{\circ} 55' 45''$, 1940 m.; all off Azores).

Head $4 \frac{1}{2}$; depth $6 \frac{2}{3}$; dorsal II, 12; anal I, 8; pectoral 2, 10; ventral II, 6; scales 60 in lateral line, 6 above, 8 below; snout $3 \frac{4}{5}$ in head measured from upper jaw tip; maxillary $1 \frac{3}{5}$.

Body elongately fusiform. Least depth of caudal peduncle 3 in its length measured to adipose fin, or 3 in total head length. Head width $2 \frac{1}{6}$ in its length. Snout depressed. Eye small, with hind edge at the first third in head length measured from the upper jaw tip. Maxillary extends greatly beyond eye, which is a little advanced

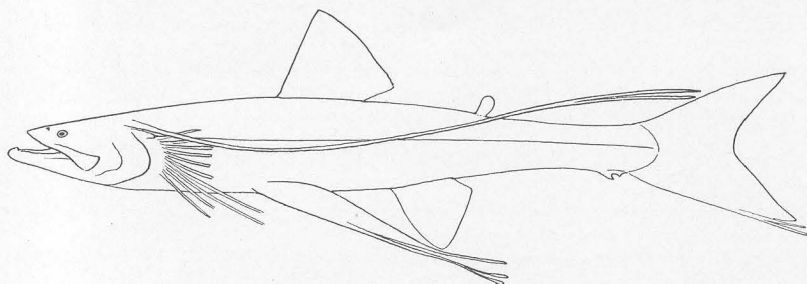


Fig. 169. *Bathypterois dubius*, from Vaillant.

from middle in its length. Teeth fine. Nostrils small, inconspicuous. Interorbital nearly equals snout and half of eye combined. Gill opening wide. Scales mostly uniform, cover most of head except muzzle. Lateral line complete, median. Dorsal advanced from middle of body, first branched ray $1 \frac{1}{2}$ in total head length. Adipose fin more than twice the eye length, behind anal. Anal behind dorsal, first branched ray $1 \frac{7}{8}$ in head. Caudal forked, 3 in combined head and trunk. Pectoral with uppermost ray bifid terminally and reaching middle of caudal. Ventral inserted before the dorsal origin; first ray bifid terminally and both outer rays reaching beyond the adipose fin or $2 \frac{1}{4}$ in combined head and trunk.

Slaty gray, blending to bluish. Pectoral and ventral dusky, with long external rays yellowish to whitish. Length 260 mm. (Vaillant.)

Eastern Atlantic.

***Bathypterois longipes* Günther**

Figure 170

Bathypterois longipes GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 184. Off east coast of South America, in 2650 fathoms.—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 396 (N. lat. $34^{\circ} 59'$, W. long. $33^{\circ} 1'$, in 2615 to 2865 m.).

Head $3 \frac{1}{10}$; depth $6 \frac{1}{3}$; dorsal II, 11; anal II, 8; pectoral 2, 7, or 8; ventral

11, 8; scales 55 in lateral line, 6 above, 8 below; snout 3 in head measured from upper jaw tip; maxillary $1\frac{1}{2}$; interorbital $2\frac{1}{2}$.

Body elongately fusiform. Least depth of caudal peduncle $3\frac{3}{4}$ in its length measured to anal fin, or $3\frac{1}{2}$ in total head length. Head width $2\frac{1}{4}$ in its length. Snout broadly depressed. Eye at first third in head as measured from snout tip, very small, 6 in snout. Maxillary reaches greatly beyond eye, expansion about 2 eye

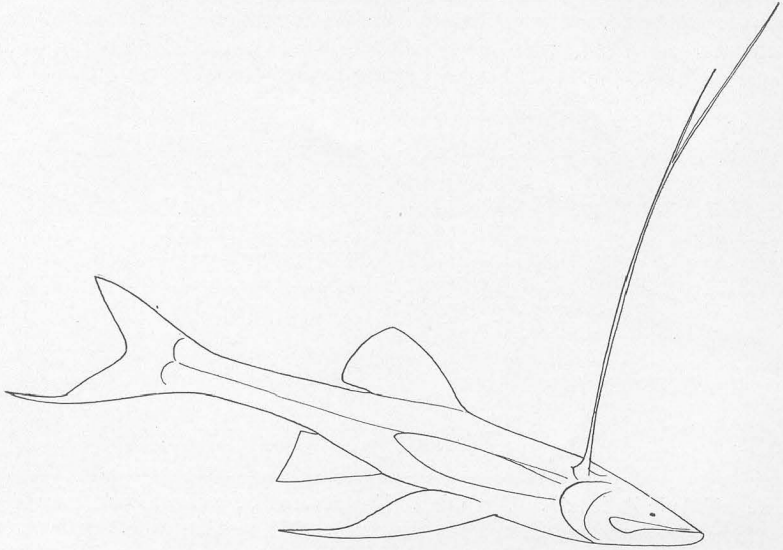


Fig. 170. *Bathypterois longipes*, from Günther.

diameters; eye at front of second half in maxillary length. Nostrils together, nearly midway in snout, posterior pair a little larger. Scales more or less uniform. Scales extend forward to nearly opposite eyes, head otherwise naked. Dorsal inserted behind ventral origin, nearly midway between snout tip and caudal base; first branched ray $1\frac{1}{3}$ in total head length. Adipose fin present or absent. Anal begins about opposite the middle of dorsal base, first branched ray $1\frac{2}{5}$ in head. Caudal forked, lower outer rays produced moderately. Outer pectoral ray reaches far as upper caudal lobe tip, bifid terminally; of 2 branches into which hind third of long pectoral ray split, 1 much shorter and weaker; lower half of pectoral reaches middle of dorsal. Ventral $2\frac{1}{2}$ in combined head and trunk; outer rays much produced, strong, not dilated terminally; 2 outer ventral rays closely adpressed from root to end, much stouter and longer than other rays; without terminal pads.

Black, with whitish fins. Length 229 mm. (Günther.)

Atlantic.

***Bathypterois viridensis* (Roule)**

Figure 171

Belonepterois viridensis ROULE, 1916, Bull. Inst. Océanogr. Monaco, No. 320, p. 13. Île de Sal, Cape Verde, in 1477 m.; 1919, Rés. Camp. Sci. Monaco, LII, p. 35, Pl. I, fig. 3 (type).

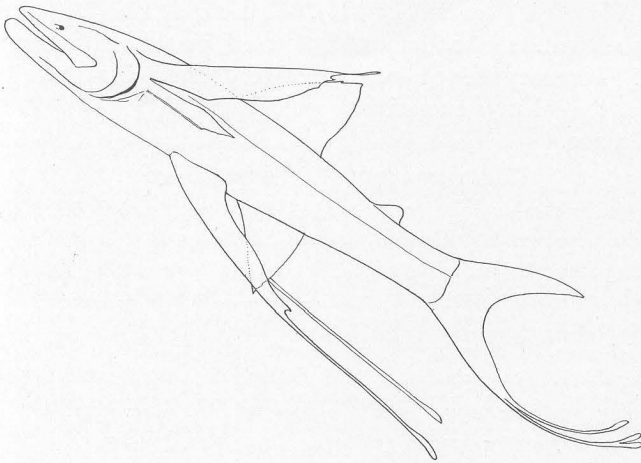


Fig. 171. *Bathypterois viridensis*, from Roule.

Head $3 \frac{1}{2}$; depth $5 \frac{1}{2}$; dorsal 1, 11; anal 1, 8; pectoral 6, 5; ventral 1, 6; 48 scales in lateral line, 6 or 7 above, 7 to 9 below; snout $2 \frac{7}{8}$ in head measured from upper jaw tip; maxillary $1 \frac{1}{3}$.

Body elongately fusiform. Least depth of caudal peduncle is slightly less than its length or $2 \frac{7}{8}$ in head. Head depressed forward. Snout large. Eye very small, at the first $\frac{2}{5}$ in total head length, $5 \frac{1}{2}$ in snout. Mouth large, lower jaw strongly protruding. Maxillary reaches $\frac{3}{4}$ in total head length; expansion twice eye diameter; eye about midway in maxillary length. Nostrils small, obsolete, midway in snout length. Scales uniform, none on head.

Dorsal origin midway between mandible tip and caudal base, first branched ray $1 \frac{1}{4}$ in total head length; first branched anal ray $1 \frac{1}{2}$. Adipose fin $4 \frac{3}{4}$ in head. Caudal deeply forked, upper lobe about as long as head; lower lobe a little over half combined head and trunk. Uppermost pectoral ray $1 \frac{1}{2}$ to caudal or about opposite

hind anal edge; lower lobe $2\frac{1}{4}$ in upper lobe. Ventral inserted before dorsal origin, with outer rays reaching beyond tips of middle caudal rays.

Uniform grayish blue, tinted russet on head, muzzle, and cheeks. Fins clear russet. Length 330 mm. (Roule.)

Off Cape Verde.

Benthosauridae

Body elongate, somewhat compressed. Head depressed. Snout more or less spatulate. Eye present, very small. Mouth cleft wide, horizontal. Maxillary well developed, expanded behind. Premaxillaries very long, styliform, tapering, immovable. Teeth small, uniform, in bands. Gill opening extremely wide. Scales cycloid. Dorsal median. No adipose dorsal. Pectoral normally formed, placed rather close behind the head. Ventral inserted in advance of dorsal. Outermost ventral and lowest caudal rays excessively prolonged.

One genus.

BENTHOSAURUS Goode and Bean

Benthosaurus GOODE AND BEAN, 1886, Bull. Mus. Comp. Zool., XII, p. 168. Type: *Benthosaurus grillator* Goode and Bean. Monotypic.

Body long, tapering behind to a long, slender caudal peduncle. Eye inconspicuous. Mouth large, lower jaw protruding. Maxillary reaches beyond eyes. Teeth in jaws on each side of vomer, but absent from palatines and tongue. Gill membranes free from isthmus. Gill rakers long, slender, numerous. No pseudobranchiae. Branchiostegals 11. Scales moderate. Dorsal begins but slightly before anal origin. Caudal forked. Pectoral high. Ventral rays 7, base entirely before dorsal.

Benthosaurus grillator Goode and Bean

Figure 172

Benthosaurus grillator GOODE AND BEAN, 1886, Bull. Mus. Comp. Zool., XII, p. 168. N. lat. $24^{\circ} 33'$, W. long. $84^{\circ} 23'$, in 1850 fathoms.—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 396 (N. lat. $34^{\circ} 59'$, W. long. $33^{\circ} 1'$, in 2615 to 2865 m.).

Head $3\frac{3}{4}$; depth $7\frac{1}{5}$; dorsal 1, 10; anal 1, 11; pectoral 9; ventral 7; scales 55 in lateral line, 9 above, 8 or 9 below; snout $3\frac{2}{3}$ in head measured from upper jaw tip; maxillary $1\frac{2}{5}$.

Body depressed slightly forward. Least depth of caudal peduncle is $4\frac{3}{4}$ in its length or $4\frac{2}{3}$ in total head length. Head attenuated in profile. Snout rather slender as seen laterally. Eye at first third in total head length; slightly advanced from the middle in maxillary length. Mouth large. Maxillary expanded behind, twice eye diameter. Nostrils small slits, median in snout length, and posterior twice large as front one. Interorbital convex, width about equals snout length. Scales thin, leathery, deciduous. Head largely scaly, apparently. Lateral line median along side. Dorsal origin median between mandible tip and caudal base, height of fin nearly equals head. First branched anal ray $1\frac{2}{5}$ in head. Caudal well forked, upper lobe nearly as long as head, lowest ray exerted beyond fin long as fin itself. Ventral with front ray 4 times head length.

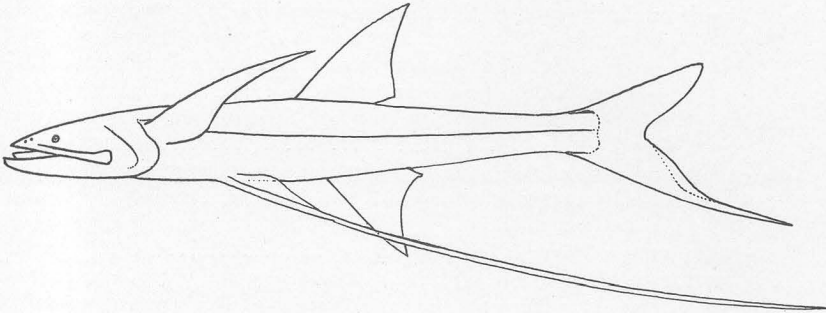


Fig. 172. *Benthosaurus grillator*, from Goode and Bean.

Brown; mouth roof, inside branchiostegal flap and membrane, also opercle, black. Length 394 mm. (Goode and Bean.)

Atlantic.

Myctophidae

Lantern Fishes

Body oblong or moderately long, mostly compressed. Snout usually short. Eye large. Mouth broad. Entire edge of upper jaw formed by the long slender premaxillaries, closely adherent to slender maxillaries. Teeth variable, usually villiform, in bands in jaws, on palatines, pterygoids, and tongue, and present on vomer in adult. No barbels. Gill membranes separate, free. Gill rakers long and slender. Pseudobranchiae well developed. Branchiostegals 8 to 10. Air vessel small. Intestinal canal short. Body covered with scales, usually cycloid. Lateral line present, the scales prominent and often enlarged. Cheeks and opercles scaly. Photophores more or less regular along sides of body, often larger luminous glands on head or caudal peduncle. Dorsal fin short, median, of soft rays. Anal moderate. Adipose fin present. Caudal forked. Pectorals and ventrals present.

Small fishes of the open seas. Living usually at considerable depths, they frequently come to the surface at night or in stormy weather, descending by day. Genera, among living forms, eight or more.

KEY TO THE GENERA

- a.—MYCTOPHINAE. Dorsal and anal fins touching or nearly so, in same vertical or overlapping; scales cycloid, variably adherent; luminous glands present.
- b.—Luminous glands on head or tail; photophores sometimes on caudal peduncle above or below.

- c.—Head short; snout mostly blunt; preopercle nearly vertical; precaudal photophores 2.
 d.—Dorsal begins well behind pectoral base. MYCTOPHUM.
 dd.—Dorsal begins over pectoral base. CYPHOSCOPELUS.
 cc.—Head longer; snout conic; preopercle oblique; precaudal photophores 4 or 2+1. LAMPANYCTUS.
 bb.—Luminous glands on tail, none on head; head somewhat conic; preopercle slightly oblique; a saddle-like gland on tail above and below.
 LAMPADENA.
 bbb.—Large luminous glands on head, but none on tail. DIAPHUS.
 aa.—NEOSCOPELINÆ. Dorsal and anal short, alike, far apart; scales large, very deciduous, covered with minute spines; no luminous glands on head or tail.
 NEOSCOPELUS.

MYCTOPHUM Rafinesque

Myctophum RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' p. 56. Type: *Myctophum punctatum* Rafinesque. Monotypic.

Nyctophis, *Myctophus*, *Nyctophus*, *Nyctophus* auct.

Scopelus CUVIER, 1817, 'Règne Animal,' II, p. 56. Type: *Gasteropelecus humboldti* RISSO. (Designated by Jordan and Evermann, 1917, Stanford Publications, 'Genera of Fishes,' I, p. 98.)

Alysia (not Latreille, 1804) LOWE, 1839, Proc. Zool. Soc. London, p. 87. Type: *Alysia loricata* Lowe. Monotypic.

Dasy Scopelus GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 405 (411). Type: *Myctophum asperum* Richardson. (Designated by Jordan, 1919, 'Genera of Fishes,' part 3, p. 333.)

Tarletonbeania EIGENMANN AND EIGENMANN, 1891, Proc. California Acad. Sci., (2) III, p. 6. Type: *Tarletonbeania tenua* Eigenmann and Eigenmann. Orthotypic.

Rhinoscopelus LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 236. Type: *Scopelus cocco* Cocco. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' part 4, p. 458.)

Benthosema GOODE AND BEAN, 1895, 'Ocean. Ichth.,' p. 75. Type: *Salmo mülleri* Gmelin. Orthotypic.

Electrona GOODE AND BEAN, 1895, *op. cit.*, p. 91. Type: *Scopelus risso* Cocco. Orthotypic.

Centrobranchus FOWLER, 1903, Proc. Acad. Nat. Sci. Philadelphia, LV, p. 754. Type: *Centrobranchus choerocephalus* Fowler. Monotypic.

Louetina FOWLER, 1925 (March 31), Amer. Mus. Novit., No. 162, p. 2. Type: *Scopelus (Rhinoscopelus) rarus* Lütken. Orthotypic.

Body oblong, compressed. Caudal peduncle rather slender. Head short, compressed. Snout mostly blunt, declivous. Eye large. Mouth large, jaws about equal. Premaxillaries long, slender. Maxillaries well developed. Teeth in villiform bands in jaws, on palatines, pterygoids, and tongue. Gill rakers long and slender. Air vessel small. Body covered with cycloid scales, not much enlarged in the lateral line. Precaudal photophores 2, supra-anals in 2 groups, with 1 or 2 posterolaterals above interval between. Dorsal fin entirely before anal, overlapping little or none. Adipose fin slender. Pectoral well developed. Ventrals with 8 rays, below or slightly before the dorsal origin.

KEY TO THE SPECIES

- a.—Body elongate, ellipsoid; caudal peduncle usually slender; head short, with a more or less projecting snout.
- b.—MYCTOPHUM. Anal not passing behind soft dorsal.
- c.—No photophores above lateral line; pectoral photophores 4, rarely 6; dorsal fin much shorter than anal and behind ventral.
- d.—Mouth cleft reaches opposite the hind edge of eye; maxillary well expanded terminally; eye very large.
- e.—One posterolateral photophore; anal photophores in 2 groups; suprapectoral photophore above pectoral base; scales cycloid.
- f.—Supra-anal photophores in an oblique row.
- g.—Ventral photophores all on the same level; last precaudal photophore at lateral line; anal photophores 6 to 8+7 to 9.....*phengodes*.
- gg.—Two median ventral photophores somewhat above the level of the row; last precaudal photophore below lateral line; anal photophores 5 to 7+2 or 3.....*laternatum*.
- ff.—Supra-anal photophores in a blunt angle; second ventral photophore elevated from level of row; anal photophores 5 or 6+4 or 5.....*pterotum*.
- ee.—Posterolateral photophores 2; scales cycloid; supra-anal photophores in blunt angle.
- h.—Last precaudals and supraventrals below lateral line; anal photophores 5 to 7+6 or 7.....*benoiti*.
- hh.—Last precaudal at lateral line; supraventrals below lateral line; anal photophores 4 to 7+6 to 8.....*reinhardtii*.
- hhh.—Last precaudal and supraventral at lateral line; anal photophores 5 to 8+6.. *hygomi*.
- dd.—Mouth cleft not reaching opposite hind eye edge; maxillary but slightly expanded terminally; eye moderately large; 1 posterolateral photophore; anal photophores in 2 groups.
- i.—Scales cycloid.
- j.—Supra-anal photophores in oblique row.
- k.—Anal photophores 7 to 9+7 to 11; anal rays 18 to 20; lateral line with 42 to 43 scales.
punctatum.
- kk.—Anal photophores 7 to 10+3 to 6; anal rays 18 to 20; lateral line with 40 scales.... *affine*.
- jj.—Supra-anal photophores in blunt angle; anal photophores 7 to 9+4 to 9.....*humboldti*.

ii.—Scales ctenoid.

l.—Supra-anal photophores in an oblique row; anal photophores 6 to 8+5 to 8. *spinosum*.

ll.—Supra-anal photophores in a blunt angle; anal photophores 7 to 8+6. *asperum*.

cc.—Four photophores above lateral line, last supra-anal photophores at end of base of dorsal fin; last posterolateral at base of adipose fin; last precaudal above lateral line and photophore close below origin of dorsal fin; last pectoral photophore and second ventral photophore elevated above level of row; mouth cleft extended beyond eye; maxillary little expanded behind; dorsal rays 11 to 12; anal 12 or 13. *valdiviae*.

bb.—Anal passing beyond soft dorsal.

m.—RHINOSCOPELUS. Gill rakers on first arch long.

n.—Dorsal inserted before the middle in body; pectoral photophores equally spaced; suprapectoral photophore above the level of base of pectoral fin; anal photophores 4 to 8+9 to 14. *cocco*.

nn.—Dorsal inserted behind middle in body; pectoral photophores unequally spaced; suprapectoral photophore horizontal with upper edge of base of pectoral fin; anal photophores 6 to 8+5 to 7. *rarum*.

mm.—CENTROBRANCHUS. Gill rakers on first arch very short.

nigro-ocellatum.

aa.—ELECTRONA. Body ovate, short, compressed; caudal peduncle deep; head short, profile abrupt, snout not projecting; anal somewhat larger than dorsal and overlapping it slightly. *risso*.

Myctophum phengodes (Lütken)

Figure 173

Scopelus phengodes LÜTKEN, 1892, K. danske Vidensk. Selsk., Skrift., Kjøbenhavn, (6) VII, p. 253, Fig. 11. S. lat. 22° to 40°, W. long. 5° to 19° to E. long. 10° to 96°.

Myctophum (Myctophum) phengodes ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 22 (between Azores and Spain, N. lat. 43°, W. long. 19°, at surface).

Head $3\frac{1}{3}$ to $3\frac{1}{2}$; depth 4 to $4\frac{1}{3}$; dorsal 12; anal 20 to 21; scales in lateral line 38. Snout 2 in eye. Eye $2\frac{1}{3}$ to 3 in head. Mouth cleft reaches hind edge of eye. Maxillary is expanded behind. Preopercle vertical. Scales cycloid. Two small anterior luminous bodies, one elevated and the other low along the front edge of eye; preopercular photophores 2, the upper one larger and level with the lower edge of eye, the lower one is behind the mouth angle; branchiostegals 3; pectorals 5; subpectorals 2, the upper one near the lower pectoral base and the anterior one somewhat lower and forward opposite the second pectoral; ventrals 4; anals in two groups, 6 or 7+7 to 9; only the last half of the second group is above anal; posterolateral close below lateral line, slightly before adipose fin; precaudals 2, upper one close below lateral line; suprapectoral is a little nearer lateral line than pectoral origin; supraventral is a little nearer lateral line than ventral fin; supra-anals 3, lowest one slightly before last

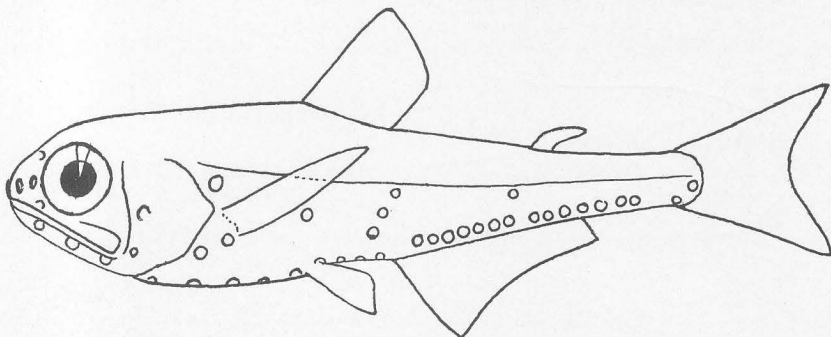


Fig. 173. *Myctophum phengodes*, from Brauer.

ventral, highest one close before lateral line opposite end of dorsal base or anal origin. Supra-caudal luminous plate present. Dorsal begins before middle of body, opposite ventral origin, and ends opposite anal origin. Adipose fin above hind part of anal. Pectoral reaches opposite vent, likewise ventral. Length 20 mm. (Brauer.)

Atlantic and Indian Oceans.

Myctophum laternatum Garman

Figure 174

Myctophum laternatum GARMAN, 1899, Mem. Mus. Comp. Zool., XXIV, p. 267, Pl. LVI, fig. 1. N. lat. 7° to 27°, W. long. 79° to 111°, surface to 1168 fathoms.—SCHMIDT, 1918 (May 1), Rept. Danish Oceanogr. Exped. Medit., No. 5, A7, p. 150, Fig. 46 (Bay of Cadiz, off Azores, off Grand Banks, in 220–1600 m.).

Myctophum (Myctophum) laternatum BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"

XV (1), p. 178, Figs. 89–91 (West Africa, Cape Verde, N. lat. $14^{\circ} 39' 5''$, W. long. $21^{\circ} 51' 8''$; Sierra Leone, N. lat. $5^{\circ} 5' 3''$, W. long. $13^{\circ} 27' 5''$; Gulf of Guinea, N. lat. $0^{\circ} 20' 2''$, W. long. $6^{\circ} 45''$; N. lat. $0^{\circ} 25' 8''$, E. long. $7^{\circ} 0' 3''$; S. lat. $3^{\circ} 55'$, E. long. $7^{\circ} 48' 5''$).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 193 (south-west of Sierra Leone, N. lat. $0^{\circ} 46'$, W. long. $18^{\circ} 59'$, 3000 m.; N. lat. $5^{\circ} 27'$, W. long. $21^{\circ} 41'$, 500 m.; mid-Atlantic, N. lat. $17^{\circ} 28'$, W. long. $29^{\circ} 42'$, 3000 m.).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 23 (off Morocco, N. lat. $35^{\circ} 13'$, W. long. $8^{\circ} 6'$, in 1800 m.).

Head $3 \frac{1}{5}$; depth $4 \frac{1}{5}$; dorsal 11 or 12; anal 15 or 16; scales in lateral line 32 to 34. Snout 2 in eye. Eye $3 \frac{1}{5}$ in head. Snout with median keel. Maxillary expanded behind. Mouth cleft reaches opposite hind eye edge. Preopercle vertical. Scales cycloid. Preorbital luminous body at upper eye edge; 2 preopercular photophores, upper one larger and close to level of lower eye edge, lower one behind mouth angle; branchiostegals 3; pectorals 5; subpectorals 2, upper one at lower pectoral base, lower one only slightly lower, opposite interspace of second and third pectorals; ventrals 4, second highest; anals 5 to 7+2 or 3, hind group behind anal fin; posterolateral at lateral line opposite adipose fin; precaudals 2, last one only slightly elevated; suprapectoral before and above pectoral, midway between lateral line and pectoral fin, a little behind anterior subpectoral; supraventral midway between

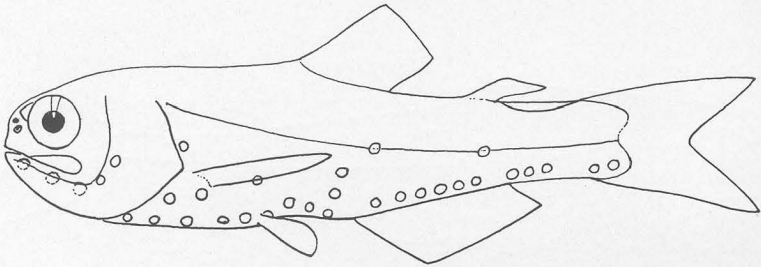


Fig. 174. *Myctophum laternatum*, from Brauer.

lateral line and ventral; supra-anals 3, lowest above vent, second little higher and posterior and third at lateral line below basal end of dorsal. Large supracaudal luminous plate, none below. Dorsal origin placed shortly before middle in body, behind ventral origin, reaches anal. Anal begins in middle of body, reaches adipose fin. Pectoral level with upper jaw, nearly reaches vent. Length 63 mm. (Brauer.)

Atlantic and Indian Oceans.

***Myctophum pterotum* (Alcock)**

Figure 175

Scopelus (Myctophum) pterotus ALCOCK, 1890, Ann. Mag. Nat. Hist., London, (6) VI, p. 217. Off Madras coast, N. lat. $18^{\circ} 30'$, E. long. $84^{\circ} 46'$, in 98 to 102 fathoms.

?*Myctophum (Myctophum) pterotum* PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 193 (off Cape Verde Islands, N. lat. $17^{\circ} 28'$, W. long. $29^{\circ} 42'$, 3000 m.; N. lat. $28^{\circ} 42'$, W. long. $34^{\circ} 33'$).

Head 3; depth $3\frac{4}{5}$; dorsal 11 to 13; anal 17 or 18; scales in lateral line 34. Snout $3\frac{1}{2}$ in eye. Interorbital $1\frac{2}{5}$ in eye. Eye 3 in head. Mouth cleft reaches vertical of hind eye edge. Maxillary expanded behind. Preopercle vertical. Scales cycloid. Small preorbital luminous body at front eye edge; 2 preopercular photophores, upper one larger and below lower eye edge, lower one near mouth angle; branchiostegals 3; pectorals 5, last one but little elevated at ventral base; subpectorals 2, posterior one at lower base of pectoral fin, anterior one slightly lower and a little behind second pectoral; ventrals 4, second one above or slightly behind first ventral and equally level with hind subpectoral; anals 5 or $6+4$ or 5; posterolateral at lateral line opposite adipose fin origin; precaudals 2, second elevated and near lateral line; suprapectoral before pectoral fin, nearly opposite first subpectoral; supraventral nearer lateral line than belly; supra-anals 3, first one above third ventral, second one equally level with first and third at lateral line near end of dorsal fin base. Supra-caudal luminous plates 3 or 4, not present in young. Dorsal begins somewhat behind

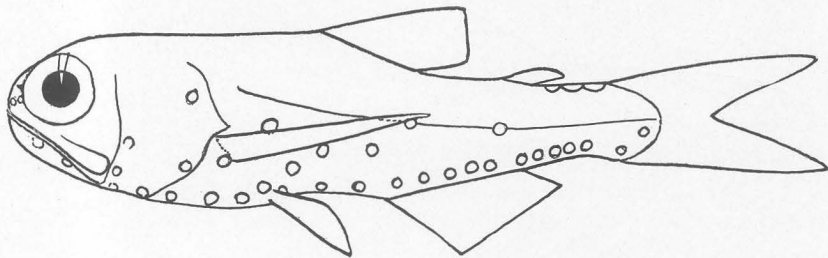


Fig. 175. *Myctophum pterotum*, from Brauer.

ventral, midway in body, ends above first anal ray. Anal origin somewhat before $\frac{2}{3}$ in body, fin ends under adipose fin. Pectoral base midway between lateral line and belly, fin reaches little beyond front of anal. Length 61 mm. (Brauer.)

Atlantic, Indian, and Pacific Oceans.

***Myctophum benoiti* (Cocco)**

Figure 176

Scopelus benoisti Cocco, 1838, Nuovi Ann. Sci. Nat., Bologna, II, p. 172, Pl. VI, fig. 4. Messina.

Scopelus benoiti LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 256, Fig. 14 (Azores, N. lat. $43^{\circ} 40'$, W. long. $24^{\circ} 20'$; N. lat. 41° , W. long. 34°).—OSORIO, 1893 (August), Jorn. Sci. Acad. Lisboa, (2) III, p. 140 (St. Thomas Island, West Africa); 1898, *op. cit.*, (2) V, p. 199 (St. Thomas Island).

Myctophum (Myctophum) benoiti BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 183, Fig. 95 (Madeira, N. lat. $31^{\circ} 59' 3''$, W. long. $15^{\circ} 5'$; south of Canaries, N. lat. $24^{\circ} 43' 4''$, W. long. $17^{\circ} 1' 13''$; N. lat. $22^{\circ} 57' 3''$, W. long. $18^{\circ} 33' 4''$; Gulf of Guinea, S. lat. $3^{\circ} 55'$, E. long. $7^{\circ} 48' 5''$).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 25 (southwest of Azores, N. lat. $33^{\circ} 3'$, W. long. $41^{\circ} 8'$, 3000 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (off Morocco).

Head $2\frac{4}{5}$; depth 3; dorsal 12 to 14; anal 17 to 19; scales in lateral line 39 or

40. Snout 2 in eye. Eye $2\frac{1}{2}$ in head, equals interorbital. Mouth cleft reaches hind eye edge. Maxillary expanded behind. Preopercle vertical. Scales cycloid. Pre-orbital luminous organs 2, one dorsal and the other ventral, both at front eye edge; small photophore at upper hind eye edge; 2 preopercular, upper one not quite so high as lower eye edge and lower at jaw angle; 3 branchiostegals; pectorals 5; sub-pectorals 2, lower opposite second pectoral and upper below lower base of pectoral fin; ventrals 4; anals in 2 groups, 5 to 7+6 or 7; posterolaterals 2, lower one is above last of first anal group, and upper one is at lateral line at origin of adipose fin; pre-caudals 2, upper one below lateral line; suprapectoral a little above and before pectoral fin, midway between lateral line and pectoral fin; supraventral somewhat nearer lateral line than ventral fin; supra-anals 3, first one lower than supraventral and little before vertical of third ventral, second one a little higher and behind vent, third one at lateral line under end of dorsal base. Male with supracaudal luminous

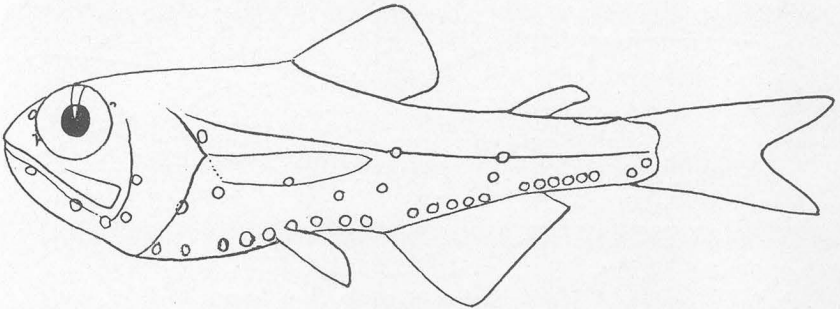


Fig. 176. *Myctophum benoiti*, from Brauer.

plate, female with 2 to 4 small infracaudals, absent in young. Dorsal fin begins slightly behind ventral origin, a little before middle in body and ends above anal origin. Anal begins behind middle in body, but ends before $\frac{2}{3}$ of body length or below adipose fin. Pectoral inserted nearer lateral line than ventral profile, reaches vent. Ventral reaches vent. Length 56 mm. (Brauer.)

Atlantic Ocean.

Myctophum reinhardtii (Lütken)

Scopelus reinhardtii LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 257, Fig. 16. Madeira, N. lat. $34^{\circ} 22'$, W. long. $18^{\circ} 10'$; mid-Atlantic, N. lat. $5^{\circ} 31'$, W. long. $23^{\circ} 15'$.

Myctophum (Myctophum) benoiti reinhardtii BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 185, Figs. 96-101 (south of Canaries, N. lat. $24^{\circ} 43' 4''$, W. long. $17^{\circ} 1' 3''$; off Sierra Leone, N. lat. $8^{\circ} 58'$, W. long. $16^{\circ} 27' 9''$; N. lat. $1^{\circ} 27' 8''$, W. long. $10^{\circ} 16' 5''$; Gulf of Guinea, N. lat. $0^{\circ} 26' 3''$, W. long. $6^{\circ} 32'$; N. lat. $1^{\circ} 51'$, E. long. $0^{\circ} 31' 2''$; N. lat. $2^{\circ} 36' 5''$, E. long. $3^{\circ} 27' 5''$; S. lat. $3^{\circ} 55'$, E. long. $7^{\circ} 48' 5''$; S. lat. $5^{\circ} 6' 2''$, E. long. $9^{\circ} 58' 6''$; off southwest Africa, S. lat. $11^{\circ} 28'$, E. long. $10^{\circ} 24'$; S. lat. $31^{\circ} 21' 1''$, E. long. $9^{\circ} 45' 9''$).—PAPPENHEIM, 1914, 'Deutsche

Südpolar Exped., XV (2), p. 193 (southwest of St. Helena, S. lat. 23° 33', W. long. 20° 51', 3000 m.; S. lat. 30° 21', W. long. 14° 2', 10 m.; Cape Verde Islands, N. lat. 17° 18', W. long. 24° 58', 3000 m.; southwest of Liberia, N. lat. 0° 46', W. long. 18° 59', 3000 m.; N. lat. 5° 27', W. long. 21° 41', 1500 m.; Cape Verde Islands, N. lat. 17° 28', W. long. 29° 42', 3000 m.; S. lat. 8° 43', W. long. 11° 55', 3000 m.).

Head $3\frac{1}{2}$; depth $4\frac{1}{4}$; dorsal III, 10; anal III, 16 (?); snout 5 in head; eye $2\frac{2}{3}$; maxillary $1\frac{3}{5}$; interorbital $3\frac{1}{3}$.

Body elongate, well compressed, deepest at nape. Caudal peduncle compressed, its least depth is twice its length or $3\frac{1}{2}$ in head. Head rather large, compressed, profiles alike. Snout short, length about $\frac{2}{3}$ its width. Eye rounded, close to upper profile at about first $\frac{2}{5}$ in head. Mouth large, well inclined. Maxillary not quite reaching preopercle ridge, extends a trifle behind eye, not expanded terminally. Teeth minute, in narrow bands in jaws, on each palatine, but none on tongue or pterygoids. Tongue small. Interorbital concave. Preopercle ridge nearly vertical. Gill opening is forward a little before front pupil edge. Gill rakers 6+14 (?), slender, lanceolate, 2 in eye. Gill filaments 3 in eye, also pseudobranchiae. Scales deciduous. Lateral line apparently midway along side. Mandibular photophores 3 pairs, large and distinct; preopercular 2, upper one a little larger and lower one indistinct; subpectorals 2, upper one at lowest pectoral rays basally, and lowest one midway between last and first pectoral; pectorals 5; ventrals 4; anals 6+7; precaudals 2; suprapectoral 1; supraventral 1; supra-anals 3; posterolaterals 2, uppermost supra-anal and posterolateral on lateral line; supraventral and anterior supra-anal low, on same plane, or former is about midway between lateral line and ventral origin. Dorsal origin much nearer snout tip than caudal base, first branched ray $1\frac{3}{5}$ in head. Adipose fin inserted at about last third between depressed dorsal tip and caudal base. Anal inserted below hind dorsal base, midway between hind pupil edge and caudal base, first branched ray $1\frac{3}{4}$. Caudal emarginate. Pectoral inserted a little below level of eye. Ventral origin a little before that of dorsal, fin $\frac{3}{5}$ to anal.

In alcohol dull brown, fins pale. Photophores white, on dusky bases. Length 31 mm.

Atlantic, Indian, and Pacific Oceans. Described above from an example from off northern Chili.

Myctophum hygomi (Lütken)

Figure 177

Scopelus hygomi LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 256, Fig. 15. Azores, N. lat. 38°, W. long. 22° 20'; off Cape of Good Hope, S. lat. 35° 12', E. long. 26°; north of St. Paul Rock, S. lat. 23° 30', E. long. 81° and S. lat. 24° 30', E. long. 75° 50'; south of Madagascar, S. lat. 39° 54', E. long. 41° 30'.

Myctophum (Myctophum) benoiti hygomi BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 187, Fig. 102 (east of Azores, N. lat. 38°, W. long. 22° 20'; S. lat. 35° 12', E. long. 26°).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (off Morocco; west of Canaries).

Head $3\frac{1}{4}$; depth $4\frac{1}{6}$; dorsal III, 9; anal III, 17; scales 33 in lateral line to caudal base, and 2 more on latter, 3 scales above lateral line, 3 below; 12 predorsal scales; snout $4\frac{4}{5}$ in head; eye $2\frac{2}{5}$; maxillary $1\frac{2}{3}$; interorbital $3\frac{4}{5}$.

Body well compressed, moderately long, deepest at pectoral origin. Caudal peduncle compressed, least depth about $1\frac{3}{4}$ its length or $3\frac{4}{5}$ in head. Head large, well compressed, upper profile a little more inclined, both rather evenly convex. Snout convex, length half its width. Eye rounded, close to upper profile at first third in head. Mouth large, a little inclined. Maxillary nearly reaches preopercle ridge, expansion $2\frac{3}{4}$ in eye. Teeth minute, in narrow bands in jaws and on each palatine, and a broad patch on each pterygoid. Tongue small, smooth, free. Interorbital slightly concave. Preopercle ridge nearly vertical. Gill opening forward opposite front eye edge. Gill rakers $5+16$, slender, lanceolate, $1\frac{5}{6}$ in eye. Gill filaments $\frac{1}{3}$ of eye, pseudobranchiae trifle less. Scales deciduous, cycloid, enlarged in lateral line. Lateral line slopes gently from shoulder to middle of caudal base. Mandibular photophores in 3 pairs, 2 preoperculars with the upper one a little larger, 5 pectorals,

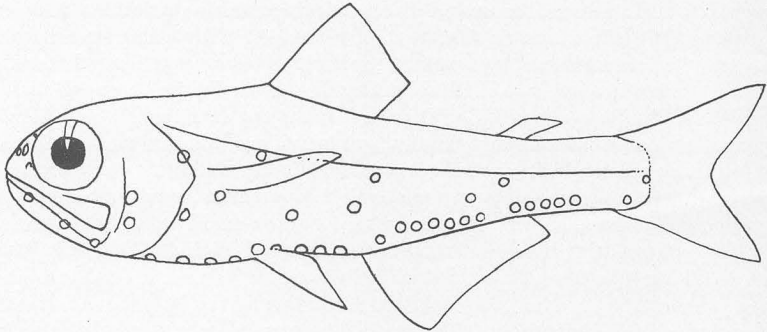


Fig. 177. *Myctophum hygomi*, from Brauer.

4 ventrals, $6+7$ anals, 2 precaudals, 2 subpectorals, 1 suprapectoral, 1 supraventral, 3 supra-anals, and 2 posterolaterals. A single large supracaudal luminous plate posteriorly. Dorsal origin nearer snout tip than caudal base by an eye diameter, first branched ray $1\frac{1}{4}$ in head. Adipose fin inserted midway between last dorsal ray base and caudal base, fin nearly halfway to latter. Anal inserted just after dorsal base, first branched ray $1\frac{1}{4}$ in head. Caudal emarginate. Pectoral slender, pointed, $1\frac{1}{4}$ in head. Ventral origin a trifle before that of dorsal, fin 2 in head.

In alcohol dull brown, with slight dusky tinge. Head and iris silvery white. Photophores white, bases dusky. Length 65 mm.

Atlantic and Indian Oceans. Described above from an example from the Gulf Stream, off eastern United States.

***Myctophum punctatum* Rafinesque**

Figure 178

Myctophum punctatum RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' p. 35, Pl. II, fig. 5. Sicily.—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (Azores, N. lat. $38^{\circ} 17'$, W. long. $26^{\circ} 46' 45''$, surface).

Myctophum (Myctophum) punctatum, MURRAY AND HJORT, 1912, 'The Depths

of the Ocean,' p. 613 (off Morocco, 2300 m.; off Cape Blanco, 214 m.; south of Azores, 2865 mm.).

Scopelus caninianus LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 251, Fig. 9 (Canaries).

Head $3\frac{1}{3}$ to $3\frac{3}{4}$; depth 4 to $4\frac{1}{4}$; dorsal II, 10; anal III, 14, 1? to III, 19, I; scales 41 or 42 in lateral line to caudal base and 3 or 4 more on latter; 3 or 4 scales above lateral line, 4 or 5 below; 13 or 14 predorsal scales; snout 5 to $5\frac{3}{4}$ in head; eye $2\frac{2}{5}$ to $2\frac{7}{8}$; maxillary $1\frac{2}{5}$ to $1\frac{1}{2}$; interorbital $2\frac{3}{4}$ or $3\frac{7}{8}$?

Body elongate, compressed, deepest at pectoral base and tapering back. Caudal peduncle well compressed, least depth about half its length or $2\frac{2}{3}$ in head. Head large, well compressed, upper profile little more abrupt and convex than lower. Snout short, length about half its width. Eye circular, large, a little before first third in head, close to upper profile. Mouth large, well inclined. Maxillary slender, not quite reaching preopercle ridge, or $2/5$ of eye posteriorly. Teeth very minute, low, uniform, apparently uniserial in jaws, upper extending almost back to the hind end of maxillary.

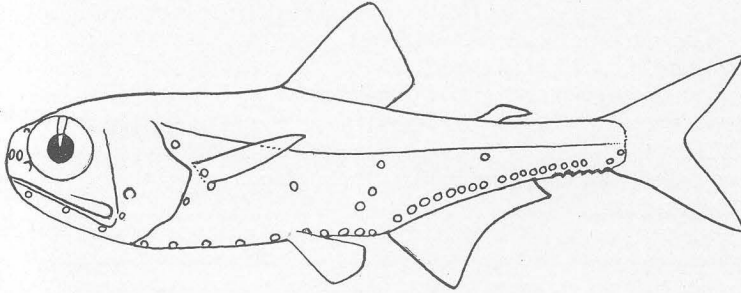


Fig. 178. *Myctophum punctatum*, from Brauer.

Palatine teeth uniserial, small, though quite noticeably larger than jaw teeth. Broad patch of minute teeth on each pterygoid. Tongue small, smooth, free. Interorbital slightly concave. Preopercle edge curved back a little convexly, nearly vertical. Gill opening forward opposite front eye edge. Gill rakers 6 or 7+18 or 19, finely asperous on inner edges, $1\frac{1}{3}$ in eye. Gill filaments half of gill rakers and pseudo-branchiae nearly as long as gill filaments. Scales thin, smooth, moderately exposed. Lateral line slopes gently from shoulder to median caudal base, scales not enlarged. Photophores large, rather conspicuous, mandibular pairs 3, pectorals 5, ventrals 4, anals 8+8, precaudals 2, preopercles 2, subpectorals 2, suprapectoral 1, supraventral 1, supra-anals 3, posterolateral 1; supra-ventral a trifle nearer ventral origin than lateral line; posterolateral on second scale before adipose fin. No luminous caudal plates. Dorsal origin midway between front eye edge and adipose fin origin, fin base $1\frac{3}{4}$ in head. Adipose fin inserted about midway between last dorsal ray base and caudal base. Anal inserted a trifle after last dorsal ray base, fin base about as long as head. Pectoral reaches at least to dorsal origin, or to first sixth in depressed ventral. Ventral origin is a trifle behind that of dorsal, nearly reaches vent, which close before anal.

In alcohol dull brownish, with silvery luster. Fins and iris pale brown. Length 33 to 97 mm.

Atlantic and Pacific Oceans. Described from Italian examples in the Academy. The example I recorded in 1901 as *Myctophum phenogodes* from between Greenland and North America, is the present species, and its characters are also included in the above description.

Myctophum affine (Lütken)

Scopelus affinis LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 252, Fig. 10. N. lat. 1° to 38°, W. long. 17° to 63°; S. lat. 1° to 8°, W. long. 11° to 26°; S. lat. 7° to 39°, E. long. 23° to 110°.

Myctophum (Myctophum) affine BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV, p. 190, Figs. 105-107 (Cape Verde, N. lat. 14° 39' 5", W. long. 21° 51' 8"; Gulf of Guinea, N. lat. 0° 20' 2", W. long. 6° 45'; N. lat. 0° 26' 3", W. long. 6° 32'; N. lat. 0° 25' 8", E. long. 7° 0' 3"; S. lat. 3° 55', E. long. 7° 48' 5"; Benguela, S. lat. 11° 28', E. long. 10° 24').—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (south of Azores, 2865 m.).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 193 (Cape Verde Islands, N. lat. 15° 50', W. long. 25° 23'; southwest of Sierra Leone, S. lat. 5° 59', W. long. 17° 39').

Myctophum affine FOWLER, 1911 (1912), Proc. Acad. Nat. Sci. Philadelphia, p. 570 (between Cape Verde Islands and Uruguay).

Head 3 1/4; depth 4 1/2; dorsal III, 10, I; anal III, 17, I; scales 37 in lateral line to caudal base and 3 more on latter; 14 predorsal scales; snout 5 1/4 in head; eye 2 3/5; maxillary 1 1/2; interorbital 3 3/4.

Body well compressed, moderately long, deepest about pectoral origin. Caudal peduncle compressed, its least depth about half its length or 4 1/8 in head. Head large, well compressed, upper profile a little more inclined and convex than lower. Snout convex over surface, length half its width. Eye circular, close to upper profile, at about the first third in head. Mouth large, but little inclined, commissure large. Maxillary nearly reaches mandibular articulation, not to hind lower preopercle ridge, expansion 3 1/2 in eye. Teeth very minute, in narrow bands in jaws, narrow band on each palatine and broad patch on each pterygoid. Tongue small, smooth, free. Interorbital concave. Preopercle ridge inclined a little posteriorly. Gill opening forward opposite front eye edge. Gill rakers 6+16, slender, lanceolate, 1 3/4 in eye. Gill filaments 2 3/4 in eye, pseudobranchiae 3. Scales deciduous, mostly uniform. Lateral line median along side, complete, slopes from shoulder to caudal base medianly. Mandibular photophores in 3 pairs, 2 preoculars with upper one a little larger, 5 pectorals, 4 ventrals, 8+5 anals, 2 precaudals, 1 suprapectoral, 1 supraventral, 3 supra-anals, 1 posterolateral. Supracaudal luminous plates 5, all rather large. Dorsal origin nearer snout tip than caudal base by eye diameter, base of fin slightly more than half of head. Adipose fin inserted midway between eighth branched dorsal ray and caudal base, fin 2 3/4 to latter. Anal inserted just behind last dorsal ray base, base of fin 1 1/5 in head. Caudal emarginate. Pectoral small, base level with lower pupil edge. Ventral inserted a trifle before dorsal.

In alcohol pale brownish, head largely silvered whitish. Iris silvery white, also photophores, many of latter with brownish pigment basally. Fins pale. Length 71 mm. (caudal damaged).

Warmer Atlantic, Indian, and Pacific Oceans. Described above from the last, in N. lat. $8^{\circ} 37'$, W. long. 168° .

***Myctophum humboldti* (Risso)**

Figure 179

Serpe humboldti RISSO, 1810, 'Ichth. Nice,' p. 358, Pl. x, fig. 38. Nice.

Scopelus humboldti STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1), p. 732 (Canary Islands).—LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 254, Fig. 12 (Azores, Madeira, Cape Verde, Ascension Island, N. lat. 22° to 34° , W. long. 18° to 28° ; S. lat. 7° , W. long. 11°).—COLLETT, 1896, Rés. Camp. Monaco, X, p. 110 (Azores).

Scopelus humboldtii VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 329 (Canaries).

Myctophum (Myctophum) humboldti BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 192, Figs. 108–111 (Canaries, N. lat. $24^{\circ} 43' 4''$, W. long. $17^{\circ} 1' 3''$).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (off Morocco; southwest of Azores).

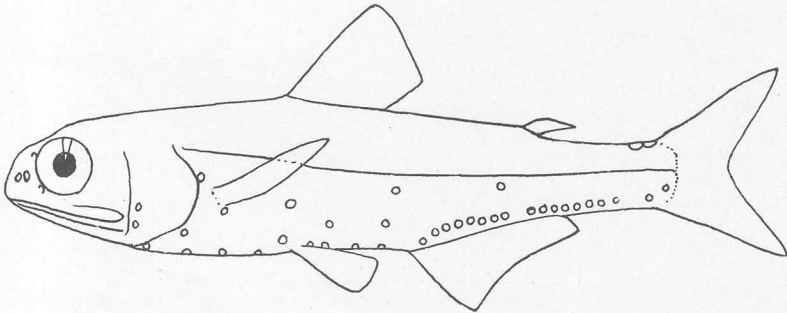


Fig. 179. *Myctophum humboldti*, from Brauer.

Head $3 \frac{2}{5}$; depth $4 \frac{2}{5}$; dorsal 13 to 15; anal 20 to 23; scales in lateral line 40 to 42. Snout 2 in eye. Eye $3 \frac{2}{5}$ in head. Mouth cleft extends beyond eye space equal to snout length. Maxillary slightly expanded behind. Scales cycloid. Two small preorbital luminous organs, one dorsal and the other ventral at front eye edge; 2 preopercular photophores, upper larger and well below lower eye edge, lower behind mouth angle; 3 branchiostegals; 5 pectorals, last one a little higher than ventral origin; subpectorals 2, upper one below lower pectoral base, lower one above second pectoral; 4 ventrals; anals 7 to 9+4 to 9; posterolateral a little before adipose fin below lateral line; precaudals 2, second a little higher; suprapectoral before pectoral fin, nearly opposite lower front subpectoral; supraventral midway between lateral line and ventral; supra-anals 3, first one lowest and over second ventral, second one on the same level over last ventral, third one above vent near lateral line. Luminous plates 1 or 2 supracaudals, infra-caudals 2 or absent. Dorsal begins before middle in body, opposite ventral, ends opposite anal origin. Anal begins behind middle of body,

before last third in body length, ends a little beyond adipose fin. Pectoral within lower half of body depth, nearly reaches ventral. Length 96 mm. (Brauer.)

Atlantic, Indian, and Pacific Oceans.

Myctophum spinosum (Steindachner)

Figure 180

Scopelus spinosus STEINDACHNER, 1867, Sitzs. Akad. Wiss. Wien, LV, p. 711, Pl. III, fig. 4a. China.—LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 239, Pl. I, figs. 1-2 (West Africa between N. lat. 3° to 14°, W. long. 20° to 29°; S. lat. 0° to 7°, W. long. 16° to 30°).

Head 4; depth 4 to 4 1/3; dorsal 13 or 14; anal 19 or 20; scales in lateral line 40. Snout very short, 3 1/3 in eye. Eye 2 2/5 in head. Mouth cleft extends nearly its length beyond eye. Maxillary little expanded behind. Preopercle vertical. Scales ctenoid, lower ones, below which photophores lie, with 3 or 4 large denticles. Small

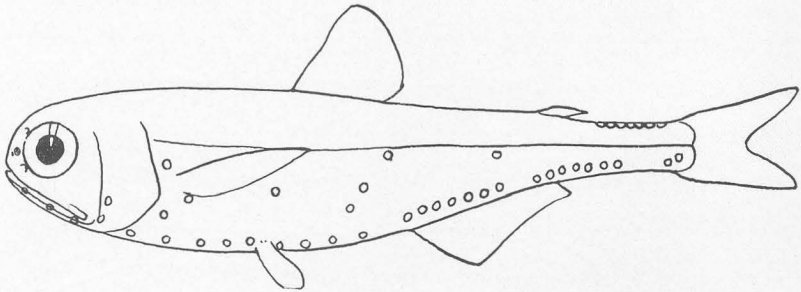


Fig. 180. *Myctophum spinosum*, from Brauer.

preorbital luminous organs 2, one dorsal and other ventral along front eye edge; 2 preopercular photophores, upper one within half of space in head depth below lower eye edge, lower one smaller and a little above mouth angle; branchiostegals 3; pectorals 5, first two interspaces greater than others; subpectorals 2, upper one at lower pectoral base, and lower one a little below level of upper preopercular, or above second pectoral; ventrals 4; anals 6 to 8+5 to 8; posterolateral close to lateral line above last of first group, well before adipose fin; precaudals 2, last slightly elevated; suprapectoral a little before and above pectoral origin, closer than to lateral line, opposite lower subpectoral; supraventral a little nearer lateral line than ventral fin; supra-anals 3, lowest above interspace of third and fourth ventrals, lower than supra-ventral, second a little above first and level with supraventral, third close below lateral line opposite base of last dorsal ray. Supracaudal luminous plates 7, infracaudals 3, or all may be absent in young. Dorsal begins somewhat behind ventral, before middle in body and ends a little before anal origin. End of anal below adipose fin. Pectoral within lower half of body depth, nearly reaches vent. Length 83 mm. (Brauer.)

Atlantic, Indian, and Pacific Oceans.

Myctophum asperum Richardson

Figure 181

Myctophum asperum RICHARDSON, 1844-1848, 'Voy. "Erebus" and "Terror,"' Ichth., p. 41, Pl. XXVII, figs. 13 to 15. Habitat?

Scopelus asper GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 411 (Gulf of Guinea).

Head $3\frac{1}{2}$; depth 4; dorsal 13; anal 20; scales 37 in lateral line, 2 above and 3 below. Depth of head $1\frac{1}{3}$ its length. Snout extremely short, obtuse, upper profile abruptly bent downward. Eye very large, $\frac{2}{5}$ head length; space between hind eye edge and preopercular edge $\frac{1}{3}$ of eye. Mouth nearly horizontal, lower jaw included in upper. Maxillary nearly reaches preopercle angle, slightly expanded behind. Hind preopercle edge vertical. Scales with strongly serrated edges; those in lateral line

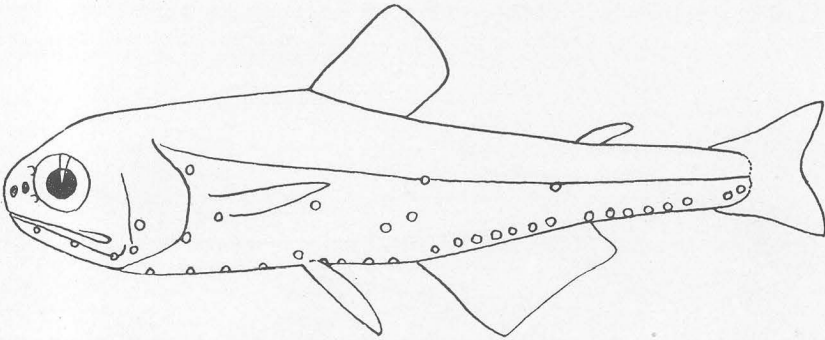


Fig. 181. *Myctophum asperum*, from Brauer.

much larger. Sometimes pearly scales on back of tail. Dorsal origin nearer snout end than caudal base, immediately behind ventral base, last ray a little before anal origin. Pectoral reaches middle of ventral, which is shorter. Length 25 to 50 mm. (Günther.)

Atlantic and Pacific Oceans. Brauer describes the photophores as very much like those in *Myctophum spinosum*.

Myctophum valdiviae Brauer

Figure 182

Myctophum valdiviae BRAUER, 1904, Zool. Anzeiger, XXVIII, p. 398, Fig. 6. Atlantic and Indian Oceans.

Myctophum (Myctophum) valdiviae BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 206, Fig. 127 (south of Canaries, N. lat. $24^{\circ} 43' 4''$, W. long. $17^{\circ} 1' 3''$; Sierra Leone and Gulf of Guinea, N. lat. $5^{\circ} 5' 3''$, W. long. $13^{\circ} 27' 5''$; N. lat. $1^{\circ} 27' 8''$, W. long. $10^{\circ} 16' 5''$; N. lat. $1^{\circ} 51'$, E. long. $0^{\circ} 31' 2''$; N. lat. $2^{\circ} 56' 5''$, E. long. $3^{\circ} 27' 5''$; S. lat. $1^{\circ} 56' 7''$, E. long. $7^{\circ} 40' 5''$; off southwest Africa, S. lat. $26^{\circ} 49' 2''$, E. long. $5^{\circ} 54'$).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 194 (southwest of Ascension Island, S. lat. $11^{\circ} 19'$, W. long. $18^{\circ} 34'$, 1200 m.; southwest of St. Helena, S. lat. $26^{\circ} 59'$, W. long. $17^{\circ} 6'$, 1340 m.; east of Ascension Island, S.

lat. $8^{\circ} 43'$, W. long. $11^{\circ} 55'$, 3000 m.; southwest of Sierra Leone, N. lat. $5^{\circ} 27'$, W. long. $21^{\circ} 41'$, 800 m.; west of Cape Verde Islands, N. lat. $17^{\circ} 28'$, W. long. $29^{\circ} 42'$, 3000 m.).

Head $3\frac{3}{5}$; depth $5\frac{4}{5}$; dorsal 11 or 12; anal 12 or 13; scales in lateral line 30. Snout variably less or more than eye, pointed, keeled. Eye $3\frac{1}{3}$ to 5 in head. Mouth cleft extends about eye diameter beyond eye. Maxillary a little expanded behind. Preopercle slightly inclined. Scales cycloid. Parietal organs show through cranium. Small preorbital luminous body at upper front eye edge; 2 preopercular photophores, upper larger and a little below level of lower eye edge, lower behind mouth angle; branchiostegals 3; pectorals 4, third above interspace of second and fourth, level with lower subpectoral; subpectorals 2, upper at middle of pectoral base, lower slightly advanced and above interspace of first and second pectoral; ventrals 4, first elevated above level of third pectoral, second ventral opposite first, fourth higher than first, opposite vent; anals 4+5 or 6, of first group only first 3 are above anal fin base; posterolaterals 2, first above interspace of anal group, second on back opposite

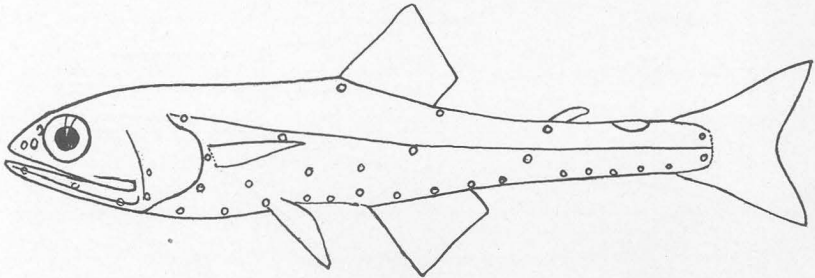


Fig. 182. *Myctophum valdiviae*, from Brauer.

adipose fin origin; precaudals 2, on caudal base, one above and other below lateral line; suprapectoral close below lateral line opposite first pectoral; supraventral close to lateral line above ventral fin base; supra-anals 3, first above last ventral, second opposite middle of anal fin close below lateral line, third on back near end of dorsal fin base; photophore on back close below dorsal fin origin. Supra-caudal luminous plate between adipose fin and caudal, sometimes absent. Dorsal fin begins a little before middle in body. Anal also inserted a little before middle in body, below first third of dorsal, and ends well before adipose fin. Pectoral nearly midway in body depth, reaches above ventral. Length 68 mm. (Brauer.)

Atlantic and Indian Oceans.

***Myctophum cocco* (Cocco)**

Scopelus cocco COCCO, 1829, Giorn. Sci. Lett. Arti Sicilia, No. 77, p. 143. Palermo.

Scopelus coccoi GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 413 (Gulf of Guinea, Congo Expedition, tropic of Cancer in the Atlantic).—COLLETT, 1896, Rés. Camp. Sci. Monaco, X, p. 116 (Azores).

Scopelus (Rhinoscopelus) coccoi LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift.,

Kjøbenhavn, (6) VII, p. 243, Fig. 2 (south Atlantic in N. lat. 13° to 35°, W. long. 3° to 36°; S. lat. 17° to 28°, W. long. 3° to E. long. 10°).

Myctophum (Myctophum) coccoi BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 199, Figs. 116 to 120 (between Azores and Newfoundland, N. lat. 42°, W. long. 43°; Azores, N. lat. 38°, W. long. 13°; between Azores and Bermudas, N. lat. 31°, W. long. 43°; Canaries, N. lat. 26°; N. lat. 30°, W. long. 22°; Cape Verde Islands, N. lat. 12°, W. long. 28°; N. lat. 16°, W. long. 28°; N. lat. 17°, W. long. 30°; N. lat. 4°, W. long. 20°).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (off Morocco, Azores, in 141 to 3239 m.).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 194 (Cape Verde Islands, N. lat. 15° 50', W. long. 25° 23'; west of Ascension Island, S. lat. 8° 51', W. long. 18° 14'; west of Cape Verde, N. lat. 17° 28', W. long. 29° 42', in 3000 m.).

Rhinoscopelus coco FOWLER, 1911, Proc. Acad. Nat. Sci. Philadelphia, p. 570 (between Norfolk, Cape de Verde Islands, and Uruguay).

Rhinoscopelus coccoi VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (off Morocco, N. lat. 34° 41', W. long. 8° 9' 45'', at surface; N. lat. 34° 32', W. long. 8° 42' 45'', at surface).

Alysia loricata LOWE, 1839, Proc. Zool. Soc. London, p. 87. Madeira; 1839, Trans. Zool. Soc. London, III, part 1, p. 14 (Madeira).

Myctophum coruscans RICHARDSON, 1844-1848, 'Voy. "Erebus" and "Terror,"' Ichth., p. 40, Pl. xxvii, figs. 1-5. Between St. Helena and Ascension Island; between Australia and New Zealand.

Myctophum hians RICHARDSON, 1844-1848, 'Voy. "Erebus" and "Terror,"' Ichth., p. 41, Pl. xxvii, figs. 19 to 21. Probably in Southern Ocean?

Scopelus gracilis LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 255, Fig. 13. N. lat. 22°, W. long. 34° to 48°; S. lat. 32° to 35°, E. long. 11° to 55°.

Head $3\frac{1}{4}$ to $4\frac{1}{8}$; depth $4\frac{1}{4}$ to 5; dorsal III, 8, I, seldom III, 9, I; anal III, 17, I, rarely III, 16, I, III, 18, I or III, 19, I; scales 40 to 43 in lateral line; 2 or 3 scales above lateral line, 4 or 5 below; 13 to 16 predorsal scales; snout $4\frac{1}{4}$ to $5\frac{1}{4}$ in head; eye 3 to $3\frac{3}{4}$; maxillary $1\frac{1}{4}$ to $1\frac{3}{5}$; interorbital $2\frac{3}{4}$ to $3\frac{1}{2}$.

Body well compressed, elongated, edges convex, deepest at dorsal origin, tapering back to a slender caudal peduncle; latter with least depth 4 to $4\frac{1}{4}$ its length or about 7 in head. Head well compressed, obtuse in front, upper profile a little more convex than lower, width $2\frac{1}{2}$ its length. Snout short, obtuse, length $\frac{1}{2}$ to $\frac{3}{4}$ its width. Eye large, circular, at about first third in head. Mouth large, little inclined. Maxillary slender, straight, extends back nearly an eye diameter beyond eye or nearly to lower edge of preopercle ridge. Row of minute uniform teeth along each jaw edge, on palatines, and a still smaller series on each pterygoid. Series of small teeth transversely across vomer or absent. Tongue is a small free knob. Interorbital evenly convex. Hind preopercle edge well inclined back. Gill opening forward about opposite front eye edge. Gill rakers 3 to 6+7 to 10, lanceolate, slender, edges inside minutely asperous, 1 to $1\frac{1}{4}$ in eye. Gill filaments about equal gill rakers, pseudo-branchiae about half as long. Scales smooth, cycloid, more or less adherent, median series forming course of lateral line is enlarged and narrowly imbricated. A single interorbital photophore, mandibulars 3 pairs, pectorals 5, ventrals 4, anals 5 or 6+12, precaudals 2, suprapectoral 1, supra-anals 3, supra-ventral 1, posterolateral 1, sub-pectoral 2, of which one is at fin base and other on shoulder girdle edge below; su-

pracaudals none to 8, infraudals none to 3; obsolete photophore at hind base of adipose fin; opercle with 2 photophores in lower front portion on each side of head. Dorsal origin nearer snout tip than caudal base by about 2/3 length of head. Adipose fin inserted about midway between dorsal origin and caudal base. Anal inserted opposite last dorsal ray base or about midway between eye center and caudal base. Caudal emarginate. Pectoral small. Ventral inserted a trifle nearer pectoral than dorsal origin.

In alcohol largely dusky, lower surface often more slaty or blackish than upper. Sides of head and trunk with a metallic brown luster. Iris pale. Fins whitish, dorsals and caudal dusky basally. Photophores pearly, with dusky or blackish edges. Length 22 to 49 mm.

Atlantic, Indian, and Pacific Oceans. Described from examples obtained in the South Atlantic, Italy, and the Gulf Stream.

I have been unable to consult the original account by Cocco, though his rough figure¹ agrees in showing no enlarged scales in a lateral series and in showing no lateral line. Otherwise his figure appears of little value; it is largely at variance with his description. The squamation is further vindicated on his figure, as he shows about 40 scales in a lateral series. Bonaparte's figure is also poor, showing but few of the photophores. It indicates a lateral line with the enlarged scales, like that by Goode and Bean.

Variation in the anal photophores is quite noticeable, and though they are usually 6+12, variants 5+12, 6+1+10, 2+3+12 or 6+11 are met with. Sometimes the opercle has a single lower photophore, though often there is a smaller obsolete one below, or in one case on the upper hind edge. Half the examples show 8, frequently 7, large white supracaudals. In other examples they are absent. Some specimens are still brightly colored, in alcohol largely deep dusky or blackish, with brilliant purple and bottle-green metallic reflections. Iris silvery. Photophores all whitish, encircled with dusky. Dusky spot at base of each tube in a lateral line, both above and below. Each side of snout pale or whitish. In none of my examples is the lateral line continued beyond the adipose fin or to any extent along the side of the caudal peduncle.

Myctophum rarum (Lütken)

Figure 183

Scopelus (Rhinoscopelus) rarus LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 246, Fig. 4. Northeast of Lesser Antilles (N. lat. 33°; N. lat. 20°, W. long. 50° to 48°; S. lat. 34° 50', W. long. 4° 30'; S. lat. 37° 40', E. long. 12°).

Myctophum (Myctophum) rarum BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 240, Figs. 123-124 (south of Cape Verde, N. lat. 4° to 10°, W. long. 29°).

Myctophum (Myctophum) rarum forma integer BRAUER, *op. cit.*, p. 205, Figs. 125-126. Madeira, N. lat. 34° to 36°, W. long. 30° to 16°; Gulf of Guinea, S. lat. 3° 55', E. long. 7° 48' 5".—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 194 (southwest of St. Helena, S. lat. 23° 33', W. long. 20° 51', 3000 m.).

¹ Nuovi Ann. Sci. Nat., Bologna, 1838, II, p. 178, Pl. vi, fig. 6.

Head 4; depth $5\frac{1}{2}$; dorsal 13; anal 7; scales 38 to 40 in lateral line. Snout protruding, conic, $1\frac{1}{2}$ in eye. Eye $3\frac{1}{3}$ in head. Mouth cleft reaches eye diameter beyond hind eye edge. Preopercle inclined. Scales cycloid. Two small preorbital luminous bodies, one dorsal and one ventral on front eye edge; 2 preoperculars, low, behind mouth cleft; branchiostegals 3; pectorals 5 or 6, first 2 and last interspaces widest; subpectorals 2, front one lower and opposite interspace of first and second pectorals and upper at lower pectoral fin base; ventrals only 2, front one close behind ventral base and second one close before vent; anals 6 to $8+5$ to 7, first group only above anal base; posterolateral a little below lateral line and below adipose fin, pre-caudals 2, on same level; suprapectoral close before pectoral origin, smaller than subpectorals; supraventral nearer ventral fin than lateral line; supra-anals 3, in a slightly inclined row from vertical above vent, upper and median opposite and a little backward. Supracaudal luminous plate is sometimes present. Dorsal begins a little be-

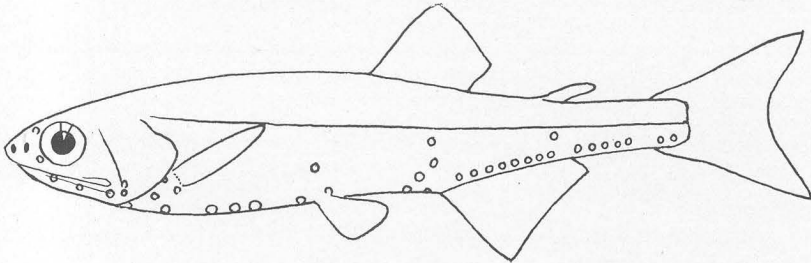


Fig. 183. *Myctophum rarum*, from Brauer.

hind middle in body length and ends above fourth to sixth anal rays. Anal begins below middle of dorsal, ends below adipose fin. Pectoral low, nearly reaches ventral. Ventral inserted before middle in body. Length 29 mm. (Brauer.)

Atlantic Ocean.

***Myctophum nigro-ocellatum* (Günther)**

Scopelus nigro-ocellatus GÜNTHER, 1873, Jour. Mus. Godeffroy, I, part 4, No. 4, p. 91. South Atlantic Ocean; 1889, 'Rept. Voy. "Challenger,"' XXXI, p. 30 (type).

Scopelus (Rhinoscopelus) andreae LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 245, Fig. 3. N. lat. 14° to 40° , W. long. 12° to 78° ; S. lat. 4° to 33° , W. long. 11° to 28° ; S. lat. 5° to 38° , E. long. 12° to 81° ; S. lat. 15° to 33° , E. long. 57° to 110° .

[*Centrobranchus choerocephalus* FOWLER, 1903, Proc. Acad. Nat. Sci. Philadelphia, LV, p. 754. Near Hawaiian Islands.]

Myctophum (Myctophum) choerocephalum MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (N. lat. $30^{\circ} 8'$, W. long. $31^{\circ} 19'$; N. lat. $34^{\circ} 59'$, W. long. $33^{\circ} 1'$, 2865 m., south of Azores).

Head contained $3\frac{7}{8}$ times in body to caudal base; depth 5. Dorsal rays 10; anal 18. Scales 35 in median lateral series to caudal base; about 6 scales in transverse series. Snout $4\frac{1}{2}$ times in head; eye $3\frac{2}{3}$; maxillary $1\frac{3}{4}$; interorbital space $3\frac{1}{2}$.

Body elongate, well compressed, slender and tapering posteriorly. Caudal peduncle long, slender, least depth 5 times in head. Head width $2\frac{1}{3}$ in its length. Snout conic, a little shorter than eye. Eye near first third in head. Mouth large, inferior. Maxillary reaches well beyond eye, slender. Teeth minute, in narrow bands in jaws, on vomer, and palatines. Interorbital convex. Gill rakers 3+5 clusters or groups of inconspicuous prickles on first arch. Scales large, entire, cycloid, stiff, rather narrowly imbricate along middle of side; a few small scales on caudal base, fins otherwise naked. No lateral line. Mandibular photophores 3; 1 photophore low on opercle anteriorly; 1 interorbital; 1 at lower base of pectoral fin, another just below along edge of gill opening; 5 pectorals; 4 ventrals; 5+10 anals; 1 supraventral; 3 supra-anals; 1 posterolateral; precaudals 1 above and 2 below; 6 large luminous scales behind adipose fin. Dorsal fin inserted nearer snout tip than caudal base; adipose fin long, placed a little before the end of anal base; anal inserted nearly midway between hind pupil edge and caudal base; pectoral small; ventral inserted near last third between pectoral and dorsal origins.

Deep dusky, with iridescent bluish, purplish, and silvery reflections. Fins plain pale brownish. Photophores black, with bright silvery centers. Supracaudal luminous scales with dull yellowish. Iris dull dark yellowish. Length 40 mm.

Atlantic, Indian, and Pacific Oceans. Described above from the types of *Centrobranchus choerocephalus* obtained near the Hawaiian Islands.

Scopelus nigro-ocellatus Günther from the South Atlantic¹ is described as follows:

Head $3\frac{1}{2}$; depth somewhat less than 4; dorsal 11; anal 17; scales 36 in lateral line; 2 scales above lateral line, 5 below. Snout conic, less than eye, with luminous organ on each side. Eye 3 in head, without supraorbital thorn. Scales smooth. Dorsal origin a little nearer snout than caudal peduncle behind ventral base. Caudal peduncle slender. Ventral not elongated. Photophores encircled by broad black ring. Length 25 mm.

Myctophum risso (Cocco)

Figure 184

Scopelus risso Cocco, 1829, Giorn. Sci. Lett. Arti Sicilia, LXXVII, pp. 15, 144, Pl. II, fig. 5. Messina.

Scopelus rissoi GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 405 (Madeira).—COLLETT, 1896, Rés. Camp. Sci. Monaco, X, p. 113 (northeast of Azores).

Myctophum (Myctophum) rissoi BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 170, Fig. 83 (Gulf of Guinea, N. lat. $0^{\circ} 25' 8''$, E. long. $0^{\circ} 3''$, in 2000 m.).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 21 (between Azores and Portugal in N. lat. $43^{\circ} 4' 30''$, W. long. $19^{\circ} 42'$, to surface).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (off Morocco; Azores, 3239 m.).

Head $2\frac{2}{5}$; depth $2\frac{1}{2}$; dorsal III, 10?; anal III, 12?; scales 31 in lateral line to caudal base, others on latter fallen; 2? scales above lateral line, 3 below; snout 7 in head measured from upper jaw tip; eye $2\frac{1}{8}$; maxillary $1\frac{1}{2}$; interorbital $4\frac{1}{8}$.

¹ Günther says that it resembles *Rhinoscopelus cocco*, but is without the enlarged scales of the lateral line.

Body well compressed, contour ovoid, deepest at pectoral origin, upper profile a little more convex. Caudal peduncle well compressed, least depth equals its length or $3 \frac{1}{8}$ in head. Profiles of head similarly inclined convexly, flattened sides not converging above or below, width $2 \frac{1}{4}$ its length. Snout short, length $\frac{3}{4}$ its width. Eye large, about first $\frac{2}{5}$ in head. Mouth large, well inclined, jaws firm. Maxillary slips below infraorbital its whole length, expansion 2 in eye, reaches hind pupil edge. Teeth minute, in narrow bands in jaws, on palatines, none on vomer. Mandible protrudes well before snout tip, shallow. Preopercle ridge nearly vertical. Interorbital a little concave. Gill opening extends well forward, nearly opposite front eye edge. Gill rakers about $3+16$, slender, $\frac{1}{2}$ of eye. Gill filaments about $\frac{1}{3}$ of eye. Scales large, mostly adherent, smooth, thin, well exposed. Lateral line complete, median on sides, of simple tubes, each scale in its course greatly enlarged and narrowly

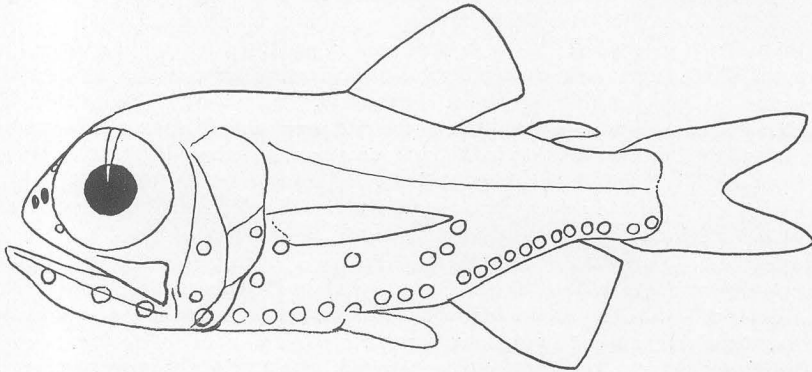


Fig. 184. *Myctophum risso*, from Brauer.

imbricated. Photophores large and conspicuous, mandibular pairs 3, pectorals 5, ventrals 4, anals 11, precaudals 2, opercles 2, subpectorals 2, supra-ventral 1, supra-anals 3. Dorsal origin about midway (?) between mandible tip and caudal base. Adipose fin inserted apparently a little nearer caudal base than last dorsal ray base. Anal inserted about opposite eighth dorsal ray base, a little nearer pectoral origin than caudal base. Pectoral with median rays longest, reaches about $\frac{2}{3}$ to anal. Ventral inserted about first $\frac{2}{5}$ in depressed pectoral.

In alcohol largely brownish, pale or whitish below and scales with silvery sheen like side of head. Iris silvery. Length 50 mm.

Eastern Atlantic and Indian Oceans. Described above from an Italian example.

CYPHOSCOPELUS Fowler

Cyphoscopelus FOWLER, 1925 (March 31), Amer. Mus. Novit., No. 162, p. 2. Type: *Scopelus langerhansi* Johnson. Orthotypic.

Distinguished from *Myctophum* chiefly by the increased anal rays and the advanced dorsal fin, which begins over the pectorals.

Johnson compares the type species with *Rhinoscopelusocco*, though it differs at once in the above characters. In some respects, as the photophores, it approaches *Myctophum antarcticum* (Günther), though its fins are entirely different.

(Κῦφος, hump, with reference to the forward dorsal; *Scopelus*, an old name for *Myctophum*.)

Cyphoscopelus langerhansi (Johnson)

Scopelus langerhansi JOHNSON, 1890, Proc. Zool. Soc. London, p. 454, Fig. (scales). Madeira.

Head $3\frac{2}{5}$; depth $5\frac{1}{4}$; dorsal 12; anal 24; pectoral 14; ventral 8. Body compressed, elongate. Head large. Snout very short, about half of eye. Eye round, large, 3 in head. Rictus reaches posterior part of orbit. Maxillary expanded behind. Minute teeth in brushlike bands in jaws and on palatines, innermost ones rather larger. Teeth on vomer and ectopterygoids roughened with asperities. Interorbital concave, at fore part thin bony crest along snout. Scales very caducous, cycloid, thin. Gill covers scaly. Lateral line begins at upper angle of opercle, falls rapidly until middle of dorsal base, then median to caudal base, scales very large, transversely elliptical and imbricated. Photophores in 2 longitudinal rows, 8 each on belly; row more widely separated halfway between median line of belly and lateral line; a few just below lateral line and closely spaced row of about 20 each side of anal up to caudal base. Dorsal fin begins over pectoral base, much before that of ventral, depressed fin not extending back so far as end of anal. Adipose fin a little before hind end of anal base. Anal begins a little behind the posterior end of first dorsal base. Caudal furcate. Pectoral long, narrow, inserted near edge of opercle, reaches much beyond ventral base, nearly as far as ventral tips, $4\frac{2}{5}$ in combined head and trunk. Ventrals (?) blackish, photophores silvery. Inside of mouth and gill openings black. Length 129 mm. (caudal damaged). (Johnson.)

Madeira.

LAMPANYCTUS Bonaparte

Lampanyctus BONAPARTE, 1840, 'Fauna Ital.,' Pesci, fasc. XXVII. Type: *Serpe crocodilus* Risso. Monotypic.

Ceratiscopelus GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 405. Type: *Scopelus maderensis* Lowe. Monotypic.

Notoscopelus GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 405 (415). Type: *Lampanyctus resplendens* Richardson. (Designated by Goode and Bean, 1895, 'Ocean. Ichth.,' p. 82.)

Notoscopellus auct.

Nannobrachium GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 199. Type: *Nannobrachium nigrum* Günther. Monotypic.

Stenobrachiis EIGENMANN AND EIGENMANN, 1890, Proc. California Acad. Sci., III, p. 4. Type: *Stenobrachiis leucopsarum* Eigenmann and Eigenmann. Orthotypic.

Catablemella EIGENMANN AND EIGENMANN, 1890, *op. cit.*, III, pp. 3, 24. Type: *Catablemella brachychir* Eigenmann and Eigenmann. Orthotypic.

Nyctimaster JORDAN, 1921, Proc. U. S. Nat. Mus., LIX, p. 645. Type: *Lamppanyctus jordani* Gilbert. Orthotypic.

Body oblong, compressed, slender. Caudal peduncle rather robust. Head compressed. Eye large. Mouth large, jaws subequal. Premaxillary very long, slender. Preopercular edge more or less oblique. Gill rakers long, slender. Scales cycloid, deciduous. Lateral line well developed, scales not enlarged. Luminous bodies usually on upper and lower edges of caudal peduncle, none on forehead. Caudal photophores 3 or 4. Dorsal fin large, not notably shorter than anal, inserted little if any behind ventrals, and rays 11 to 24. Anal rays 9 to 19. Pectoral inserted low, narrow, well developed.

KEY TO THE SPECIES

- a.—LAMPANYCTUS. Upper subpectoral photophore above pectoral base.
- b.—Luminous precaudal scales usually present, also sometimes extending along ventral edge of body and side of back; 3 or 4 precaudal photophores, usually well separated from anal photophores.
- c.—Pectoral and ventral photophores all on the same level; supra-anal photophores in a steeply oblique row; posterolateral photophores 2; eye moderately large.
- d.—Precaudal luminous scales, also along anal fin base and between ventral and anal fins; no luminous scales on back above lateral line medially; dorsal rays 13; anal rays 13; pectoral reaches anal.....*warmingii*.
- dd.—No precaudal luminous scales; row of luminous scales on back below dorsal and above and parallel with lateral line; dorsal rays 21 to 24; anal rays 17 to 19; pectoral reaches ventral.
resplendens.
- cc.—Last pectoral photophore and second ventral photophore above the level of the row; supra-anal photophores in an abruptly arched oblique row; anal photophores 4 to 6+3 to 5; eye large; dorsal equals or shorter than anal; pectoral reaches at least to anal.
- e.—Antero-orbital luminous body dorsal on snout; 3 postorbital luminous organs at hind edge of eye; photophores all very small; luminous scales at bases of dorsal, anal, and ventral fins; dorsal rays 11 to 13; anal rays 13 to 15.
longipes.
- ee.—Antero-orbital luminous body ventral on snout; postorbital photophore very small; dorsal rays 13 or 14; anal rays 13 or 14.
- f.—Ventral photophores 6; luminous scales along dorsal and anal fin bases, at base of ventral fin and between anal and caudal fins.....*gaussi*.
- ff.—Ventral photophores 5; numerous luminous scales along dorsal fin.....*güntheri*.
- bb.—Luminous scales only on edge of caudal peduncle; only 1 small antero-orbital luminous body; subpectoral photophores always above ventral fin; next to last pectoral photophore elevated above row; supra-anal

photophores in blunt angle; posterolateral photophores 2, in oblique row, seldom 1; precaudal photophores 1 or 2.

g.—Pectoral fin very short, not reaching ventral; no photophores on cheek or at shoulder; anteroanal photophores at same level.

h.—Both precaudal photophores follow obliquely from last anals to lateral line.

i.—Dorsal fin inserted a little before middle in body, ends above middle of anal; anal rays 16 to 18. *micropterus*.

ii.—Dorsal fin median, ends above first third of anal; anal rays 14 to 16. *oculeus*.

hh.—Upper precaudal photophore above lower; anal rays 16 to 19. *niger*.

gg.—Pectoral very long, reaching at least to anal origin.

j.—No photophores on cheek or shoulder; anal photophores 6+6; dorsal rays 14; anal rays 18. *tenuiformis*.

jj.—Photophore on cheek, none on shoulder.

k.—One photophore on cheek, none on shoulder; anteroanals on same level; anals 4 to 8+8 or 9; last precaudal photophore above and before the most posterior; anal rays 15 to 18; pectoral reaches to end of anal.

. *pusillus*.

kk.—Two photophores on cheek; anteroanals on same level; anals 6 or 7+7 to 9; last precaudal above lower and most posterior; anal rays 16 to 18; pectoral reaches anal origin. *gemmifer*.

kkk.—Three photophores on cheek; first anteroanal somewhat lowered; anals 4 to 8+6; upper precaudal above lower; anal rays 17 or 18; pectoral reaches anal origin.

. *crocodilus*.

jjj.—No photophore on cheek, 1 on shoulder; first anteroanal lowered; anals 4 to 6+8 to 10;

lower precaudal advanced; dorsal rays 12 to 14; anal rays 18 or 19; pectoral reaches anal. *macropterus*.

aa.—*CERATOSCOPELUS*. Upper subpectoral photophore not above pectoral base; small spine above each eye. *maderensis*.

Lampanyctus warmingii (Lütken)

Figure 185

Scopelus (Nyctophus) warmingii LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 256, Fig. 18. South of Azores (N. lat. 32° 6', W. long. 39° 28').

Myctophum (Lampanyctus) warmingi BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 229, Fig. 19 (Canaries, N. lat. 24° 43' 4", W. long. 17° 1' 3"; Gulf of Guinea, N. lat. 1° 51', E. long. 0° 31' 2").—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (southwest of Azores, in 3886 m.).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 195 (southwest of Ascension Island in S. lat. 11° 9', W. long. 18° 34', in 1200 m.; south of St. Helena in S. lat. 30° 21', W. long. 14° 2'; S. lat. 24° 55', W. long. 1° 18', in 1500 m.).

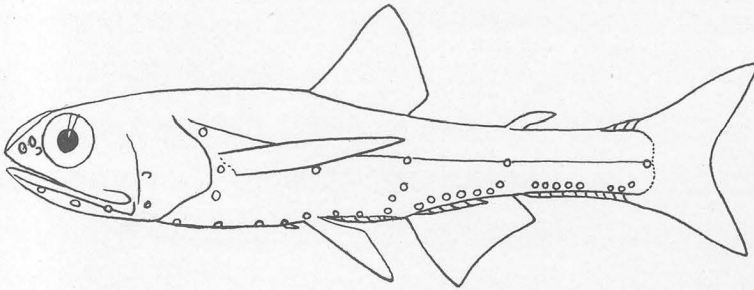


Fig. 185. *Lampanyctus warmingii*, from Brauer.

Head 3 to 3 1/3; depth 5; dorsal 13; anal 13; eye 3 to 3 1/2 in head; snout 2 in eye. Snout with median keel, but no frontal points. Mouth cleft extends a snout length beyond eye. Maxillary little expanded behind. Scales cycloid. Small pre-orbital photophore, somewhat below middle of front eye edge; 2 behind preopercle edge below, upper close below lower eye edge, somewhat larger than lower one; 3 branchiostegals; pectorals 5, last at ventral origin slightly higher; subpectorals 2, somewhat before vertical of second pectoral, upper one under pectoral base and lower one somewhat higher than lower preopercular; ventrals 4, second and third a little higher than others; anals 5 or 6 + 4 or 5, in 2 groups, just above anal and second along side of caudal peduncle; posterolaterals 2, first one a little above and behind last of first anal group, second at lateral line under adipose fin; precaudals 4, first 3 in a row near rudimentary caudal rays and upper one at lateral line a little posterior, at middle of caudal base; suprapectoral a little before subpectorals, close below lateral line; supraventral a little nearer lateral line than ventral; supra-anals 3, first one lowest, close behind and above last of ventrals, second one is but slightly before third, which

is more distant and at lateral line opposite base of last dorsal ray. Luminous pectoral scale close before ventral origin, ventrals 4, anals 7, precaudals 12 below and 4 above. Dorsal origin midway in body, slightly behind ventral, and base ends close before anal origin. Anal ends below adipose fin. Pectoral midway in body depth, reaches anal. Length 60 mm. (Brauer.)

Eastern Atlantic and Indian Oceans.

Lampanyctus resplendens Richardson

Figure 186

Lampanyctus resplendens RICHARDSON, 1844–1848 [before March 1, 1845], 'Voy. "Erebus" and "Terror,"' Ichth., p. 42, Pl. xxvii, figs. 16 to 18. Gulf of Guinea.

Scopelus resplendens GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 415 (type: Gulf of Guinea).

Scopelus caudispinosus JOHNSON, 1863, Proc. Zool. Soc. London, XXXIII, p. 42. Madeira.—GÜNTHER, 1864, *op. cit.*, V, p. 416 (type).

Scopelus elongatus LÜTKEN, 1891 (1892), Vid. Med. Nat. För. Kjöbenhavn, p. 808 (south of Cape Verde, N. lat. 3° 10', W. long. 20° 30').

Myctophum (Lampanyctus) elongatum BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 232, Figs. 152–153 (Gulf of Guinea and west of Cape Colony).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 196 (off Senegal, N. lat. 11° 13', W. long. 25° 6', in 3000 m.).

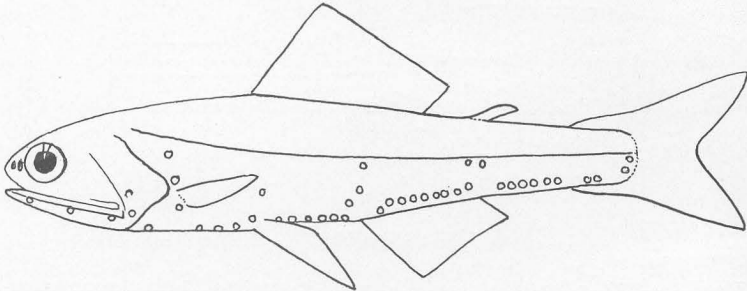


Fig. 186. *Lampanyctus resplendens*, from Brauer.

Head $3\frac{4}{5}$; depth 5; dorsal 21 to 24; anal 17 to 19; scales in lateral line 39; snout 2 in eye; eye $3\frac{2}{3}$ to $4\frac{1}{10}$ in head. Mouth cleft reaches more than eye diameter behind eye. Maxillary little expanded terminally. Preopercles inclined. Scales cycloid. Small preorbital luminous body, above front eye edge; 2 photophores below at hind preopercle edge, upper somewhat larger and nearly level with lower eye edge, lower behind angle of jaw; 3 branchiostegals; 5 pectorals, last at ventral origin, little elevated; subpectorals 2, opposite space between first and second pectorals; 5 or 6 ventrals; anals 8 to 10+6 or 7, first group above anal with first anteroanal little lower than others and last little higher, second group along lower side of caudal peduncle; 2 postero-laterals, equally high and close below lateral line, also below adipose fin; 3 or 4 precaudals, of which first 2 level with the last group of anals and 3

higher on caudal base, sometimes also fourth on the caudal base; 1 suprapectoral above subpectorals, nearer lateral line than pectoral fin; 1 supraventral, little nearer ventral fin than lateral line; sometimes row of 10 photophores below dorsal parallel and above lateral line. Dorsal and ventral origins opposite, before middle of body. Dorsal ends over middle of anal. Anal ends below adipose fin. Pectoral low, well below middle of body, reaches ventral. Length 125 mm. (Brauer.)

Atlantic and Mediterranean. According to Richardson¹ the sixty-third plate in his account of the "Erebus" and "Terror" fishes was published March 1, 1845. This shows priority over *Scopelus elongatus* Costa.²

***Lampanyctus longipes* (Brauer)**

Figure 187

Myctophum (Lampanyctus) longipes BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 236, Fig. 155. Madeira (N. lat. 31° 59' 3", W. long. 15° 5'); Gulf of Guinea (N. lat. 0° 25' 8", E. long. 7° 0' 3"); Indian Ocean, south and north of Cocos Island; Bay of Bengal; south of Ceylon; Chagos Archipelago; Seychelles.

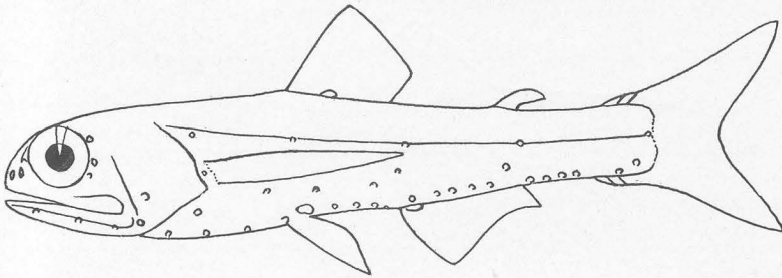


Fig. 187. *Lampanyctus longipes*, from Brauer.

Head $3\frac{2}{5}$; depth $5\frac{1}{3}$; dorsal 11 to 13; anal 13 to 15; scales in lateral line 35 or 36; snout 3 in eye; eye 3 to $3\frac{1}{3}$ in head. Mouth cleft reaches somewhat over half eye diameter behind eye edge. Maxillary somewhat expanded posteriorly. Preopercle little inclined. Scales cycloid. Luminous organs as follows: small luminous organ above front eye edge; 3 photophores close behind hind eye edge; 2 below hind preopercle edge, the upper one somewhat below lower eye edge and lower little below mouth angle; 3 branchiostegals; 5 pectorals, 2 subpectorals, the front one at middle of pectoral base and lower little advanced, somewhat nearer second pectoral; 5 ventrals, of which second highest; 4 to 6+3 to 5 anals, first group above anal fin and the second group on lower side of caudal peduncle; 2 weak posterolaterals, upper at lateral line at end of adipose fin; 3 precaudals, second small and somewhat above first and third close above lateral line; 1 suprapectoral, above subpectorals close below lateral line; 1 supraventral, close below lateral line;

¹ 1846, Rep. British Assoc. Adv. Sci. ('Ichth. China Jap.').

² 1846, 'Fauna Napoli,' Pesci, fasc. 46, p. 2, Pl. xxxv. Ercolano.

supra-anals 3, in inclined row, first above last ventral photophore and equally high with second ventral photophore; the second supra-anal somewhat higher than first, above anal origin, and the third at lateral line, most posterior or at end of dorsal fin; 2 precaudal luminous bodies, one above and 2 or 3 ventral, a small one at anal origin, another at seventh dorsal ray base and one near ventral axil; also minute luminous dots on head within interorbital, others on body. Dorsal and ventral origins at same vertical, before middle in body. Anal origin below end of dorsal, ends below end of base of adipose fin. Pectoral base midway in body depth, fin reaches little beyond anal origin. Length 32 mm. (Brauer.)

Atlantic and Indian Oceans.

Lampanyctus gaussi (Brauer)

Figure 188

Myctophum (Lampanyctus) gaussi BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 235, Fig. 154. "Material der deutschen Südpol-Expedition."—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 196 (southwest of Ascension Island, S. lat. 14° 3', W. long. 19° 10', 900 m.; southwest of Sierra Leone, N. lat. 0° 46', W. long. 18° 59', 3000 m.; N. lat. 5° 27', W. long. 21° 41', 1903 m.).

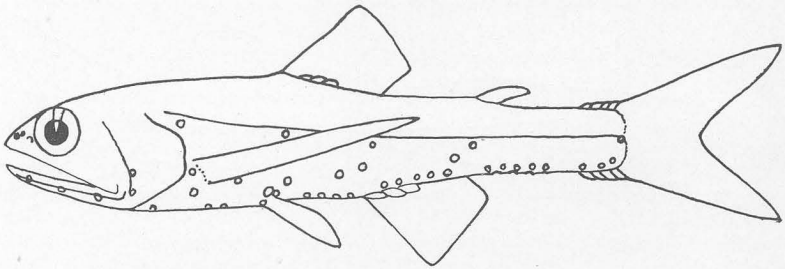


Fig. 188. *Lampanyctus gaussi*, from Brauer.

Head 3 1/2; depth 5 1/2; dorsal 13 or 14; anal 13 or 14; snout 2 in eye; eye 3 7/10 in head; interorbital 1 1/2. Mouth cleft extends nearly an eye diameter behind orbit. Maxillary little expanded behind. Preopercle oblique. Scales cycloid. Small preorbital luminous body at front eye edge; 2 photophores at preopercle edge, upper one larger and somewhat below lower eye edge, lower one at jaw angle; branchiostegals 3; pectorals 5; fourth highest, nearly as high as upper subpectoral, or above space between third and fifth, space between first and second greatly broader than that between third and fifth, that between second and third narrowest; subpectorals 2, upper little before middle of pectoral base, somewhat higher than upper preopercular; ventrals 6, second elevated; anals 4 to 6+5 or 6, only first group above base of anal; posterolaterals 2, above and behind last of first anal group, upper close to lateral line below adipose fin origin; precaudals 4, first 3 closer and on the same level, last one at lateral line; suprapectoral close below lateral line, little before subpectorals; supraventral at lateral line opposite dorsal origin; supra-anals 3, uppermost is close below lateral line, a little behind lower, which is opposite anal origin, and anterior

or lowest one is above fifth ventral; 6 luminous scales between anal and caudal, 3 each side of front half of dorsal and anal, 1 at ventral origin between last pectoral photophore and first ventral, and also upper and lower precaudal on short rudimentary caudal rays. Dorsal origin little behind that of ventral, before middle in body, and ends somewhat behind anal origin. Latter behind middle, before last third in body, fin ending below adipose fin origin. Pectoral low, at middle of lower half in body depth, very long, reaches nearly to end of anal. Length 38 mm. (Brauer.)

South and eastern Atlantic.

***Lampanyctus güntheri* Goode and Bean**

Figure 189

Lampanyctus güntheri GOODE AND BEAN, 1895 'Ocean. Ichth.,' p. 79, Fig. 90. Obtained by the Gloucester fleet.

Myctophum (Lampanyctus) güntheri PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 196 (southwest of Ascension Island; S. lat. 14° 3', W. long. 19° 10', 1900 m.; northwest Cape Verde Islands, N. lat. 17° 28', W. long. 29° 42', 3000 m.).

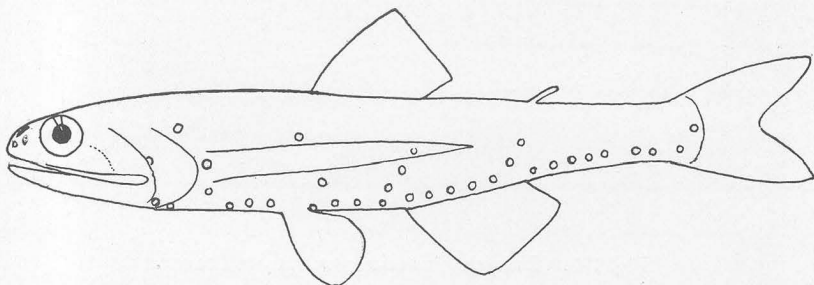


Fig. 189. *Lampanyctus güntheri*, from Goode and Bean.

Head $3\frac{2}{3}$; depth $5\frac{1}{2}$; dorsal 13; anal 13; scales 36. Snout short, about half diameter of eye. Eye nearly 4 in head. Mouth oblique, very large. Maxillary very little expanded behind, extends nearly to preopercle angle. Upper jaw about $\frac{2}{3}$ of head. Scales 9 between hind edge of adipose fin and caudal base. Supra-anal photophores 3; posterolaterals 2; precaudals 3 or 4, last at end of lateral line; posterolaterals in advance of adipose dorsal, forming a gently curved series continuous with front half of broken anal series. Dorsal origin a little nearer snout tip than caudal root, immediately over ventral origin and eleventh or twelfth scale of lateral line. Anal origin below sixteenth scale of lateral line, base short, about $\frac{2}{3}$ of head. Adipose fin small, entirely behind anal base. Least depth of caudal peduncle is one-half of greatest body depth. Length 52 mm. (Goode and Bean.)

Atlantic Ocean, in warmer regions.

***Lampanyctus micropterus* (Brauer)**

Figure 190

Myctophum (Lampanyctus) micropterus BRAUER, 1906, 'Wiss. Ergebn. "Val-

divia," XV (1), p. 239, Fig. 157. Gulf of Guinea, N. lat. $0^{\circ} 26' 3''$, W. long. $6^{\circ} 32'$; S. lat. $1^{\circ} 51'$, E. long. $0^{\circ} 31' 2''$; N. lat. $2^{\circ} 36' 5''$, E. long. $3^{\circ} 27' 5''$; N. lat. $3^{\circ} 10'$, E. long. $5^{\circ} 28' 5''$; S. lat. $1^{\circ} 56' 7''$, E. long. $7^{\circ} 40' 6''$; west coast of Sumatra; north of Chagos Archipelago; east of Seychelles.—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (southwest of Azores in 3886 m.; west of Azores).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 197 (northwest of Cape Verde Islands, N. lat. $20^{\circ} 41'$, W. long. $31^{\circ} 53'$, in 3000 m.).

Myctophum (Lampanyctus) oculum (not Garman) BRAUER, 1904, Zool. Anzeiger, XXVIII, p. 396 (Valdivia collections).

Head $3 \frac{1}{5}$ to $3 \frac{1}{2}$; depth 5 to $5 \frac{1}{2}$; dorsal 13 to 16; anal 16 to 18; scales 35 in lateral line; snout $1 \frac{1}{5}$ to $1 \frac{1}{4}$ in eye; eye $4 \frac{1}{5}$ to 5 in head. Mouth cleft reaches more than an eye diameter beyond eye. Maxillary slightly expanded behind. Preopercle oblique. Scales cycloid. Small photophore below at front eye edge; 3 branchiostegals; pectorals 5, interspace between first and second greatest; sub-pectorals 2, lower before second pectoral, and upper one before and below middle of

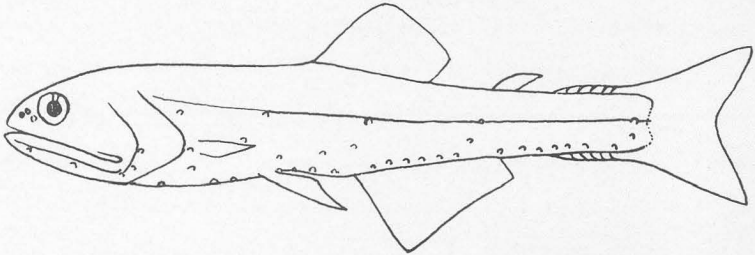


Fig. 190. *Lampanyctus micropterus*, from Brauer.

base of pectoral fin; ventrals 5, second one above and a little behind first; anals 5 to 7+6 to 8, first group above anal base; posterolaterals 2, lower behind and above last of first anal group and upper on lateral line opposite adipose fin origin; precaudals 2 or 3, first follows last of second anal group, next little higher and posterior, and third at middle of caudal base on lateral line; suprapectoral close below lateral line; supra-ventral at lateral line; first supra-anal above and between fourth and fifth ventrals, second supra-anal somewhat higher, and third at lateral line opposite middle of dorsal; precaudal luminous scales 3 to 5 above, 5 to 7 below. Dorsal begins behind ventral, slightly before middle in body. Anal begins below middle of dorsal, behind middle of body and ends below adipose fin. Pectoral inserted below middle in body depth, short, not reaching ventral. Length 74 mm. (Brauer.)

Tropical Atlantic and Indian Oceans.

Lampanyctus oculus (Garman)

Figure 191

Myctophum oculum GARMAN, 1899, Mem. Mus. Comp. Zoöl., XXIV, p. 260, Pl. LVI, fig. 2. S. lat. 0° to N. lat. 32° , W. long. 78° to 135° , to 1772 fathoms.

Myctophum (Lampanyctus) oculum PAPPENHEIM, 1914, 'Deutsche Südpolar

Exped.,' XV (2), p. 196 (south of Ascension Island, S. lat. $14^{\circ} 3'$, W. long. $19^{\circ} 10'$, 1900 m.; southeast of St. Helena, S. lat. $24^{\circ} 55'$, W. long. $1^{\circ} 18'$, in 1500 m.; southeast of Ascension, S. lat. $11^{\circ} 19'$, W. long. $18^{\circ} 34'$, 1200 m.; Cape Verde, N. lat. $5^{\circ} 27'$, W. long. $21^{\circ} 41'$, 1500 m.).

Head 3; depth 5; dorsal 13 to 15; anal 14 to 16; ventral 8; scales in lateral line 35; scales 2 above lateral line, 4 below. Body moderately long, compressed. Head more than half wide as deep, somewhat pointed in front, little convex on forehead. Snout short, blunt, $\frac{3}{5}$ of eye, convex on top, with pronounced median inter-narial keel. Eye large, 4 in head, equals interorbital. Mouth wide, $2\frac{2}{5}$ long as eye. Premaxillaries very slender, form entire mouth edge; maxillary $1\frac{1}{2}$ eye diameters beyond orbit. Opercle large, elongate, greater part membranous. Scales large, smooth, wider in lateral line. Luminous organ on interorbital immediately behind rostral keel; 3 branchiostegals, last lower than the other two; 1 behind end of maxillary and smaller below at mouth angle; 1 at pectoral base, another above and forward on lateral line, third below and forward from pectoral two-thirds; on lateral line second of its series above and behind from ventral base, third over fifth anal ray,

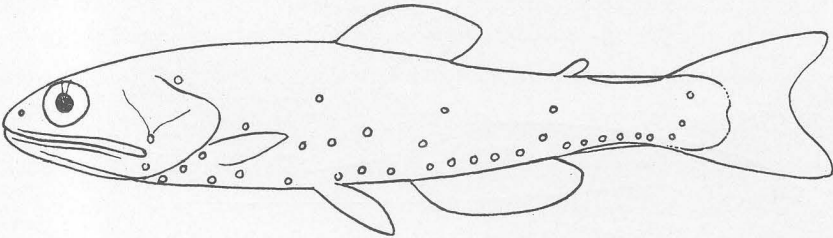


Fig. 191. *Lampanyctus oculeus*, from Garman.

fourth above hind end of anal base, fifth little above median line on caudal base; 4 between isthmus and ventrals, third farther out; ventrals 3; anals 5 or 6, last farther out; 8 at lower part of caudal peduncle, last up short space on caudal base; behind opercle and halfway to ventral 1; above ventral axil on lower part of side foremost of series of 5 of which fourth is nearer first and fifth is near next to hindmost anal ray. Large elongate luminous body from adipose fin to caudal and longer ones from base of anal backward on tail. Dorsal origin midway from snout to caudal base. Adipose fin above last anal rays. Anal origin below tenth dorsal ray. Ventral a little behind midway from isthmus to first anal ray, sometimes absent. Black, fins lighter, scales lustrous. Length 70 mm. (Garman.)

Atlantic and Pacific Oceans.

Lampanyctus niger (Günther)

Figure 192

Nannobranchium nigrum GÜNTHER, 1877, 'Rept. Voy. "Challenger,"' XXII, p. 199, Pl. LI, fig. B. South of Philippines, 500 fathoms.

Myctophum (Lampanyctus) nigrum BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 242, Fig. 159 (Gulf of Guinea, N. lat. $1^{\circ} 51'$, E. long. $0^{\circ} 31' 2''$).—PAPPEN-

HEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 197 (south of Azores, N. lat. 28° 42', W. long. 34° 33', in 10 m.).

Head $3\frac{1}{2}$ to $3\frac{2}{3}$; depth $4\frac{4}{5}$ to 5; dorsal 13 to 15; anal 16 to 19; scales in lateral line 35; snout equals eye or little longer; eye 5 to 7 in head. Mouth cleft extends beyond eye a space equal to more than that of the combined length of eye and snout. Maxillary slightly expanded behind. Preopercle oblique. Scales cycloid. Small preorbital luminous body close below front eye edge; 2 photophores behind preopercle edge below, lower behind jaw angle; 3 branchiostegals; pectorals 5, fourth higher than third, interspace between first and second greatest; subpectorals 2, upper advanced, concealed by gill cover overlapping, and lower between and above first and second pectorals; ventrals 4, 2 median little elevated above first and fourth; anals 6 to 8+7 to 10, first group above anal fin, second group along lower side of caudal peduncle; posterolaterals 2, lower one above and behind posterior or first anal group and second close below lateral line opposite origin of adipose fin; 2 precaudals, opposite one another, lower little above posterior of second anal group and upper at lateral line on caudal base; suprapectoral close below lateral line, over upper subpectoral; supraventral slightly below lateral line; supra-anal with first lowest, above third ventral, second above anal origin, and third highest, posterior and close below

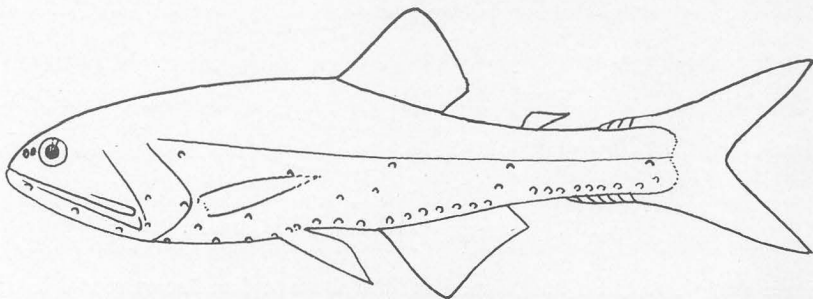


Fig. 192. *Lampanyctus niger*, from Brauer.

lateral line; luminous precaudal scales 3 or 4 above, 6 to 8 below. Dorsal begins behind ventrals, midway in body, above middle of space between ventral and anal. Anal begins below middle of dorsal and ends below origin of adipose fin. Pectoral placed below middle in body depth. Length 48 mm. (Brauer.)

Tropical Atlantic, Indian, and western Pacific Oceans.

***Lampanyctus tenuiformis* (Brauer)**

Myctophum (Lampanyctus) tenuiforme BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 243, Fig. 160. Between Seychelles and Zanzibar, S. lat. 4° 34' 8", E. long. 53° 42' 8".—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 197 (southeast of Cape Verde Islands, N. lat. 0° 46', W. long. 18° 59', in 3000 m.).

Head 3; depth $5\frac{1}{5}$; dorsal 14; anal 18; scales 37 or 38. Eye 6 in head. Mouth cleft extends well beyond hind eye edge. Maxillary little expanded behind. Preopercle oblique. Scales cycloid. Photophores bean-shaped; preorbital small;

ventrals 4, on same level; anals 5+9, on same level, first group above anal and only first photophore of second group so; posterolaterals 2, lower a little behind and above last anal of first group, upper at lateral line below adipose fin origin; precaudals 2, lower but little higher than last anal, and upper below lateral line a little posterior; supraventral nearly midway between lateral line and ventral; supra-anals 3, first above third ventral and a little lower than supraventral, second above anal origin and a little higher than first, third above second at lateral line and a little before end of dorsal. Luminous scales on precaudal 4 above, 5 below. Dorsal begins a little behind ventral origin, somewhat before middle in body and ends only a very little behind anal origin. Latter is somewhat before last third in body and ends under hind end of adipose fin base. Pectoral nearly reaches anal origin. Length 21 mm. (Brauer.)

Indian and Atlantic Oceans.

Lampanyctus pusillus (Johnson)

Figure 193

Scopelus pusillus JOHNSON, 1890, Proc. Zool. Soc. London, p. 457. Madeira.

Lampanyctus alatus GOODE AND BEAN, 1895, 'Ocean. Ichth.,' p. 79, Fig. 92. Gulf of Mexico (N. lat. 28° 43', W. long. 87° 14' 30'', in 525 fathoms).

Myctophum (Lampanyctus) alatus BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 244, Figs. 161-162 (south of Canaries, N. lat. 24° 43' 4'', W. long. 17° 1' 3''; Sierra Leone, N. lat. 8° 58', W. long. 16° 27' 9''; N. lat. 5° 5' 5'', W. long. 13° 27' 5''; Gulf of Guinea, N. lat. 2° 36' 5'', E. long. 3° 27' 5'').

Myctophum (Lampanyctus) alatum ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 38 (Canaries, N. lat. 28° 4', W. long. 16° 49' 30'', in 1000 m.; southwest of Azores, N. lat. 31° 42', W. long. 42° 40', in 2500 m.; off Azores, N. lat. 39° 36', W. long. 26° 5', in 2500 m.).

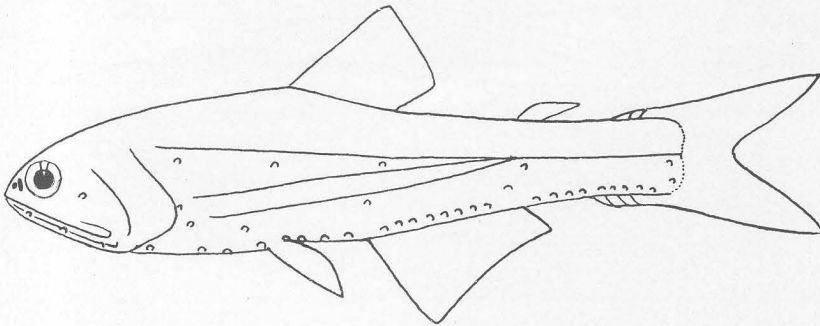


Fig. 193. *Lampanyctus pusillus*, from Brauer.

Head $3\frac{4}{5}$; depth $4\frac{1}{3}$ to $4\frac{1}{2}$; dorsal 11 to 14; anal 15 to 18; scales in lateral line 35 to 37; snout $4\frac{2}{5}$ in eye; eye $3\frac{1}{5}$ to $4\frac{2}{5}$ in head. Mouth cleft reaches over an eye diameter beyond eye. Maxillary a little expanded terminally. Preopercle inclined. Scales cycloid. Preorbital luminous body obscure; 3 branchiostegal photophores; one photophore at middle of cheek; pectorals 5, last on same

level as others, fourth little before dorsal origin; subpectorals 2; ventrals 4; anals 4 to 8+8 or 9, first group above anal base and second group along lower side of caudal peduncle; posterolaterals 2, uppermost opposite origin of adipose fin close to lateral line; suprapectoral above dorsal subpectoral, nearer lateral line than pectoral fin; supraventral close to lateral line; posterior supra-anal below last dorsal rays, first lowest and about opposite anal origin; luminous precaudal scales 3 or 4 above, 3 to 6 below, usually 4. Dorsal begins somewhat behind ventral, before middle of body and reaches nearly to fifth or sixth anal rays. Anal origin nearly midway in body and ends before adipose fin. Pectoral very long, inserted below middle in body depth, reaches end of anal fin. Length 93 mm. (Brauer.)

Warmer Atlantic and Indian Oceans.

***Lampanyctus gemmifer* Goode and Bean**

Figure 194

Lampanyctus gemmifer GOODE AND BEAN, 1895, 'Ocean. Ichth.,' p. 80, Fig. 88. N. lat. 39° 39' 45", W. long. 71° 35' 15", in 538 fathoms, Gulf Stream off Middle Atlantic States.

Myctophum (Lampanyctus) gemmifer ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 40 (Madeira, N. lat. 32° 38', W. long. 16° 37' 30", in 2286 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (Azores, 1235 m.).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 197 (northwest Cape Verde Islands, N. lat. 24° 41', W. long. 32° 21', 20 m.).

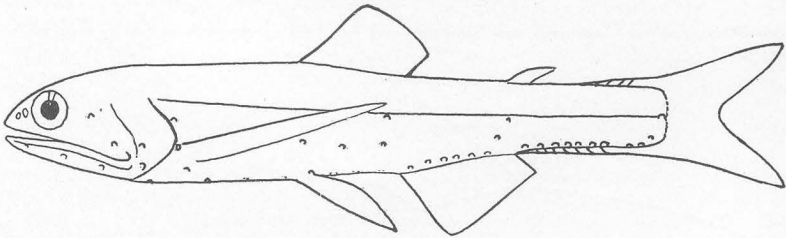


Fig. 194. *Lampanyctus gemmifer*, from Brauer.

Head 4; depth 6; dorsal 13 or 14; anal 16 or 17; snout $1\frac{1}{2}$ in eye; eye $4\frac{3}{5}$ in head. Mouth cleft extends an eye diameter beyond eye. Maxillary expanded slightly behind. Preopercle oblique. Scales cycloid. Photophores bean-shaped; small preorbital above at upper eye edge; 2 on cheek, 1 between hind eye edge and front edge of preopercle, about level with eye center, lower one near end of maxillary opposite upper preopercle; preopercles 2, upper one level with lower eye edge and lower 1 on cheek, lower behind jaw angle; 3 branchiostegals; pectorals 5, fourth above space between third and fifth and level with pectoral origin, interspace between first and second greatest; subpectorals 2, upper one before middle of pectoral base, lower one a little posterior; ventrals 4, same level; anals 6+9, last 2 of second group appear as 2 precaudals; anteroanals all above anal fin; posterolaterals 2, last at lateral line, below adipose fin origin; suprapectoral a little before pectoral

nearly above upper subpectoral and a little nearer lateral line than pectoral; supra-ventral midway between lateral line and ventral, a little higher than fourth pectoral; first 2 supra-anals equally high and on same level, first also a little deeper than supra-ventral, above space between second and third ventrals, second above fourth ventral and third above vent at lateral line; precaudal luminous scales 4 above, 7 below. Dorsal inserted somewhat behind ventral, before middle in body, and ends above origin of anal, which fin ends at 2/3 of body. Anal ends below adipose fin. Pectoral low, in middle of under half of body depth, reaches anal origin. Length 54 mm. (Brauer.)

Tropical Atlantic.

***Lampanyctus crocodilus* (Risso)**

Figure 195

Serpe crocodilus RISSO, 1810, 'Ichth. Nice,' p. 357. Nice.

Scopelus crocodilus LÜTKEN, 1892, K. danske Vidensk. Selsk. Skrift., Kjøbenhavn, (6) VII, p. 263, Fig. 22 (N. lat. 33°, W. long. 40°).

Lampanyctus crocodilus VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (off Morocco in N. lat. 34° 4', W. long. 8° 58' 45'', in 3475 m.).

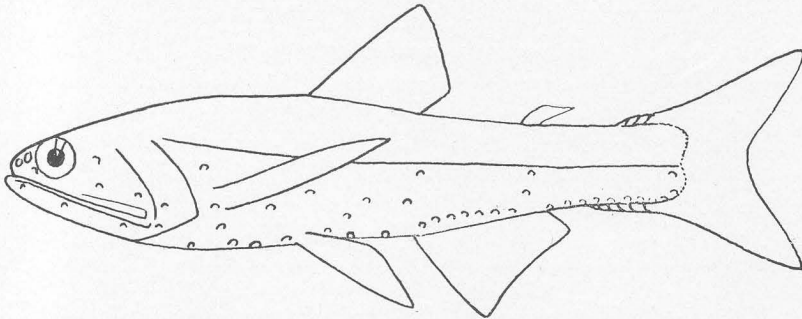


Fig. 195. *Lampanyctus crocodilus*, from Brauer.

Head 3 to 3 1/3; depth 5 to 6 1/3; dorsal III, 10 or III, 11; anal III, 12 to III, 14; scales 35? to 38 in lateral line to caudal base and 3 more on latter; snout 6 to 6 1/5 in head measured from upper jaw tip; eye 4 2/5 to 5; maxillary 1 1/4; interorbital 3 1/2 to 5.

Body well compressed, elongate, deepest at dorsal origin. Caudal peduncle well compressed, least depth 3 2/5 its length or 4 in total head length. Head long, compressed, tapers rather pointedly forward. Snout depressed, length 3/4 its width. Eye a little ellipsoid, close to upper profile at about first fourth in head. Mouth large, commissure curved down. Maxillary long, slender, extends back close to lower preopercle ridge or about 2 eye diameters behind eye. Teeth minute, in bands in jaws, little wider band on each palatine, patch of small vomerine teeth and a broad area of fine pterygoid teeth. Tongue small, free. Mandible projects well beyond snout. Interorbital level. Preopercle ridge well inclined posteriorly, nearly vertical behind

maxillary. Gill opening forward about opposite front eye edge. Gill rakers 4+10, slender, inner edges with fine asperities, $1\frac{1}{5}$ in eye. Gill filaments about $\frac{1}{3}$ of gill rakers and pseudobranchiae nearly equal gill filaments. Scales deciduous, smooth, well exposed, in even longitudinal series. Scales in lateral line not especially enlarged, course median, along side, with a gentle slope forward. Mandibular photophores in 3 pairs, pectorals 5, ventrals 4, anals 6+8, precaudals 4, cheek 2, preopercle 1, sub-pectorals 2, supraventral 1, supra-anals 3, posterolaterals 2. Dorsal origin nearer snout tip than caudal base by combined snout and half of eye, first branched ray $1\frac{2}{5}$ in head. Adipose fin about midway between median dorsal base and caudal base, fin small, slender. Anal inserted directly after dorsal base, first branched ray 3 in head. Caudal well forked. Pectoral low, reaches middle of ventral at least. Ventral inserted a trifle before dorsal origin, reaches vent close before anal.

Color in alcohol dull brown, fins paler. Length to 95 mm.

Atlantic Ocean. Described above from examples obtained at Messina, Italy. Brauer gives the length as a little greater, 125 mm. My examples are in agreement with Cocco's figure of *Nyctophus bonapartii*¹ except that the slightly damaged pectorals probably never reached back much beyond the middle of the depressed ventral. Cocco's figure shows them reaching as far as the last fourth in the anal base.

Lampanyctus macropterus (Brauer)

Figure 196

Myctophum (Lampanyctus) macropterus BRAUER, 1904, Zool. Anzeiger, XXVIII, pp. 397, 404. Indian Ocean.—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 197 (southwest of Sierra Leone, N. lat. $0^{\circ} 46'$, W. long. $18^{\circ} 59'$, in 3000 m.).

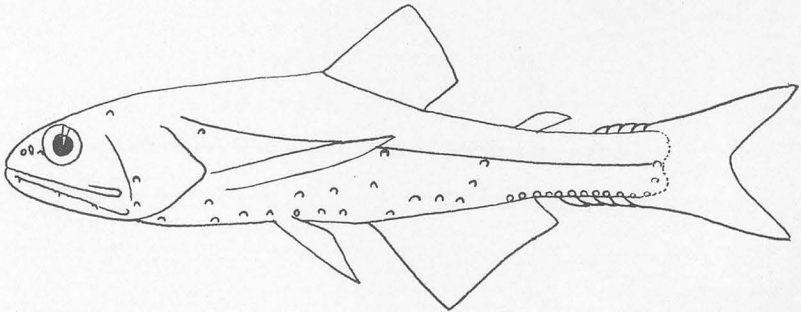


Fig. 196. *Lampanyctus macropterus*, from Brauer.

Head $3\frac{1}{3}$ to $3\frac{4}{5}$; depth $4\frac{4}{5}$ to $5\frac{1}{3}$; dorsal 12 to 14; anal 18 or 19; scales 35. Snout equally large, greater or smaller than eye. Eye $4\frac{1}{3}$ to 6 in head. Mouth cleft extends more than eye diameter beyond eye. Maxillary a little expanded behind. Preopercle oblique. Scales cycloid. Small preorbital ventral photophore

¹1838, Nuovi Ann. Sci. Nat., Bologna, II, p. 189, Pl. VII, fig. 10. Messina.

at front eye edge; 2 photophores behind front preopercle edge near jaw angle; 3 branchiostegals; none on cheek; pectorals 5, interspace between first and second greatest; subpectorals 2, before pectoral base, upper somewhat advanced, lower somewhat nearer second pectoral than first; ventrals 4, second elevated; anals 4 to 6 + 10 to 12, first group all above anal, with first photophore lowest, of second group only first 2 are above anal; last 2 anals of second group may be separated, appearing as precaudals; posterolaterals 2, upper at lateral line a little before adipose fin; precaudals 2, lower above last anal of second group, upper a little posterior at lateral line; suprapectorals 2, posterior one above upper subpectoral close below lateral line, anterior one higher at shoulder above preoperculars; supraventral nearer lateral line than ventral fin; first supra-anal somewhat behind third ventral, second a little higher and above anal origin, third nearer or at lateral line above first anal, before end of dorsal fin. Luminous precaudal scales 3 or 4 above, 5 to 7 below. Dorsal begins slightly behind ventral, a little before middle in body length, and ends above seventh or eighth anal rays. Anal begins below middle of dorsal, somewhat behind middle in body, ends below adipose fin base. Pectoral low, within lower half of body depth, reaches a little beyond anal origin. Length 65 mm. (Brauer.)

Indian and Atlantic Oceans.

Lampanyctus maderensis (Lowe)

Figure 197

Scopelus maderensis LOWE, 1839, Proc. Zool. Soc. London, VII, p. 87. Madeira; 1839, Trans. Zool. Soc. London, III, part 1, p. 14 (Madeira); 1850, Proc. Zool. Soc. London, p. 250 (Madeira).—GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 412 (type; Madeira).

Myctophum (Lampanyctus) maderense BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 227, Fig. 148 (Canaries, N. lat. 24° 43' 4", W. long. 17° 1' 3"; between Portugal and Azores in N. lat. 42°, W. long. 14°).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 35 (off Azores in N. lat. 37° 38', W. long. 25° 53' 30", in 1000 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (off Canaries, in 2170 m.).

Ceratoscopelus maderensis ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 30 (south of Azores at surface).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (Azores in N. lat. 38° 27', W. long. 26° 30' 35", at surface).

Scopelus bonapartii JOHNSON, 1862, Ann. Mag. Nat. Hist., London, X, p. 281 (Madeira).

Head 3 to 4; depth 4 to 5; dorsal III, 10, I, varies III, 11, I or III, 9, I; anal III, 11, I; scales 34 in lateral line to caudal base and 3 more on latter; 3 scales above lateral line, 4 below; 12 predorsal scales; snout 5 in head; eye 3; maxillary 1 1/3; interorbital 3 2/5.

Body elongate, deepest about pectoral base, predorsal and preventral edges slightly trenchant. Caudal peduncle compressed, least depth about 2 1/2 its length or 3 3/4 in head. Head large, compressed, lower profile slightly more inclined than upper, flattened sides but slightly convergent below, width 2 1/2 its length. Snout short, obtuse, length 4/5 its width. Eye large, impinging on upper profile, a trifle before first third in head. Mouth large, a little inclined. Maxillary slender, its whole upper edge slipping below posteroinfraorbital expansion about 3 2/3 in eye, and end

not quite reaching preopercle ridge. Narrow bands of minute teeth along jaw edges and on palatines, none on vomer. Mandible shallow, jaws about even. Nostrils small, close together and close before front eye edge. Interorbital depressed concavely, each supraorbital ridge flaring out above eye with a sharp slender prong in front. Gill opening forward nearly opposite front eye edge. Gill rakers 6 to 8 + 15 to 18, slender, $1 \frac{1}{4}$ in eye and gill filaments 3. Pseudobranchiae about as long as gill filaments. Scales moderately large, mostly fallen, cycloid, smooth, rather well exposed in a longitudinal series parallel with lateral line, of about uniform size. Photophores 3 obscure mandibular pairs, 4 pectoral, 4 ventral, 6 + 6 anal, 4 caudal, 2 preopercle, 2 subpectoral, 1 suprapectoral, 1 supraventral, 3 supra-anal, 2 posterolateral. Cluster of 2 enlarged median preventral luminous scales, with a smaller accessory one on each side. About 12 luminous scales along anal base to origin of rudimentary caudal rays. Dorsal origin about midway between snout tip and caudal base, first branched ray $1 \frac{2}{3}$ in head. Adipose fin inserted about midway between median dorsal base and caudal base. Anal inserted just behind dorsal base, or a little nearer pectoral origin than caudal, first branched ray $2 \frac{1}{3}$. Caudal emarginate. Pectoral reaches

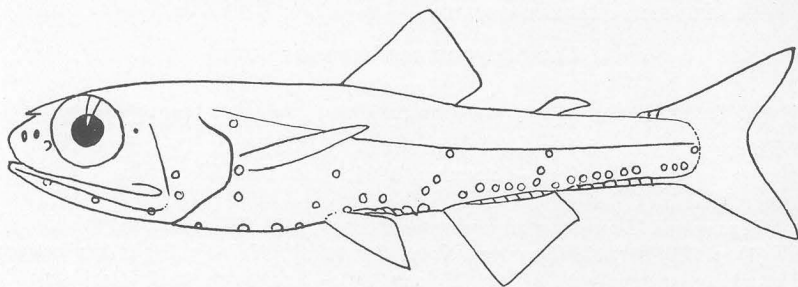


Fig. 197. *Lampanyctus maderensis*, from Brauer.

anal, as long as head. Ventral inserted a trifle before dorsal or about midway between hind pupil edge and last anal ray base, 2 in head, reaches vent close before anal.

Color in alcohol deep brownish, scarcely paler below. Photophores adamant golden, with blackish basal edges. Iris deep slaty. Inside gill opening blackish. Length 47 to 76 mm.

Warmer regions of the Atlantic and Mediterranean. The above description is from an example taken from the stomach of a shark in the "Atlantic Ocean" by Isaac Tyson, and five examples from N. lat. $36^{\circ} 24'$, W. long. $71^{\circ} 24'$, by Dr. W. H. Jones. They agree with Brauer's figure, though they differ from Goode and Bean's, as the latter does not show any supraventral or posterolateral photophores and there are no luminous marginal scales. Goode and Bean further show the scales of the lateral line enlarged, which is not the case with my material.

LAMPADENA Goode and Bean

Lampadena GOODE AND BEAN, 1895, 'Ocean. Ichth.', p. 85. Type: *Lampadena speculigera* Goode and Bean. Monotypic.

Head somewhat conic. Snout short, obtusely conic, upper and lower profiles nearly equal. Mouth cleft a little oblique. Lower jaw prominent. Maxillary reaches preopercle angle, ends in triangular dilation. Preopercle slightly oblique. Scales in lateral line not enlarged, tubes luminous. No luminous gland on head, usually but 1 on caudal peduncle above, or another on its lower surface, or both. Precaudal photophores in 2 groups, last by itself at end of lateral line. Dorsal and anal nearly equal, not touching same vertical. Pectoral small or minute, not reaching ventral origin, or not much longer than eye.

Lampadena chavesi Collett

Figure 198

Lampadena chavesi COLLETT, 1905, Zool. Anzeiger, XXVIII, p. 728. Azores.

Myctophum (Lampadena) chavesi BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), pp. 163, 210, Fig. 129 (Azores).—PAPPENHEIM, 1914, 'Deutsche Süd-polar Exped.,' XV (2), p. 194 (west of Cape Verde, N. lat. 17° 28', W. long. 29° 42', 3000 m.).

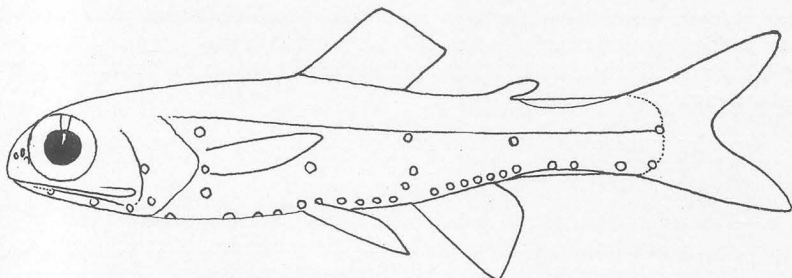


Fig. 198. *Lampadena chavesi*, from Brauer.

Head $3\frac{2}{5}$; depth $4\frac{4}{5}$; dorsal 14; anal 13; scales in lateral line 39; snout $2\frac{4}{5}$ in eye; eye equals interorbital, 3 in head. Mouth cleft extends half an eye diameter beyond eye. Maxillary a little dilated behind. Preopercle somewhat inclined. Scales cycloid. Small preorbital luminous body somewhat below middle of front eye edge; 2 photophores at hind edge of preopercle, upper one somewhat larger and nearly level with lower pupil edge, lower one at jaw angle; 3 branchiostegals; pectorals 5, with last near ventral origin and somewhat above others; subpectorals 2, upper one just below middle of pectoral base, and lower one below pectoral base; ventrals 5 or 6; anteroanals 7 and posterior 2, latter at side of lower caudal peduncle luminous body; one posterolateral, nearer lateral line above last anteroanal and under end of base of adipose fin; precaudals 3, first 2 equally low, last at end of lateral line; suprapectoral nearer lateral line than pectoral origin; supraventral nearly midway between lateral line and ventral; supra-anals above vent, third above second,

under end of dorsal near lateral line; large luminous body on upper edge of caudal peduncle behind adipose fin, a slightly larger one opposite along lower edge. Dorsal begins in same vertical as ventral, before middle of body, and ends shortly before anal origin above vent. Anal begins shortly before last third in body length and ends under adipose fin. Pectoral base nearly midway in body depth, reaches a little beyond ventral base. Length 70 mm. (Brauer.)

Azores.

DIAPHUS Eigenmann and Eigenmann

Diaphus EIGENMANN AND EIGENMANN, 1890, Proc. California Acad. Sci., (2) III, p. 3. Type: *Diaphus theta* Eigenmann and Eigenmann. Monotypic.

Aethoprora GOODE AND BEAN, 1895, 'Ocean. Ichth.,' p. 86. Type: *Nyctophus metopoclampus* Cocco. (Designated by Jordan, 1920, 'Genera of Fishes,' part 4, p. 467.)

Collettia GOODE AND BEAN, 1895, 'Ocean. Ichth.,' p. 88. Type: *Nyctophus rafinesquii* Cocco. Monotypic.

Lamprossa JORDAN AND HUBBS, 1925 (June 27), Mem. Carnegie Mus., X, No. 2, p. 156. Type: *Diaphus anteorbitalis* Gilbert. Orthotypic.

Panthophos JORDAN AND HUBBS, 1925 (June 27), *idem*. Type: *Diaphus glandulifer* Gilbert. Orthotypic.

Body moderately robust. Mouth wide, moderately inclined. Teeth in villiform bands. Opercular apparatus obliquely articulated. Scales cycloid. Luminous gland before eye and below nostril, none on tail. Pearl-like lateral photophores of body divided by a transverse septum of black pigment, posterolaterals in obliquely ascending row. Precaudals 4. Dorsal and anal alike, not touching the same vertical. Pectoral low.

Species numerous. Known chiefly by the divided photophores.

KEY TO THE SPECIES

- a.*—Pair of luminous glands on front part of head, another on each side of hollow of first infraorbital; scales of lateral line somewhat enlarged. *rafinesquii*.
- aa.*—Single antero-orbital luminous body on snout superior.
- b.*—Postorbital luminous bodies 3; no opercular photophores; ventral fin small, not reaching halfway to anal fin. *dofleini*.
- bb.*—No postorbital luminous bodies; 2 opercular photophores behind preopercular edge below; ventral large, reaches anal.
- c.*—Last supra-anal, posterolateral, and precaudal photophores well below lateral line: dorsal rays, 17, fin longer than anal. *gemellarii*.
- cc.*—Last supra-anal, posterolateral and precaudal photophores near lateral line; dorsal rays 13 or 14, equally long or shorter than anal. *dumerilii*.
- aaa.*—Two antero-orbital luminous bodies, one above the other, the upper one horn-shaped and the lower oblong; 2 opercular photophores; ventral nearly reaches anal. *splendidus*.
- aaaa.*—One antero-orbital luminous body, superior on snout and one or 2 suborbitals; ventral long, nearly or quite reaching vent.
- d.*—Antero-orbital luminous bodies separated.

- e.*—One suborbital luminous body; last supra-anal, posterolateral and supracaudal photophores close to lateral line; eye $3\frac{1}{2}$ to 4 in head; anal rays 13 to 16.
- f.*—Suborbital luminous body large, oblong; dorsal rays 15 or 16.....*lütkeni*.
- ff.*—Suborbital luminous body small, oval; dorsal rays 13 or 14.....*vanhoeffeni*.
- ee.*—One large oblong suborbital luminous body and one small and round; last supra-anal, posterolateral, and supracaudal photophores distant from lateral line; dorsal rays 11 to 13; anal rays 9 to 13.....*theta*.
- dd.*—Antero-orbital luminous bodies connected, as 1 suborbital, small and oval; last supra-anal, posterolateral, and precaudal photophores removed from lateral line; dorsal rays 13 or 14; anal rays 13 or 14.....*fulgens*.

Diaphus rafinesquii (Cocco)

Figure 199

Nyctophus rafinesquii Cocco, 1838, Nuovi Ann. Sci. Nat., Bologna, II, p. 180, Pl. VII, fig. 7. Messina.

Myctophum (Diaphus) rafinesquii MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613, Fig. 461 (west of Azores).

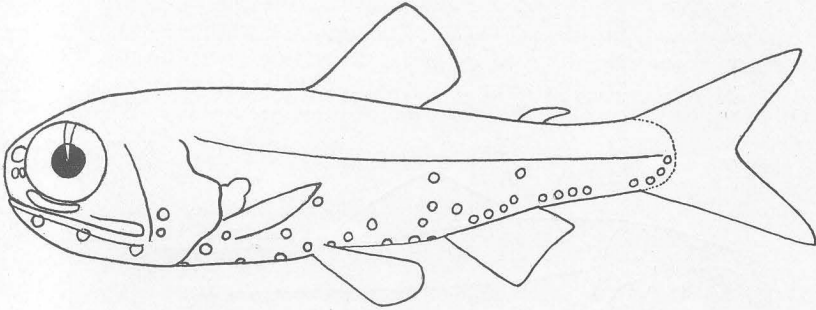


Fig. 199. *Diaphus rafinesquii*, from Brauer.

Head 3 to $3\frac{1}{5}$; depth 4 to $4\frac{1}{5}$; dorsal IV, 9; anal III, 8; scales 33 in lateral line to caudal base and 2 more on latter; 3 scales above lateral line, 3 below; 12 predorsal scales; snout $6\frac{3}{5}$ to 7 in head; eye 3; maxillary $1\frac{1}{2}$ to $1\frac{3}{5}$; interorbital $3\frac{3}{4}$ to $3\frac{7}{8}$.

Body elongate, well compressed, deepest about pectoral origin, trunk tapering evenly back. Caudal peduncle well compressed, least depth about half its length or 3 in head. Head well compressed, upper anterior profile convexly gibbous so front nearly vertical, width $2\frac{1}{4}$ its length. Snout obtusely convex, length $\frac{2}{5}$ basal width. Eye large, close to front upper profile, before first third in head. Mouth large, a little inclined, commissure curving convexly below. Maxillary narrow, nearly

reaches preopercle ridge, a little wider forward and tapering slightly behind. Teeth minute, fine, in bands in jaws, on palatines and pterygoids, none on tongue. Mandible shallow, included in upper jaw. Nostrils together, close before middle of front eye edge. Supraorbital ridge broad. Interorbital broadly convex. Preopercle ridge inclined well back. Bones of upper surface of head thin, rather cavernous. Gill rakers 9 or 10+14, rather firm, slender, about half of eye, twice gill filaments. Scales thin, well exposed. Lateral line complete, slopes gently from shoulder to caudal base, each scale enlarged with a narrowly imbricate exposure. Tubes simple. Photophores conspicuous; large luminous organ close to eye, another long one along its lower edge medianly in infraorbital rim; mandibulars 3, isthmian 3, pectorals 5, ventrals 5, anals 4+5, 1 on preopercle, 2 subpectorals, 1 supraventral, 3 supra-anals, 2 posterolaterals, 1 ? precaudal; apparently luminous organ above pectoral axilla. Dorsal origin a little nearer snout tip than caudal base. Anal inserted a little behind dorsal base or midway between pectoral origin and caudal base. Caudal apparently well forked. Pectoral low, small. Ventral inserted a trifle before dorsal.

Brownish. Length 82 to 92 mm.

Atlantic and Mediterranean. Described above from Italian examples. My examples agree with Cocco's figure in showing enlarged scales in the lateral line. Goode and Bean give a figure which shows these scales apparently smaller than the others.

***Diaphus dofleini* (Zugmayer)**

Figure 200

Myctophum (Lampanyctus) dofleini ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 3. N. lat. 34° 2', W. long. 12° 21', in 4000 m.; N. lat. 37° 39', E. long. 0° 20', in 2170 m.; N. lat. 36° 17', W. long. 1° 58', in 1800 m.; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 35, Pl. I, fig. 9 (types).

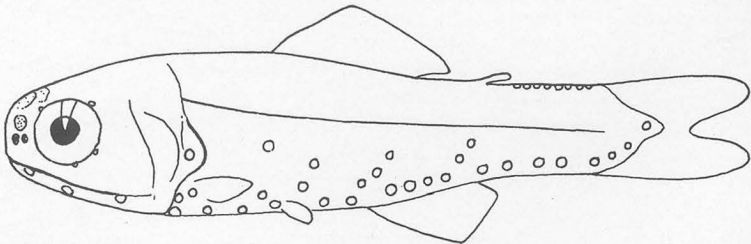


Fig. 200. *Diaphus dofleini*, from Zugmayer.

Head $3 \frac{1}{3}$; depth $4 \frac{1}{3}$; dorsal 16; anal 16; pectoral 13; ventral 8; scales in lateral line 35 to 41. Snout $\frac{2}{3}$ of eye. Eye 3 in head; interorbital 3. Scales caducous with age, adherent in young. Long preorbital luminous body; 3 postorbital photophores; 3 branchiostegals; 2 operculars; pectorals 5, fourth little elevated; ventrals 4, first little elevated, second still higher; anals 5 anteriorly and 5 along lower side of caudal peduncle; precaudals 4, last on lateral line at end of lateral line;

subpectorals 2, upper close before pectoral base; posterolateral behind and above last of first anal group, opposite base of last anal ray; suprapectoral somewhat before and closer above pectoral base than lateral line; supraventral a little before ventral origin, level with suprapectoral; 3 supra-anals, first lowest and little before anal origin, and the third above first anal. Some luminous precaudal scales, but little developed in young; adult male with 8 above, and 1 or 2 lower in female. Dorsal origin nearer snout tip than caudal base, opposite that of ventral. Anal begins below hind dorsal rays, similar to dorsal, ends below small adipose fin. Caudal emarginate. Pectoral small, not reaching ventral. Brownish. Jaws clear blue, with nacre reflections at opercle. Scales of lateral line steel blue. Photophores reflect gold and violet. Length 15 to 35 mm. (Zugmayer.)

Atlantic Ocean.

***Diaphus gemellarii* (Cocco)**

Figure 201

Nyctophus gemellarii Cocco, 1838, Nuovi Ann. Sci. Nat., Bologna, (1) II, p. 186, Pl. VII, fig. 9. Messina.

Scopelus gemellarii VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 117 (coasts of Morocco, Canaries, Soudan, 550 to 1635 mm.).

Myctophum (Diaphus) gemellari BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 212, Figs. 130-131 (south of Canaries, N. lat. $24^{\circ} 43' 4''$, W. long. $17^{\circ} 1' 3''$; Gulf of Guinea, N. lat. $1^{\circ} 27' 8''$, W. long. $10^{\circ} 16' 5''$; S. lat. $3^{\circ} 55'$, E. long. $7^{\circ} 48' 5''$).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (west of Canaries; off Azores, 2865 to 3239 m.).

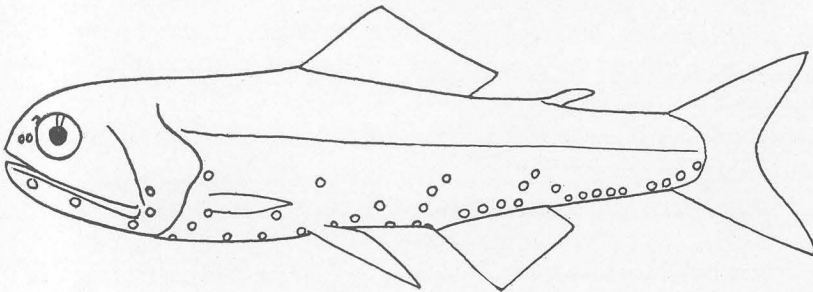


Fig. 201. *Diaphus gemellarii*, from Brauer.

Head $3 \frac{1}{2}$ to $3 \frac{1}{3}$; depth $4 \frac{1}{6}$ to $4 \frac{1}{4}$; dorsal IV, 12 or 13; anal III, 11; scales in lateral line 34 to caudal base and 3 or 4 more on latter; 4 scales above lateral line, 4 below; 11 or 12 predorsal scales; snout $5 \frac{1}{2}$ in head measured from tip of upper jaw; eye $3 \frac{5}{6}$ to 4; maxillary $1 \frac{1}{4}$; interorbital $3 \frac{1}{3}$ to $3 \frac{7}{8}$.

Body well compressed, deep, upper profile a little more convex anteriorly than lower, deepest at dorsal origin, edges all convex. Caudal peduncle well compressed, least depth about one-half its length or $2 \frac{7}{8}$ in total head. Head well compressed,

upper profile more convex and inclined than lower, flattened sides not converging below, width $2\frac{1}{8}$ its length. Snout convex, length $\frac{3}{5}$ its width. Eye ellipsoid, not elevated, at about first fourth in head. Mouth large, scarcely inclined, commissure a little deflected. Maxillary slender, extends back within short space of preopercle ridge below, or behind eye for a space equal to combined eye and snout. Teeth minute, slender, short, in narrow bands in jaws, on palatines a little wider, on pterygoids in quite wide areas, and a small patch on each side of vomer in front. Tongue small. Mandible low, rami slightly protruding. Interorbital broadly convex. Preopercle ridge well inclined back. Posteroinfraorbital about equals eye. Gill opening forward to front eye edge. Gill rakers $6+14$, slender, inner edges finely asperous, $1\frac{1}{5}$ in eye. Gill filaments $2\frac{1}{4}$ in eye and pseudobranchiae half of gill filaments. Scales large, thin, cycloid, deciduous, a little smaller on caudal base and breast. Lateral line complete, midway along side, tubes large. Mandibular photophores large, in 3 pairs, not very distinct through mandibular rami. At lower corner of opercle conspicuous photophore. Isthmus with 3 pairs of small inconspicuous photophores, then 5 pectoral pairs, 4 ventral pairs, $4+6$ anal pairs, precaudals ?, subpectorals 2, suprapectoral 1, supraventral 1, supra-anals 3, posterolaterals 2. Long supracaudal luminous organ after adipose fin. Small photophore near and close under last dorsal rays on each side of back. Dorsal origin nearer snout tip than caudal base by combined length of snout and eye, first branched ray $1\frac{3}{4}$? in head. Adipose dorsal small. Anal inserted just behind tenth dorsal ray base, or a little nearer caudal base than hind preopercle ridge. Caudal well forked. Pectoral small, low. Ventral inserted a trifle behind dorsal origin or little nearer pectoral than anal origin.

Color in alcohol largely dull or uniform brownish, fins pale, Iris dull slaty. Photophores with slightly darker edges. Length 108 to 113 mm.

Eastern Atlantic and Indian Oceans. Described above from two examples obtained in Italy. They agree with Cocco's account and figure, and though the latter is quite crude it shows a much shorter pectoral than Brauer, also large tubes in the lateral line. Both of my examples are in poor condition, the squamation obsolete, and the photophores without apparent division.

Diaphus dumerilii (Bleeker)

Figure 202

Scopelus dumerilii BLEEKER, 1856, Act. Soc. Sci. Ind. Néerl. (Menado), I, p. 66. Menado, Celebes.

Scopelus schmitzi JOHNSON, 1890, Proc. Zool. Soc. London, p. 456. East end of Madeira.

Lampanyctus lacerta GOODE AND BEAN, 1895, 'Ocean. Ichth.,' p. 81, Fig. 89. Gulf Stream in N. lat. $28^{\circ} 38' 30''$, W. long. $85^{\circ} 52' 30''$, in 142 fathoms; (N. lat. 39° to 35° , W. long. 70° to 74° , in 0 to 671 fathoms).

Myctophum (Diaphus) lacerta BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 214, Figs. 132-135 (Gulf of Guinea in N. lat. 0° to 5° , W. long. 6° to 13° ; N. lat. 0° to 2° , E. long. 0° to 7° ; S. lat. 0° to 9° , E. long. 7° to 9°).

Head $3\frac{1}{2}$; depth 5; dorsal 13; anal 15; scales 36 in lateral line. Snout somewhat obtuse, rounded, with strong keel, length half of eye. Eye moderate, $3\frac{1}{2}$

in head. Mouth cleft somewhat oblique. Maxillary reaches preopercle angle, somewhat dilated. Photophores with 3 supra-anals, in obliquely vertical row, 1 posterolateral under adipose fin, precaudals in low horizontal line, and anals 7+5. Mandible with 3 large luminous pits. Dorsal origin much nearer snout tip than caudal base. Anal inserted behind end of dorsal base. Caudal large and forked. Pectoral

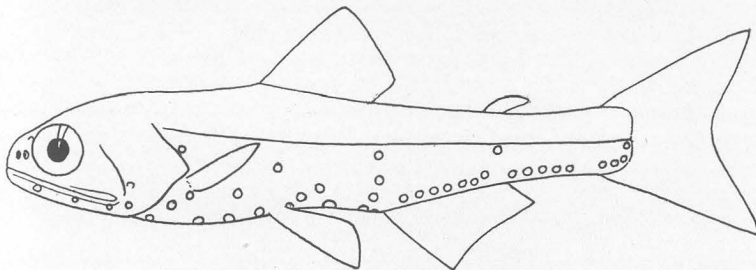


Fig. 202. *Diaphus dumerilii*, from Brauer.

slender, middle rays elongate. Ventrals inserted slightly behind dorsal origin, reach first anal ray base. Light brown, scales opalescent. Length 57 mm. (Goode and Bean.)

Warmer Atlantic and Indian Oceans. Brauer gives dimensions of 69 mm.

***Diaphus splendidus* (Brauer)**

Myctophum (*Nyctophus*) *splendidum* BRAUER, 1904, Zool. Anzeiger, XXVIII, p. 399, Fig. 7. Atlantic and Indian Oceans.

Myctophum (*Diaphus*) *splendidum* BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 218, Figs. 138-139 (Gulf of Guinea, S. lat. $3^{\circ} 55'$, E. long. $7^{\circ} 48' 5''$; S. lat. $9^{\circ} 31'$, E. long. $9^{\circ} 46'$).

Head $3 \frac{1}{5}$ to $3 \frac{1}{2}$; depth $4 \frac{2}{5}$ to $5 \frac{1}{4}$; dorsal 13 to 15; anal 15 or 16; scales 38 or 39 in lateral line; snout $1 \frac{1}{2}$ in eye; eye $3 \frac{1}{2}$ to $4 \frac{1}{3}$ in head. Mouth cleft nearly an eye diameter behind hind eye edge. Maxillary scarcely expanded behind. Preopercle oblique. Scales cycloid. Two preorbital luminous bodies, one above nostrils and other before front eye edge. Anal photophores 5 or 6+4 to 6, first and last of row a little elevated, and last postanal little smaller than others; suprapectorals nearer pectoral than lateral line, with a large angular luminous body joined below; supraventral nearer lateral line than ventral; supra-anal, posterolateral, and precaudal at lateral line. Anal begins a little behind end of dorsal base, somewhat before last third in body length, end under adipose fin. Pectoral low, nearly reaches ventral. Ventral and dorsal origin opposite, before middle of body. Length 10 to 55 mm. (Brauer.)

Eastern Atlantic and Indian Oceans.

Diaphus lütkeni (Brauer)

Figure 203

Myctophum (Nyctophus) lütkeni BRAUER, 1904, Zool. Anzeiger, XXVIII, pp. 393, 400. Indian Ocean.

Myctophum (Diaphus) lütkeni PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 195 (southwest of Sierra Leone, N. lat. $0^{\circ} 46'$, W. long. $18^{\circ} 50'$, in 3000 m.).

Head $3 \frac{1}{3}$; depth $4 \frac{3}{5}$ to 5; dorsal 15 or 16; anal 16; scales in lateral line 36. Snout $1 \frac{4}{5}$ in eye. Eye $3 \frac{1}{2}$ to 4 in head, somewhat broader than high. Mouth cleft extends an eye diameter beyond hind eye edge. Maxillary very little expanded behind. Preopercle oblique. Scales cycloid. Large preorbital horn-shaped luminous organ above nostrils and greatly larger one all along lower front eye edge; anal photo-

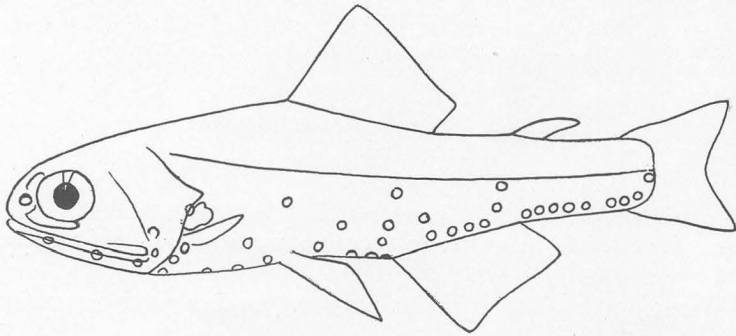


Fig. 203. *Diaphus lütkeni*, from Brauer.

phores 6 or 7+5, first or two first supra-anals higher than rest of row (last of first group appearing as lower posterolateral); suprapectoral nearer pectoral than lateral line, within large luminous scale; supraventral nearer lateral line than ventral fin; last supra-anal, posterolateral, and precaudal close below lateral line; other photophores as usual. Dorsal begins somewhat behind ventral origin, a little before middle in body. Anal begins before last third in body, below last third in dorsal, and ends below adipose fin. Caudal very short. Pectoral low, well within middle of lower half of body depth, not reaching ventral. Ventral reaches anal. Length 53 mm. (Brauer.)

Atlantic and Indian Oceans.

Diaphus vanhoeffeni (Brauer)

Figure 204

Myctophum (Diaphus) vanhoeffeni BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 222, Fig. 143. Deutsche Südpolar. Exped.—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 195 (southwest of Sierra Leone, N. lat. $0^{\circ} 46'$, W. long. $18^{\circ} 59'$, in 3000 m.).

Head 3; depth 4; dorsal 13 or 14; anal 15 or 16; scales in lateral line 38 to 40. Snout $1\frac{4}{5}$ in eye. Eye $3\frac{3}{5}$ in head. Mouth cleft reaches an eye diameter beyond hind eye edge. Maxillary but slightly expanded behind. Preopercle inclined. Scales cycloid. Preorbital luminous body along front eye edge, narrow; small oval suborbital photophore at middle of lower eye edge; anals 8+5, anterior one either equal in height to first and last or somewhat higher than others, when last appears as second posterolateral; suprapectoral nearer lateral line than pectoral fin, within a small luminous scale; supraventral somewhat nearer lateral line than ventral fin; last supra-anal, posterolateral, and last precaudal on or very close below lateral line. Other photophores as usual. Dorsal origin opposite ventral. Anal begins very slightly behind end

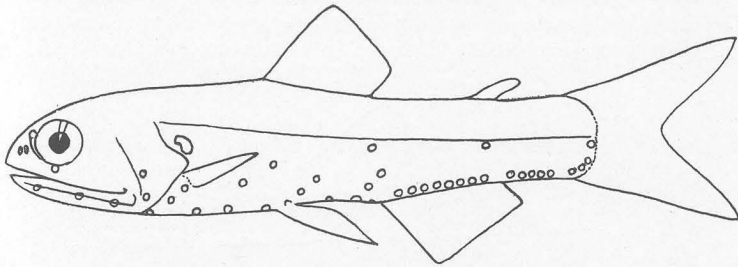


Fig. 204. *Diaphus vanhoeffeni*, from Brauer.

of dorsal, near $\frac{2}{3}$ in body length, and ends below adipose fin. Pectoral low, below under half of middle in body depth, scarcely reaches ventral. Ventral inserted a little before middle in body. Length 20 mm. (Brauer.)

Tropical Atlantic.

***Diaphus theta* Eigenmann and Eigenmann**

Diaphus theta EIGENMANN AND EIGENMANN, 1890, Proc. California Acad. Sci., (2) III, p. 4. Off Point Loma, California.—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (off Madeira, N. lat. $30^{\circ} 45'$, W. long. $25^{\circ} 20' 5''$, surface).

Head 3 to $3\frac{1}{2}$; depth $3\frac{1}{2}$ to 4; dorsal 11 to 13; anal 9 to 12; scales 34 in lateral line. Body compressed, deepest at nape, tapering evenly above and below to caudal peduncle, whose least depth equals half greatest body depth. Head short, deep, depth $1\frac{1}{5}$ its length, profile convex, not encroached upon by low supraorbitals. Orbit 3 in head, $\frac{3}{4}$ of interorbital. Maxillary $1\frac{1}{3}$ in head. Preopercle inclined. Scales entire. Conspicuous luminous organ on snout just before each eye; 5 photophores on breast, 5 on belly, 14 from anal origin to caudal, none on bases of middle caudal rays and remaining photophores as in *Myctophum californiense* with an additional one just above fourth on breast. No white blotches or spines about caudal peduncle. Dorsal origin a little nearer snout tip than caudal origin; dorsal base 2 to $2\frac{1}{2}$ to caudal base; base of last dorsal ray slightly before anal origin. Adipose fin equidistant from caudal base and last dorsal ray. Pectoral minute, very low, not

reaching ventral. Ventral reaches little beyond anal origin. Black, scales strikingly cocerulescent. Fins light. Length 33 to 65 mm. (Eigenmann and Eigenmann.)

Eastern Pacific and Atlantic Oceans.

Diaphus fulgens (Brauer)

Figure 205

Myctophum (Nyctophus) fulgens BRAUER, 1904, Zool. Anzeiger, XXVIII, pp. 393, 402, Fig. 4. Indian Ocean.

Myctophum (Diaphus) fulgens PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 195 (Cape Verde, N. lat. 17° 28', W. long. 29° 42', in 3000 m.).

Head $3\frac{1}{5}$ to $3\frac{2}{5}$; depth 4; dorsal 13 or 14; anal 13 or 14; scales 35 in lateral line. Snout very short, 4 in eye, 3 in interorbital, with strong median keel. Eye 3 in head. Mouth cleft reaches half an eye diameter beyond hind eye edge. Maxillary but very little expanded behind. Preopercle a little inclined from vertical. Scales

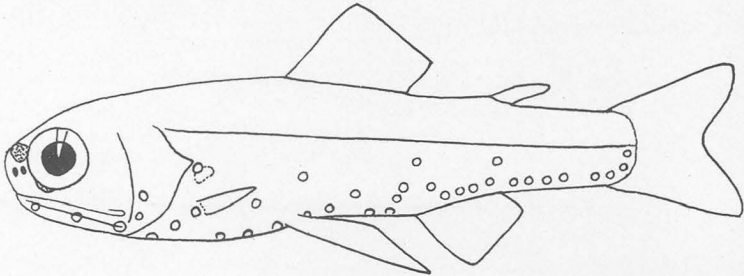


Fig. 205. *Diaphus fulgens*, from Brauer.

cycloid. Large shining scales in lateral line. Large horn-shaped preorbital luminous body above nostrils, and smaller one at lower front eye edge. Anal photophores 5+4 or 5, first and last of first group somewhat higher than others (with last appearing as a lower posterolateral); suprapectoral little nearer pectoral origin than lateral line, within a luminous scale; supraventral slightly nearer lateral line than ventral; last supra-anal, posterolateral and precaudal all well below lateral line. Other photophores as in *Diaphus gemellarii*. Dorsal begins slightly behind ventral origin, before middle in body. Anal begins close behind base of last dorsal ray, ends under adipose fin. Pectoral placed low, well below middle of lower half in body depth, short, not reaching ventral. Length 39 mm. (Brauer.)

Indian and east Atlantic Oceans.

NEOSCOPELUS Johnson

Neoscopelus JOHNSON, 1863, Proc. Zool. Soc. London, XXXIII, p. 44. Type: *Neoscopelus macrolepidotus* Johnson. Monotypic.

Body oblong, compressed. Mouth cleft not extending beyond eyes. Maxillary expanded terminally and furnished with a small supplemental bone. Upper mouth border formed entirely of premaxillaries. Scobinate bands of teeth in both jaws,

on palatines, and on vomer, and patches on entopterygoids. Body covered with large caducous scales. No luminous glands on head or tail. Dorsal inserted over ventrals. Pectoral long, lower rays not especially thick.

***Neoscopelus macrolepidotus* Johnson**

Figure 206

Neoscopelus macrolepidotus JOHNSON, 1863, Proc. Zool. Soc. London, XXXIII, p. 44, Pl. VII. Madeira.—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 119, Pl. IX, fig. 2, *a-b* (off Morocco, 1350 to 1590 m.).

Scopelus macrolepidotus GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 414 (type).

Head 3; depth 4; dorsal 13; anal 13; scales in lateral line 30, transversely 3 above and 5 below. Snout conic, longer than eye. Eye moderate, equals interorbital or space between its own hind edge and preopercle edge, 5 in head. Maxillary reaches beyond hind edge of eye, much expanded terminally. Lower jaw prominent. Hind

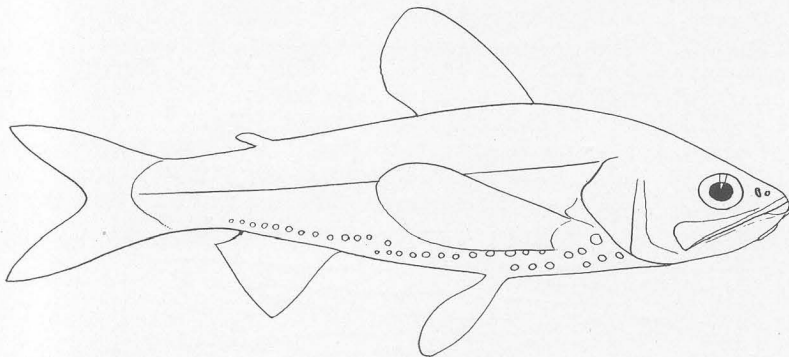


Fig. 206. *Neoscopelus macrolepidotus*, from Johnson.

edge of each scale covered with minute spines, edge itself not serrated. Dorsal origin before ventral origin, nearer end of snout than base of caudal. Pectoral long, extending nearly to vent. Length 242 mm. (Günther.)

Cosmopolitan.

Omosudidae

Body oblong. Head compressed. Eye very large. Mouth cleft very broad. Lower jaw broad and of very thin bones, like the rest of the head. Jaws with some enlarged teeth, not barbed. Premaxillary and maxillary slender. Gills 4, gill filaments broad, pseudobranchiae well developed. Branchiostegals 8. No air vessel. Stomach very distensible. Supraclavicle and postclavicle form a long rod from occiput on each side downward to abdomen, partly free, not covered by skin. Body and head naked. Dorsal fin short, behind middle in body. Adipose fin present. Anal long. Ventral inserted posteriorly.

One genus.

OMOSUDIS Günther

Omosudis GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 21. Type: *Omosudis lowii* Günther. Monotypic.

Body compressed. Snout moderate. Orbital cavity large. Mouth edge formed by premaxillaries only. Premaxillary with a series of very small equal teeth, only 1 or 2 of the anterior ones are enlarged. Mandible, vomer, and palatines with a very few large and lanceolate teeth. Gill rakers very short. Dorsal fin median or posterior. Adipose fin very small. Ventral behind pectorals, below dorsal origin.

KEY TO THE SPECIES

- a.*—Dorsal fin short, behind middle in body.....*lowii*.
aa.—Dorsal fin long, before middle in body.....*brevis*.

Omosudis lowii Günther

Figure 207

Omosudis lowii GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 201, Pl. LII, fig. C-C'. South of the Philippines, 500 fathoms; Magdalena, Madeira.—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613, Fig. 462 (west of Canaries).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 192 (west of Cape Verde Islands, N. lat. 17° 28', W. long. 29° 42', 3000 m.).

Omosudis lovei indicus BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 141, Fig. 69. Gulf of Guinea, N. lat. 0° 25' 8", E. long. 7° 0' 3", 2000 m.; Indian Ocean north of Cocos Islands and between Seychelles and Zanzibar, 1900 to 3396 m.

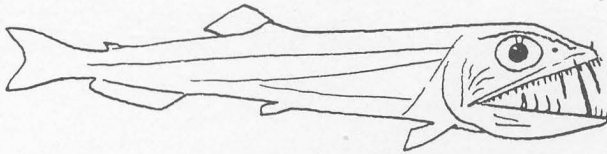


Fig. 207. *Omosudis lowii*, from Günther.

Head $3\frac{1}{2}$; depth 5; dorsal 9; anal 14; pectoral 12; ventral 6? Head strongly compressed. Snout somewhat pointed, rather longer than eye. Eye 3 in head. Mouth cleft reaches preopercle angle. Longest tooth is anterior on side of mandible, its length nearly 3 in head; next largest teeth are on palate and 2 on each side, besides several smaller ones; smaller teeth on hinder part of dentary bone; all large teeth depressible. Head with rather a flat upper surface. Head bones extremely thin, opercle smaller than subopercle and supported by 2 or 3 ridges. Infraorbital ring nearly membranaceous. Semicircular scalelike osseous plate, extremely thin, covers lower part of cheek and is marked by very shallow concentric striae. Dorsal begins midway between caudal base and eye, rays very feeble. Anal begins some space behind dorsal, ends not very far from caudal. Caudal very small, rudimentary rays rather numerous above and below. Pectoral quite low. Ventrals very small, partly coalescent. Light brown on back with numerous brown pigment spots on sides. Abdomen black. Length 89 mm. (Günther.)

Eastern Atlantic and Pacific.

Omosudis brevis Brauer

Figure 208

Omosudis brevis BRAUER, 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 142, Fig. 70. Cape Verde Islands, N. lat. $14^{\circ} 39' 5''$, W. long. $21^{\circ} 51' 8''$, in 2500 m.

Head $2 \frac{2}{5}$; depth $3 \frac{2}{5}$; dorsal 21; anal 13; pectoral 13. Eye round, $1 \frac{1}{10}$ in snout, $3 \frac{1}{10}$ in head, $\frac{2}{5}$ of interorbital. Mouth cleft reaches hind edge of eye. Small teeth in jaws, 2 large teeth on palatines and 1 in mandible. Groove each side of forehead. Nostrils small, midway in snout. Dorsal inserted before middle of body, entirely before ventral, fin low and long. Adipose fin far back, above last anal rays. Anal in last third of body, rays elongate, shorter than dorsal. Pectoral below dorsal,

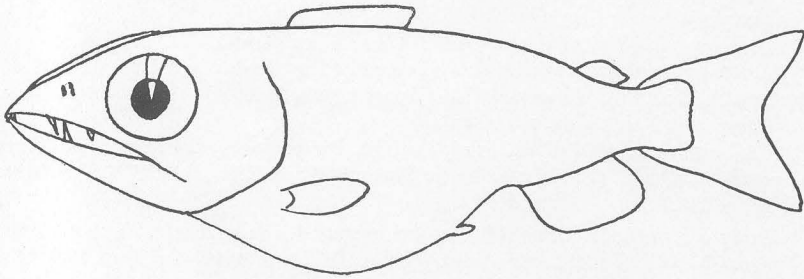


Fig. 208. *Omosudis brevis*, from Brauer.

short. Ventral rudimentary, behind middle of body. Belly with dark pigment. Peritoneum with two short blackish pigment plates. Head and back brownish black. Caudal clear. Length 15 mm. (Brauer.)

Cape Verde Islands.

Alepisauridae

Lancet Fishes

Body elongated. Snout produced. Mouth cleft very wide. Pre-maxillaries very long, slender, not protractile, form entire edge of upper jaw. Maxillary thin, long, immovable. Teeth variable, erect. Opercular bones thin, membranaceous. No barbel. Gill openings very wide. Pseudobranchiae large. Branchiostegals 5 to 7. No air vessel. Vertebrae about 50. Abdominal ribs extend symmetrically the whole length of abdomen, before anal fin. Body scaleless. No photophores. Dorsal very long, occupies nearly whole length of back. Adipose fin present. Anal moderate. Caudal forked. Ventrals abdominal.

Deep-sea fishes, widely distributed in temperate and tropical seas. Günther says:

Every part of the Alepidosauri is so fragile that it is extremely difficult to obtain perfect specimens. It is almost impossible to preserve them in spirits without some portion of the dorsal and of the other fins being broken. The entire structure of the dorsal fin is so delicate that it must even be liable to injury and alteration of outline while the fish is in its native element. The fibrous ligaments connecting the vertebrae are very loose and extensible, so that the form of the fish is easily lengthened when its body is slightly stretched.

ALEPISAURUS Lowe

Lancet Fishes

Alepisaurus LOWE, 1833, Proc. Zool. Soc. London, I, p. 104. Type: *Alepisaurus ferox* Lowe. Monotypic.

Alepidosaurus GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 420 (corrected orthography).

Plagyodontis (Steller) PALLAS, 1811, 'Zool. Ross. Asiat.,' III, p. 38.3 Atypic. Type: *Alepisaurus aesculapius* Bean. (Designated by Jordan and Evermann, 1917, Stanford Publications, 'Genera of Fishes,' part 1, p. 84.)

Plagyodum PALLAS, *op. cit.* Atypic.

Caulopus GILL, 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 128. Type: *Alepisaurus altivelis* Poey. (Designated by Jordan and Gilbert, 1882, Bull. U. S. Nat. Mus., No. 17, p. 276.)

Body compressed. Head attenuate, compressed. Snout conic. Eye moderate or large. Maxillary with supplemental bone. Series of small teeth on the entire length of premaxillary, the anterior ones sometimes larger or curved. Palatine teeth compressed, triangular, pointed, 2 or 3 anterior ones are very long fangs, the others are moderate. Mandibular teeth like palatine, 1 anterior and 2 or 3 median pairs are much enlarged. Tongue toothless. Gill rakers short, spinelike. Gill membranes not united, free from isthmus. Dorsal rays more than 40, slender, simple, all depressible in deep groove, fin invisible when depressed. Adipose fin moderate. Ventral nearly median, rays 9 to 13, the first ones simple and spinelike.

Alepisaurus ferox Lowe

Golpim, Cavallo, Bicuda da India (Madeira)

Figure 209

Alepisaurus ferox LOWE, 1833, Proc. Zool. Soc. London, I, p. 104. Madeira; 1835, Trans. Zool. Soc. London, I, p. 128, Pl. XIX, p. 395, Pl. LIX (Madeira); 1837, *op. cit.*, II, part 3, p. 181 (Madeira).—VALENCIENNES, 1849, 'Hist. Nat. Poiss.,' XXII, p. 392 (Madeira).—JOHNSON, 1862, Ann. Mag. Nat. Hist., London, X, p. 317 (Madeira).

Alepidosaurus ferox GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 421 (type; Madeira).—COLLETT, 1890, Bull. Soc. Zool. France, XV, p. 223 (Funchal).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 330 (Canaries).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (off Madeira, N. lat. 32°, W. long. 16° to 17°, in 2480 m.).

Alepisaurus azureus VALENCIENNES, 1849, 'Hist. Nat. Poiss.,' XXIII, p. 393. Grand Canary (on drawing by Webb).

Head less than 6; depth 12; dorsal 41 to 44; anal 14 to 17; pectoral 14 or 15; ventral 9 or 10. Eye median, 6 in head, equals interorbital space. Dorsal fin greatly

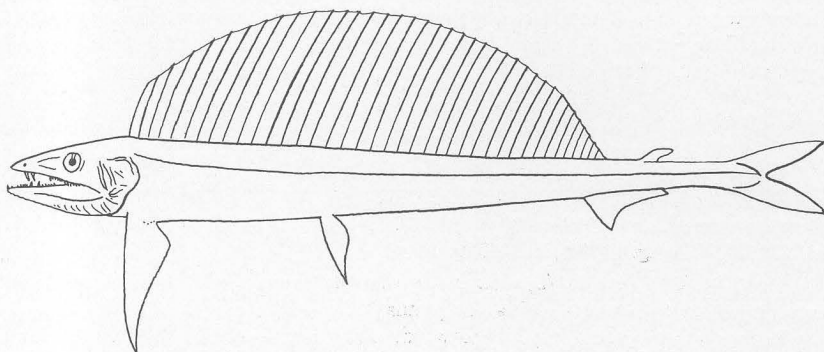


Fig. 209. *Alepisaurus ferox*, from Goode and Bean.

elevated. Upper caudal lobe produced in a long filament. Pectoral elongate, ends at a great distance from ventral. First ray of dorsal, pectoral, and ventral with edge slightly serrated. (Günther.)

Atlantic. Reaches 1500 mm. Barnard reports it from East London, South Africa (1925, Ann. South African Mus., XXI, part 1, p. 250).

Cetomimidae

Body compressed. Caudal peduncle short, slender. Head large. Eyes very small. Mouth exceedingly large; edge of upper jaw formed by premaxillary only; lower jaw strongly curved and projects slightly beyond upper. Teeth in jaws in bands, covering all bones of mouth, tongue, and throat. No barbels. Opercular apparatus incomplete, bones very thin and membrane-like. Gill opening immense. Gills 3, no slit behind third. No pseudobranchiae. No scales. Lateral line conspicuous. Dorsal posterior, far back, opposite similar anal. No adipose fin. Caudal small. Pectorals rather low. No ventrals.

Bathypelagic. Two genera.

CETOMIMUS Goode and Bean

Cetomimus GOODE AND BEAN, 1894 (1895), Proc. U. S. Nat. Mus., XVII, p. 452. Type: *Cetomimus gillii* Goode and Bean. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' part 4, p. 465.)

Cetostoma ZUGMAYER, 1914, Bull. Inst. Océanogr. Monaco, No. 288, p. 3. Type: *Cetostoma regani* Zugmayer. Monotypic.

Body oblong. Eyes placed far below dorsal profile. Teeth granular, in jaws, on vomer, palatines, pterygoids, first gill arch, tongue, and upper pharyngeals. Nostrils well advanced, open slits without flaps. Gill membranes deeply cleft, free from isthmus. No gill rakers. Branchiostegals 9. Mucous pores sometimes on back.

Lateral line broad, of two furrows connected vertically by numerous short cross grooves. Dorsal short and high. Anal like dorsal, opposite. Caudal weak, emarginate or truncate. Pectoral short.

Cetomimus storeri Goode and Bean

Figure 210

Cetomimus storeri GOODE AND BEAN, 1894 (1895), Proc. U. S. Nat. Mus., XVII, p. 453, Pl. xvii, fig. 3. N. lat. $39^{\circ} 3' 15''$, W. long. $70^{\circ} 50' 45''$, in 1535 fathoms.—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' pp. 613, 681, Fig. 497 (N. lat. $27^{\circ} 27'$, W. long. $14^{\circ} 52'$, in 2603 m.).

Head $3 \frac{1}{8}$; depth $3 \frac{4}{5}$; dorsal 19; anal 16; snout $2 \frac{9}{10}$ in head measured from upper jaw tip; mouth cleft along premaxillary $1 \frac{3}{4}$; eye 18.

Body elongately ovoid, deepest forward. Least depth of caudal peduncle 2 in its length or 5 in head. Eye 7 in snout, placed nearer to dorsal profile than to jaw. Lower jaw strongly curved, protrudes. Nostrils together, midway in snout length. Lateral line curved down from head until midway on side below dorsal. Row of mucous pores each side of median line predorsally. Dorsal origin little before that of

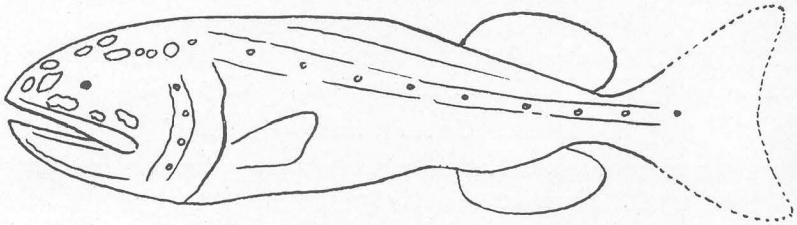


Fig. 210. *Cetomimus storeri*, from Murray and Hjort.

anal, near last third in combined head and trunk; base a little longer than that of anal; about equally as high as anal and longest rays $2 \frac{1}{2}$ in head. Pectoral low, almost on abdominal line, fin lanceolate, about half (?) length of head. Length 120 mm. (Goode and Bean.)

Atlantic.

ORDER MICROCYPRINI

Killifishes

Mouth terminal. Maxillaries not entering gape, not forming upper jaw edge, which is bordered by extremely protractile premaxillaries. Second, third, and fourth upper pharyngeals with teeth, lower separate or with persistent median suture. Branchiostegals 6 or less. Air vessel without duct connecting esophagus. No lateral line. Ventrals abdominal, with 6 or less rays.

SUBORDER POECILIOIDEA

Killifishes

Mouth small, unless jaws are produced. Premaxillaries usually protractile. Maxillary little movable, joined to preorbital. Teeth in jaws and sometimes on vomer, never on palatines. Gill membranes free from isthmus. Ventrals usually well developed, with 6 rays, sometimes absent.

Cyprinodontidae

Killifishes

Body oblong or moderately elongate, compressed behind, depressed forward. Head usually broad. Mouth terminal, small, lower jaw usually projects. Premaxillaries strong. Teeth incisor-like or villiform, usually only in jaws. Gill membranes somewhat connected. Gill rakers very short, thick. Pseudobranchiae none. Lower pharyngeals separate, with cardiform, rarely molar teeth. Stomach siphonal, without pyloric appendages. Air vessel simple, often absent. Scales rather large, cycloid, adherent, in regular rows. Head scaly, at least above. Lateral line absent or only as a few imperfect pores. Dorsal fin single, posterior, of soft rays only. Caudal not forked. Pectorals low.

A large family, chiefly of fresh-water fishes, mostly in tropical America. Though some live only in tidal waters, either fresh or brackish, others live along the shores of bays or the ocean, even in the surf. All the marine forms are shore-loving, living at the surface, usually about shallows with sandy or muddy bottoms.

FUNDULUS Lacépède

Fundulus LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 37. Type: *Fundulus mudfish* Lacépède = *Cobitis heteroclita* Linné. (Designated by Jardine, 1834, Nat. Library 'Fish. Brit. Guiana, Schomburgk,' XXXIX, p. 204.)

Hydrargira LACÉPÈDE, *op. cit.*, p. 378. Type: *Hydrargira swampina* Lacépède = *Fundulus majalis* Walbaum. Monotypic.

Hydrargyra, *Hydrargyre* auct.

Zygonectes AGASSIZ, 1854, Amer. Jour. Sci. Art., (2) XVI, p. 135. Atypic; 1854, *op. cit.*, (2) XVII, p. 533. Type: *Poecilia olivacea* Storer. Orthotypic.

Micristius GILL, 1865 (August), Canadian Nat., (N.S.) II, p. 266. Type: *Fundulus notatus* (not Mitchill) Valenciennes. (Designated by Jordan and Gilbert, 1877, Proc. Acad. Nat. Sci. Philadelphia, p. 94.)

Xenisma JORDAN, 1876, Bull. Buffalo Soc. Nat. Hist., p. 142. Type: *Xenisma stellifera* Jordan. Monotypic.

Borborys (Broussonet) GOODE AND BEAN, 1885, Proc. U. S. Nat. Mus., p. 204. Type: *Cobitis heteroclita* Linné. Monotypic.

Plancterus GARMAN, 1895, Mem. Mus. Comp. Zoöl., XIX, No. 1, p. 96. Type: *Plancterus kansae* Garman. Monotypic.

Fontinus JORDAN AND EVERMANN, 1896, Bull. U. S. Nat. Mus., XLVII, part 1, pp. 633, 634. Type: *Fundulus seminolis* Girard. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' part 4, p. 473.)

Gambusinus JORDAN AND EVERMANN, *op. cit.*, pp. 633, 635. Type: *Fundulus rathbuni* Jordan and Meek. (Designated by Jordan, *loc. cit.*)

Gelasaccus FOWLER, 1916, Proc. Acad. Nat. Sci. Philadelphia, p. 416. Type: *Hydrargira similis* Baird and Girard. Orthotypic.

Chriopeops FOWLER, *op. cit.*, p. 425. Type: *Lucania goodei* Jordan. Monotypic.

Oxyzygonectes FOWLER, *loc. cit.* Type: *Haplochilus dovii* Günther. Monotypic.

Fonticola JORDAN AND EVERMANN, 1928, Rept. U. S. Fish Comm., part 2 (1930), p. 178. Type: *Fundulus seminolis* Girard. Monotypic.

Menona JORDAN AND EVERMANN, *loc. cit.*, p. 178. Type: *Fundulus menona* Jordan. Tautotypic.

Body elongate, compressed behind. Head rather large. Eye small, larger in young. Mouth moderate, lower jaw projecting, bones firmly united. Two or more series of simple pointed teeth in each jaw, usually as a narrow band. Gill opening not restricted above, opercle with edge not adnate to shoulder girdle. First upper pharyngeal without teeth, the other toothed, the third and fourth joined. Intestinal canal short. Air vessel present. Scales moderate. Preopercle, opercle and lower jaw with mucous pores. Dorsal and anal alike, small or rather large, dorsal inserted before, above or behind front of anal. Ventrals well developed. Sexes variable in color, size, and fin development, anal of male normal. Oviparous.

A large genus containing the largest members of the family. Some are brightly colored.

Fundulus nisorius Cope

Fundulus nisorius COPE, 1870, Trans. Am. Philos. Soc., (2) XI, p. 456. Gaboon.—FOWLER, 1916, Proc. Acad. Nat. Sci. Philadelphia, p. 417 (types); 1919, Proc. U. S. Nat. Mus., LVI, p. 265 (types).

Fundulus nigrofasciatus GÜNTHER, 1889, 'Rept. Voy. "Challenger,"' XXXI, p. 33 (between Teneriffe and St. Thomas.).

Head 3 to 3 3/5; depth 3 1/8 to 4; dorsal 1, 11, rarely 1, 10 or 1, 12; anal 1, 10, vary 1, 8 to 1, 11; scales 31 to 35 in median lateral series to caudal base and 3 to 5 more on latter; snout 3 1/3 to 4 in head measured from snout tip; eye 2 3/4 to 4 1/2; maxillary 2 3/4 to 3 1/2; interorbital 2 to 2 2/3.

Body rather robust, compressed, more so in male. Caudal peduncle compressed, least depth 1 7/8 to 2 1/8 in total head or 1 1/3 to 1 1/2 in its own length. Head short, obtuse, width 1 3/5 to 1 2/3 in its total length. Snout depressed, length 2/5 to 1/2 its width. Eye close to upper profile, center near first third in head. Mouth moderate, lower jaw obtuse, projects. Teeth fine, conic, in bands in jaws, outer row enlarged. Interorbital flat. Gill rakers 2 or 3+9, lanceolate, half length of gill filaments. Scales largest on top of head, smaller on breast, belly and caudal base; basal radiating striae 17 to 23; circuli coarse. Dorsal origin a little nearer caudal base than gill opening in adult female, much nearer latter in young and adult male; second branched

ray about 2 in head. Anal origin opposite second branched dorsal ray base; fourth branched ray $1 \frac{2}{5}$ to $1 \frac{4}{5}$ in head; female without anal sheath though with long simple tube, as long as first ray. Caudal truncate, rounded convexly behind when spread open; $1 \frac{1}{8}$ to $1 \frac{1}{4}$ in head. Pectoral not quite reaching ventral, $1 \frac{2}{5}$ to $1 \frac{2}{3}$ in head. Ventral not quite to anal, $2 \frac{1}{3}$ to $2 \frac{3}{4}$ in head.

Color brownish generally, a little paler below. Sides with about 14 to 17 narrow vertical bars, less than half the width of the exposed scales. In the course of each bar are scattered pearly or whitish rounded spots, smaller and more crowded about caudal base. Vertical fins dusky, with irregular and variable whitish spots, smaller on caudal, and edges of all these fins broadly whitish. Female uniform brownish, paler on under surfaces, and without dusky or dark pectorals and ventrals of male. Male with terminal portions of anal rays covered with little points or denticles, row to each shaft. These absent in female, though in some females there are a few little points or granules on rays of dorsal fin on their outer portions. Length 33 to 91 mm.

West Africa, from the Canaries to the Gaboon. Described above from the types of *Fundulus nisorius* Cope. Apparently close to the American *Fundulus heteroclitus*, with which it agrees in many respects. The scale structure of both is the same.

ORDER SYNENTOGNATHI

Synentognathous Fishes

Maxillary very close to premaxillary, sometimes firmly joined though the sutures are distinct. Branchiostegals 9 to 15. Vertebrae 45 to 70, abdominal much more numerous than caudal. Air vessel large, without pneumatic duct. Intestinal canal simple, without pyloric appendages. Lateral line concurrent with belly, of peculiar structure. Ventral abdominal, rays more than 5.

KEY TO THE SUBORDERS

a.—Mouth small; third upper pharyngeals strongly enlarged, together they form a somewhat convex ovoid plate; scales rather large.

EXOCOETOIDEA.

aa.—Mouth usually large; third upper pharyngeals moderately enlarged, separate, fourth usually present; scales very small.

SCOMBERESOCOIDEA.

SUBORDER EXOCOETOIDEA

Flying Fishes

Mouth small. Second and third upper pharyngeals with teeth, third pair strongly enlarged, together forming a somewhat convex ovoid plate. Fourth upper pharyngeals broad, triangular, with concave upper surface. Pharyngeal teeth on principal plates villiform in front, incisors

behind their edges transversely expanded and horizontal. Intermediate forms of teeth, many tricuspid, connect above types. Scales rather large.

KEY TO THE FAMILIES

- a.*—Mouth cleft short, jaws not produced in a long beak; pectorals more or less elongated as organs of flight **EXOCOETIDAE.**
aa.—Mouth cleft narrow, lower jaw usually produced; pectorals not elongated as organs of flight **HEMIRAMPHIDAE.**

Exocoetidae

Flying Fishes

Body oblong or elongate. Head with vertical sides. Mouth moderate, terminal. Jaws not prolonged as a beak. Premaxillaries not protractile, with a straight transverse front edge. Upper jaw edge formed chiefly by premaxillaries, and sometimes short maxillaries enter the lateral edge. Maxillary free from or merely adherent to premaxillary, its edge slipping under front of preorbital. Teeth various, small, villiform, weak. Nostrils large, double, near eye. Gill membranes not united, free from isthmus. Gills 4, slit behind fourth. Gill rakers various. Pseudobranchiae hidden, glandular. Vertebrae 44 to 52. Air vessel very large, not cellular, extends far back among the haemophyses of the caudal vertebrae. Shoulder girdle and pectoral muscles very strong. Scales deciduous, cycloid. Head more or less scaly. Dorsal without spines, on hind part of body opposite anal and mostly similar. No finlets. Pectorals large, high, used as organs of flight. Ventrals of several soft rays, placed posteriorly. Vent close before anal.

Carnivorous or herbivorous fishes of all warm seas, mostly pelagic, swimming near the surface and skipping or sailing through the air, sometimes for considerable distances.

KEY TO THE GENERA

- a.*—**FODIATORINAE.** Body not angular in outline, cross section elliptical; vomer, palatines, and pterygoids toothed; dorsal elevated; anal long, its base scarcely shorter than that of dorsal; pectorals moderate, not reaching beyond middle of dorsal; ventrals rather long, inserted behind middle of body . . . **FODIATOR.**
aa.—**EXOCOETINAE.** Body angular in outline, cross section subquadrate; mouth roof and tongue with fewer teeth, vomer and palatines toothed or not; pectorals very long, usually reaching near caudal base.
b.—Ventrals inserted anteriorly, much nearer snout tip than caudal base, not used in flight, their tips not reaching nearly to front of dorsal.

EXOCOETUS.

- bb.*—Ventrals inserted posteriorly, more or less nearer caudal base than snout tip, used in flight, their tips reaching past middle of anal base.

CYPSELURUS.

FODIATOR Jordan and Meek

Sharp-nosed Flying Fishes

Fodiator JORDAN AND MEEK, 1885, Proc. U. S. Nat. Mus., p. 45. Type: *Exocoetus acutus* Valenciennes. Monotypic.

Body moderately long. Snout slender, pointed, much longer than eye. Lower jaw acute, tip produced. Vomer, palatines, pterygoids, and tongue with teeth. Dorsal high. Anal as long as dorsal. Pectoral moderate, not reaching beyond middle of dorsal. Ventral long, posterior.

One species, widely distributed. Notable for the long, produced snout, suggestive of the halfbeaks.

Fodiator acutus (Valenciennes)

Figure 211

Exocoetus acutus VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XIX, p. (125) 91. Surinam, Nice.—GÜNTHER, 1866, 'Cat. Fish. Brit. Mus.,' VI, p. 281 (about 100 miles off Fernando Po).—PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 153 (Togo, Dahomey); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 30 (Lomé, Togo).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 251, Fig. 29A (Port Étienne).

Fodiator acutus FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 265 (Gaboon), p. 275 (Loando, Angola).

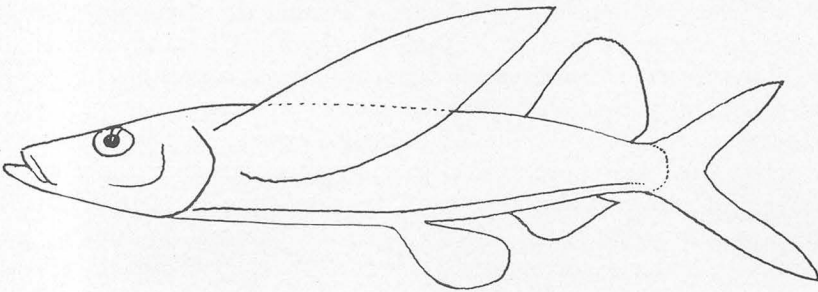


Fig. 211. *Fodiator acutus*, from Jordan and Evermann.

Head $3 \frac{2}{5}$ to $3 \frac{2}{3}$; depth $4 \frac{3}{5}$ to 5; dorsal 1, 8, 1 or 1, 9, 1; anal 1, 9, 1 or 1, 10, 1; scales about 50 in lateral line to caudal base; 38 to 43 scales from shoulder to caudal base medially; 6 scales above lateral line to dorsal origin, 3 below to anal origin; 23 to 26 predorsal scales; snout $2 \frac{1}{3}$ to $2 \frac{7}{8}$ in head measured from upper jaw tip; eye 3 to $3 \frac{2}{3}$; maxillary 4 to $4 \frac{3}{4}$; interorbital $3 \frac{1}{8}$ to $3 \frac{3}{4}$.

Body compressed, fusiform, deepest about midway. Least depth of caudal peduncle about 4 in head from snout tip. Head width $2 \frac{3}{5}$ its length from snout tip. Snout long, conic, width $1 \frac{2}{5}$ to $1 \frac{1}{2}$ its length. Eye midway in head from snout tip, $1 \frac{1}{2}$ in snout. Mouth small, lower jaw produced in a short beak beyond the snout tip for a space about equal to the horizontal pupil diameter. Maxillary entirely

concealed above posteriorly by preorbital, not quite to nostril. Teeth minute, conic, in bands, upper band a little broader. Nostrils in rather a large cavity close above and before front of eye. Interorbital level. Gill rakers 8+24 or 25, lanceolate, about $1/2$ to $4/5$ of gill filaments, latter about $1\ 1/2$ in eye. Scales caducous, narrowly exposed, with 3 to 5 radiating striae forming 2 basal lobes. Scales a little smaller on caudal base. Dorsal origin about half an eye diameter nearer the last dorsal ray base than ventral origin, second branched ray $1\ 3/4$ in head from snout tip. Anal origin about opposite first branched dorsal ray base, second branched ray 4 in head. Caudal well forked, about as long as head. Pectoral long, reaches slightly behind dorsal origin. Ventral inserted a little nearer caudal base than hind eye edge, fin not quite reaching anal, $1\ 7/8$ in head.

Brown above, sides and below silvery white, also iris and side of head. Dorsal with elevated front portion blackish. Greater outer portion of pectoral dusky, rays all pale or whitish. Median portion of caudal lobes brownish, fins otherwise pale. Length 150 mm.

Tropical Atlantic and eastern Pacific. Described above from examples from Loando, Gaboon, and Panama. The Atlantic examples have much longer pectorals, which reach $2/5$ of the dorsal. They also have a slightly shorter snout, in which the eye is equally long or about $4/5$ to $7/8$ in length of same. Jordan and Evermann¹ have figured a Panama example with the pectoral equally as long as my African examples, but they show the snout longer, like my Panama specimen. Also the mandible of the latter extends beyond the upper jaw a space equal to the horizontal pupil diameter, though it is much shorter in African specimens. In the closed jaws of the Panama example the maxillary is entirely concealed behind, whereas, in African examples, it is always visible. Also the cheek is a little deeper in African specimens. Günther describes an example with the ventrals reaching the vent, in agreement with my African material, though in the Panama specimen they extend very slightly beyond. Also the "ventral fin midway between the center of the eye and the root of the caudal," though by the latter he doubtless means the basal caudal squamous area and not the last caudal vertebra. The latter method of computation agrees with my Loando example. In the Panama specimen the ventral is very slightly more backward.

EXOCOETUS Linné

Flying Fishes

Exocoetus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 316. Type: *Exocoetus volitans* Linné. Monotypic.

Hirundo (not Linné) CATESBY, 1771, 'Hist. Nat. Carolina,' 2d Ed., p. 8. Type: *Exocoetus volitans* Linné. Monotypic. (Inadmissible.)

Pterichthys (Commerson) LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 403.

¹1900, Bull. U. S. Nat. Mus., No. 47, part 4, Pl. cxvii, fig. 315.

Type: *Exocoetus commersonii* Lacépède = *Exocoetus volitans* Linné. Monotypic. (Inadmissible.)

Halocypselus WEINLAND, 1859, Proc. Boston Soc. Nat. Hist., VI, p. 385. Type: *Exocoetus mesogaster* (not Bloch) Weinland = *Exocoetus evolans* Linné. Monotypic.

Body moderately elongate, compressed. Snout short, jaws about equal. Very small teeth in jaws, none on palate or tongue. Gill openings wide. Gill rakers well developed. Scales rather large. Lateral line running low along side of body. Dorsal and anal about equal, opposite. Pectoral very long, reaches nearly or quite to caudal base. Ventrals short, their origin much nearer snout tip than caudal base.

A single species, widely diffused and abundant in most warm seas.

***Exocoetus volitans* Linné**

Volador (Canaries), Nankhar (Senegambia)

Figure 212

Exocoetus volitans LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 316. Pelagic in high seas of Europe and America.—OSBECK, 1765, 'Reise Ost-Ind., China,' p. 394 (in the Grass Sea).—LAY AND BENNETT, 1839, 'Zool. Beechey's Voyage,' p. 43 (off Teneriffe).—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV (1), p. 48 (Rufisque).—VINCIGUERRA, 1890, Lo Spallanzani, Roma, (2) XIX, p. 483 (Las Palmas, Grand Canary).; 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 331 (Grand Canary).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 40 (three miles south of Point Areynaya, Grand Canary).

Exocoetus evolans VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XIX, p. 138 (Cape Verde).—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 263 (Porto Praya, Cape Verde Islands).—VON MARTENS, 1876, 'Preuss. Exped. Ost-Asien,' I, pp. 34, 401 (Atlantic in N. lat. 15°).—RICHARD, 1905 (October 15), Bull. Mus. Océanogr. Monaco, XLVI, p. 13 (N. lat. 26°, W. long. 26° to 27°).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 59 (off Madeira, N. lat. 30° 50', W. long. 25° 20' 45"; southwest of Azores, N. lat. 31° 44' 30", W. long. 42° 39'; Azores, N. lat. 37°, W. long. 27°).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 220 (Cape Blanco).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 251 (Cape Blanco).

Exocoetus evolans ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 138 (Cape Verde, Gorée, Dakar, Banc d'Argain).

Exocoetus (Exocoetus) evolans LAMPE, 1914, 'Deutsche Südpolar Exped.,' XV, p. 221, Pl. XI, figs. 1-3, Text Fig. 2a-c (Porto Grande, São Vincente; N. lat. 2°, W. long. 17°; N. lat. 3° 18', W. long. 17° 46').

Halocypselus evolans ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 40 (between Canaries and Cape Verde).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 131 (Madeira, N. lat. 31° 4', W. long. 24° 51'; south of Azores, N. lat. 33° 30', W. long. 27° 20').

Exocoetus obtusirostris GÜNTHER, 1866, 'Cat. Fish. Brit. Mus.,' VI, p. 383. Cape Verde Islands, New Orleans, India.—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV (1), p. 54 (Gaboon).—GÜNTHER, 1889, 'Rept. Voy. "Challenger,"' XXXI, p. 31 (tropical Atlantic).—OSORIO, 1895 (March), Jorn. Sci. Math. Phys. Nat. Acad., Lisboa, (2) III, p. 253 (100 miles off Cape Verde); 1898, *op. cit.*,

(2) V, p. 199 (Dahomé).—CLARK, 1913, Proc. Roy. Phys. Soc. Edinburgh, XIX, p. 385 (Ascension Island), p. 391 (St. Helena).

Exocoetus holubii STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV (1), p. 54. West Africa at equator.

Exocoetus holubi COLLETT, 1896, Rés. Camp. Sci. Monaco, X, p. 123, Pl. iv, fig. 18 (between Azores and Newfoundland).

Exocoetus gaussianus LAMPE, 1914, 'Deutsche Südpolar Exped.,' XV, p. 224, Pl. XI, fig. 6. N. lat. $2^{\circ} 9'$, W. long. $17^{\circ} 38'$.

Head $3\frac{2}{5}$ to 4; depth $4\frac{3}{4}$ to $6\frac{1}{5}$; dorsal II, 11 to 13; anal I, or II, 11 or 12; scales 38 to 47 in median lateral series to caudal base and 3 or 4 more on latter; 7 scales above lateral line, 2 below; 26 to 30 predorsal scales; snout $3\frac{3}{4}$ to 5 in head measured from upper jaw tip; eye $2\frac{2}{3}$ to $4\frac{1}{8}$; maxillary $3\frac{2}{3}$ to $4\frac{3}{4}$; interorbital $2\frac{1}{2}$ to $3\frac{1}{5}$.

Body long, sides flattened, broader above. Caudal peduncle small, compressed. Head widely convex above, flattened sides converge below. Snout short, convex, length $\frac{4}{5}$ its width. Eye large, rounded, well anterior. Mouth small, wide, convex

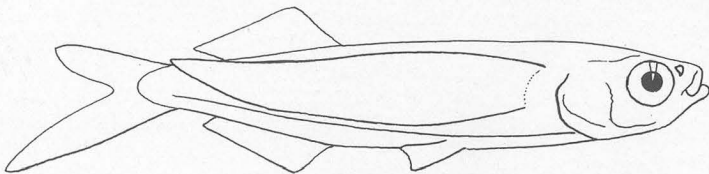


Fig. 212. *Exocoetus volitans*, from Day.

lower jaw protruding. Curved maxillaries not quite reaching nostril. No teeth. Nostril large, close before eye. Interorbital wide, flat. Gill rakers 7 to 9+20 to 27, slender, about half of eye. Scales firm, narrowly exposed, smaller on hind part of body. Head and caudal base scaly. Lateral line low, not extending beyond anal. Dorsal inserted at about last third in combined head and trunk, front rays higher. Anal opposite, similar. Caudal with lower lobe much longer, more than head. Pectoral with first ray simple, second divided. Ventral inserted nearer snout tip than caudal base, reaches $\frac{1}{2}$ to anal.

Olivaceous above, tinted with dusky, sides and below silvery white. Iris silvery white. Dorsal, anal, and caudal pale dusky, though anal is with a basal band, broader in front. Pectoral dark above, lower edges white. Young with 2 dark crossbands and sometimes a small barbel at chin. Length 229 mm.

Widely distributed in most warm or tropical seas as the Atlantic, Indian, and Pacific Oceans. Described above from a series largely from the tropical Atlantic.

One in the U. S. National Museum from near St. Thomas Island, West Africa.

One 230 mm. long from N. lat. 27° , W. long. $26^{\circ} 30''$, with barnacle growing out of head, in Museum of Comparative Zoölogy.

Exocoetus holubii Steindachner is based on an example 177 mm. long. It is described as differing from *Exocoetus volitans* in the higher dorsal fin, the second and third rays of which are longer than half the length of the head, or contained in the head length 1 1/2 times.

Exocoetus gaussianus Lampe, based on an example but 38 mm. long, is doubtless the young. It agrees with the present species in the fin formula and the anterior insertion of the ventrals. Their black color, as well as the lower basal third of the pectoral, dorsal, and anal fins is frequently met with in young specimens of *Exocoetus volitans*.

CYPSELURUS Swainson

Cypselurus SWAINSON, 1839, 'Nat. Hist. Animals, II, p. 296. Type: *Exocoetus nuttallii* Le Sueur. (Designated by Jordan and Gilbert, 1882, Bull. U. S. Nat. Mus., No. 16, p. 380.)

Cypselurus auct.

Cheilopogon LOWE, 1840, Proc. Zool. Soc. London, VIII, p. 38. Type: *Cypselurus pulchellus* Lowe. Monotypic.

Pterichthys MÜLLER, 1843, Archiv Naturg., p. 312. Type: *Exocoetus furcatus* Mitchill. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 2, p. 216.)

Exonantes JORDAN AND EVERMANN, 1895 (1896), Rept. U. S. Fish Comm., XXI, p. 322. Type: *Exocoetus exiliens* P. L. S. Müller. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' part 4, p. 472.)

Pteronotus OGILBY, 1908, Proc. Roy. Soc. Queensland, XXI, p. 13. Type: *Exocoetus cirriger* Peters. Monotypic.

Hirundichthys BREDER, 1928 (March), Bull. Bingham Oceanogr. Collection, II, Art. 2, p. 20. Type: *Exocoetus rubescens* Rafinesque. Orthotypic.

Prognichthys BREDER, *idem*. Type: *Exocoetus gibbifrons* Valenciennes. Orthotypic.

Body long, broad above, somewhat compressed. Head short, blunt, narrowed below. Snout short, eye large. Mouth small, jaws very short and about equal. Young with mandibular barbel. Teeth very feeble or absent, sometimes on palatines, none on vomer, pterygoids, or tongue. Gill rakers moderate. Gill openings wide. Scales large or moderate. Lateral line low, along lower side of body. Dorsal fin short, opposite anal. Caudal widely forked, lower lobe longer. Pectorals very long, reach past front of anal, or even to caudal base. Ventrals very large, inserted posteriorly, used in flight.

Species numerous in open warm seas in large schools, some nearly cosmopolitan.

KEY TO THE SPECIES

a.—EXONAUTES. Anal long, its base about equals that of dorsal, first ray inserted opposite that of dorsal, branched rays 10 to 12.

b.—First and second pectoral rays simple, third divided.

c.—Second pectoral ray as long as first ray; ventral inserted midway between hind edge of eye and caudal base. *exiliens*.

- cc.—Second pectoral ray about $1/2$ longer than first; ventral inserted midway between middle of preopercle and caudal base. *rondeletii*.
- bb.—First pectoral ray simple, second and third divided; ventral inserted midway between middle of preopercle and caudal base. *rubescens*.
- aa.—CYPSELURUS. Anal shorter, base $1/2$ to $2/3$ that of dorsal, its insertion behind first dorsal ray, branched rays 8 or 9.
- d.—Ventral inserted midway between pupil and caudal base. *furcatus*.
- dd.—Ventral inserted midway between hind preopercle edge and caudal base.
- e.—Pectoral abruptly black behind, variegated with black. *pinnatibarbatulus*.
- ee.—Pectoral unicolor, not abruptly black behind or variegated with black. *lineatus*.
- ddd.—Ventral inserted midway between middle of opercle and caudal base. *bahiensis*.

Cypselurus exsiliens (P. L. S. Müller)

Exocoetus exsiliens P. L. S. MÜLLER, 1776, 'Des Ritters C. v. Linné vollständiges Natursystem,' Suppl., (Nürnberg), p. 209. Carolina.—VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II, part 2, p. 71 (Canaries).

Exocoetus exsiliens BOWDICH, 1825, 'Excurs. Madeira,' p. 124 (Madeira).

Exocoetus (Exonantes) exsiliens LAMPE, 1914, 'Deutsche Südpolar Exped.,' XV, p. 223 (Cape Verde to Ascension Island).

Head $4\frac{1}{4}$; depth $5\frac{3}{4}$; dorsal I, 10; anal I, 11, 1; scales 43 in lateral series to caudal base and 5 more on latter; 7 scales above lateral line, 2 below; 30 predorsal scales; snout 4 in head measured from upper jaw tip; eye $2\frac{2}{5}$; maxillary $2\frac{1}{4}$; interorbital $2\frac{1}{8}$.

Body elongate, sides slightly flattened, back moderately wide, but a little broader than belly. Caudal peduncle compressed, least depth $1\frac{1}{4}$ its length or $3\frac{2}{5}$ in total head length. Head broad above, flattened sides converging below, width $1\frac{2}{5}$ its total length. Snout short, length $2/5$ its width. Eye large, rounded, well anterior, projects in the upper profile. Mouth small, wide, lower jaw slightly protruding. Slightly curved maxillary about reaches front of eye, largely concealed above. Teeth minute, simple, conic, in a narrow series in jaws. Nostril large, close before eye. Interorbital wide, slightly concave. Gill rakers III, 4+18, lanceolate, nearly $2/5$ of eye. Scales rather loose, narrowly exposed, not much reduced on body posteriorly. Head and caudal base scaly. Scales with 4 basal radiating striae, edge scalloped; circuli 17. Lateral line low, complete. Dorsal inserted at about last third between front pupil edge and caudal base; first branched ray $1\frac{1}{2}$ in total head length. Anal opposite dorsal, equally long; first branched ray $1\frac{1}{4}$ in head. Pectoral reaches caudal base, first and second rays simple, the former a trifle longer, both with rather wide distensible connecting membranes; first ray $2\frac{1}{5}$ in fin. Ventral inserted midway between hind eye edge and caudal base, fin extends as far back as pectoral end; $1\frac{3}{4}$ in pectoral.

Brownish above, silvery white below. Breast with 3 blackish crossbands. Black spot on upper part of front dorsal rays, fin otherwise whitish. Anal whitish. Caudal

whitish, lower lobe with blackish spot at about $1/3$ its distance from base. Pectoral dusky, edged paler above, with blackish basal, median and terminal areas transversely. Ventral somewhat similar, only basal whitish area larger. Length 70 mm.

Open tropical seas. Described above from an example taken in the Atlantic in N. lat. $31^{\circ} 30'$, W. long. $36^{\circ} 36'$. No large examples appear to be known.

***Cypselurus rondeletii* (Valenciennes)**

Volador (Cape Blanco)

Figure 213

Exocoetus rondeletii VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XIX, p. 84, Pl. DLXII. Naples, Sicily, Canaries.—GÜNTHER, 1889, 'Rept. Voy. "Challenger,"' XXXI, p. 37 (off Cape Verde Islands).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 221 (Cape Blanco).

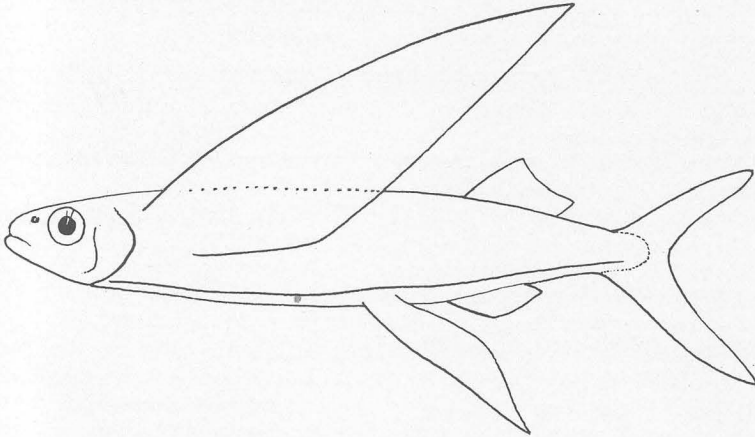


Fig. 213. *Cypselurus rondeletii*, from Valenciennes.

Head $4 \frac{1}{2}$; depth $5 \frac{1}{2}$; dorsal 1, 10; anal 1, 10; pectoral 11, 16; ventral 1, 5; scales 47 in lateral series from shoulder to caudal base and 4 more on latter; 8 scales above lateral line to dorsal origin; 30 predorsal scales; snout $3 \frac{1}{2}$ in head measured from upper jaw tip; eye $3 \frac{7}{8}$; maxillary $3 \frac{1}{2}$; interorbital 2.

Body elongate, compressed, rather fusiform. Caudal peduncle compressed, least depth $1 \frac{3}{4}$ in its length or 3 in total head length. Head compressed, width $1 \frac{1}{2}$ its length. Snout broad, obtuse, length $1 \frac{1}{2}$ its width. Eye large, slightly impinging on upper profile, hind edge about midway in head length. Mouth rather small, lower jaw slightly protruding. Maxillary partly free, reaches opposite nostrils. Teeth small, conic, in narrow bands. Nostrils in rather a large cavity close before front of

eye. Interorbital slightly concave. Gill rakers 7+15, lanceolate, slightly curved or twisted, $2\frac{1}{3}$ in eye. Scales mostly firmly adherent; radiating striae 5, edge scalloped; circuli fine. A few small scales on caudal base. Lateral line low, runs close along lower profile, to middle in length of caudal peduncle. Tubes largely simple and well exposed. Dorsal inserted at about last third in space between hind preopercle edge and caudal base or midway between ventral origin and last dorsal ray base; first branched ray $1\frac{3}{4}$ in total head length. Anal origin very slightly behind dorsal origin; first branched ray $2\frac{3}{4}$ in head. Caudal well forked, upper lobe $\frac{2}{3}$ of lower (damaged), which is greater than head. Pectoral long, first 2 rays simple, depressed fin reaching caudal base. Ventral inserted about an eye diameter nearer caudal base than hind eye edge, fin reaching base of last anal ray; $2\frac{2}{3}$ in pectoral length. Vent close before anal.

Color brownish above, pale or whitish below. Fins brownish. Middle of each caudal lobe basally dark brown. Outer portions of pectorals dusky along hind edge. Ventrals with outer portions dusky, edge pale all around. Iris whitish. Length 248 mm.

Tropical seas, in the Atlantic, Indian, and Pacific Oceans. Described above from an American example (Gulf of Mexico).

***Cypselurus rubescens* (Rafinesque)**

Exocoetus rubescens RAFINESQUE, 1818, Amer. Month. Mag. Crit. Rev., p. 205. Banks of Newfoundland.

Exocoetus polleni BLEEKER, 1866, Ned. Tijds. Dierk., III, p. 130. S. lat. $4^{\circ} 4'$, W. long. $32^{\circ} 44'$ (east of Brazil).

Exocoetus affinis GÜNTHER, 1866, 'Cat. Fish. Brit. Mus.,' VI, p. 288. Cuba?, Atlantic, West Africa.

Exocoetus (Exonautes) affinis LAMPE, 1914, 'Deutsche Südpolar Exped.,' XV, p. 223 (between Ascension Island and Cape Colony).

Exocoetus speculiger CLARK, 1913, Proc. Roy. Phys. Soc. Edinburgh, XIX, p. 391 (St. Helena).

Head $4\frac{1}{6}$; depth $6\frac{1}{4}$; dorsal I, 11, 1; anal I, 12; scales 53 from shoulder to caudal base and 5 more on latter; 6 scales above lateral line to dorsal origin, 2 below to anal origin; 42 predorsal scales; snout 4 in head measured from upper jaw tip; eye $3\frac{1}{3}$; maxillary $3\frac{3}{5}$; interorbital $2\frac{1}{2}$.

Body elongate, well compressed, sides flattened. Caudal peduncle well compressed, least depth $1\frac{2}{3}$ its length or $3\frac{4}{5}$ in total head length. Head width $1\frac{3}{4}$ in its length. Snout broad, depressed, length $\frac{2}{3}$ its width. Eye large, slightly impinging on upper profile, hind pupil edge midway in head length. Mouth small, broad, lower jaw slightly protruding. Maxillary largely concealed, reaches a point opposite the hind edge of nostril. Teeth fine, in narrow bands in jaws. Nostril large triangular cavity at about last third in snout. Interorbital broad, slightly concave. Gill rakers I, 7+15, III, lanceolate, $1\frac{1}{5}$ in gill filaments or $1\frac{2}{3}$ in eye. Scales firmly adherent, narrowly exposed, slightly smaller behind. Head and caudal base scaly; scales with 4 basal radiating striae, edge scalloped; circuli coarse. Lateral line low, extends back midway in length of caudal peduncle. Dorsal inserted at last third in space between hind preopercle edge and caudal base; first branched ray $2\frac{1}{3}$ in total head length. Anal origin opposite that of dorsal, or much nearer ventral origin than

caudal base; first branched ray 3 in head. Caudal with lower lobe much longer, though apparently but little longer than head. Pectoral reaches as far back as tip of last depressed dorsal ray; first ray simple, all others divided. Ventral inserted about midway between hind preopercle edge and caudal base, reaches base of tenth branched anal ray, therefore is a little longer than head.

Color brownish on head and back above, sides and below silvery white. Dorsal, anal, caudal, and ventral pale, last whitish. Pectoral largely brownish, hind edge and sub-basal oblique bar to middle, white. Iris silvery white. Length about 270 mm.

Tropical Atlantic, Indian, and Pacific Oceans. Described above from an example from the open Atlantic.

Exocoetus polleni Bleeker is based on an example 293 mm. long. It seems to differ in no important way from *Cypselurus rubescens*.

***Cypselurus furcatus* (Mitchill)**

Exocoetus furcatus MITCHILL, 1815, Trans. Lit. Philos. Soc. New York, I, p. 449, Pl. v, fig. 2. New York.

Cypselurus pulchellus LOWE, 1839, Proc. Zool. Soc. London, VIII, p. 38. Madeira; 1840, Trans. Zool. Soc. London, III, p. 13 (Madeira).

Head $4\frac{1}{5}$ to $4\frac{1}{4}$; depth $4\frac{3}{5}$ to 5; dorsal I, 12 or I, 13; anal I, 8; scales along lateral line to caudal base 50? to 56 and 5 or 6 more on latter; 8 scales above lateral line to dorsal origin, 3 below to anal origin; snout $3\frac{4}{5}$ to 4 in head measured from upper jaw tip; eye $2\frac{3}{4}$ to $3\frac{1}{8}$; maxillary 4; interorbital $2\frac{1}{2}$ to $2\frac{3}{5}$.

Body elongate, sides flattened, back broad. Caudal peduncle small, compressed, a little longer than deep, least depth $1\frac{1}{3}$ in its length or $3\frac{1}{3}$ in head length. Head broadly convex above, width $1\frac{7}{8}$ in its total length. Snout convex, length about $\frac{2}{3}$ its width. Eye large, rounded, well anterior, longer than snout, impinging slightly on upper profile. Mouth small, wide, convex lower jaw protruding. Maxillary a little curved, reaches about opposite eye. Teeth very minute, simple, in narrow series in jaws. Nostrils large, close before eye. Interorbital wide, flattened or slightly concave. Gill rakers II or III, 3+14 or 15, III, lanceolate, about 3 in eye. Scales rather firm, narrowly exposed, slightly smaller on body behind; with 4 or 5 basal radiating striae, edge scalloped; circuli 29 to 40. Head and caudal base scaly. Lateral line low, extends back as far as end of depressed anal. Dorsal inserted about opposite last third in space between front pupil edge and caudal base; first branched ray $1\frac{1}{5}$ in total head length. Anal inserted well behind dorsal origin or a little nearer caudal base than ventral origin; first branched ray $1\frac{4}{5}$ in head. Caudal with lower lobe much longer, about an eye diameter longer than head. Pectoral reaches middle of depressed anal, first ray simple, all others divided. Ventral inserted about midway behind hind edge of eye and caudal base, fin reaching caudal base; length $1\frac{1}{2}$ in pectoral length.

Color brownish on back and head above, sides and below silvery white. Iris silvery white. Dorsal and caudal tinged with dusky, with 2 or 3 larger dark spots on the dorsal fin basally and on lower lobe of the caudal fin. Anal pale or whitish, with dusky spots at tips of some rays. Pectoral contrasted blackish and white, with broad whitish tint extending from axil obliquely to upper rays near terminal ends, and some rays tipped with whitish. Ventral black, except 2 outer white rays. Length 134 to 135 mm.

Tropical Atlantic. Described above from two American specimens (Newport, R. I.).

Though Günther said in 1866 that "according to our present knowledge of these fishes *Cypselurus pulchellus* Lowe . . . from Madeira cannot be specifically separated from *C. solandri*," I think *C. pulchellus* would appear to be more likely the young of *C. furcatus*.

Cypselurus pulchellus Lowe is described as follows:

From want of materials for comparison, I am unable to give correctly the specific characters of this most elegant little Flying-fish, which is remarkably characterized by two or three bright rose-colored horseshoe-shaped marks on each side of the belly, one behind the other. The ventral fins are placed a little behind the middle of the body, not reckoning the caudal fin, and their tips reach to the base of the latter. The tips of the pectoral fins reach only to the end of the base of the dorsal fin, which is large, high, and produced. The anal fin is small and low, but a little produced backwards. The cirrate appendage to the lower jaw is like a leathern flap or apron, torn irregularly at the bottom into strips or thongs. I willingly abandon my own MS. name of *Cheilopogon* for this genus, distinguished from *Exocoetus* by the variously-appendaged lower jaw, in favor of the designation which I find this group of fishes has received from Mr. Swainson whilst this paper has been going through the press.

***Cypselurus pinnatibarbus* (Bennett)**

Figure 214

Exocoetus pinnatibarbus BENNETT, 1831, Proc. Comm. Zool. Soc. London, p. 146. Atlantic coast of North Africa.—GÜNTHER, 1866, 'Cat. Fish. Brit. Mus.,' VI, p. 284 (no data).—ROULE AND ANGEL, 1921 (August), Bull. Inst. Océanogr. Monaco, No. 397, p. 4 (Azores).

Exocoetus nigricans BENNETT, 1840, 'Whaling Voyage,' II, p. 287. Atlantic and Pacific, N. lat. 5°.—BLEEKER, 1866-1872, 'Atlas Ichth.,' VI, p. 75 (Atlantic, N. lat. 9° 50', W. long. 25° 5', off Paris).—VON MARTENS, 1876, 'Preuss. Exped. Ost-Asien,' I, pp. 28, 34, 401 (Atlantic Ocean, N. lat. 8°).

Exocoetus spilopus VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XIX, p. 118. La Rochelle, St. Helena, West Indies, India, Arabia, De Witt Land.—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (Fig. 61, p. 82) (off Gran Canaria).

Head $3\frac{7}{8}$; depth $5\frac{1}{3}$; dorsal I, 14; anal I, 9; scales 48 in lateral series to caudal base; 8 scales above lateral line; 30 predorsal scales; snout $3\frac{1}{2}$ in head, measured from upper jaw tip; eye $3\frac{2}{5}$; maxillary $4\frac{1}{5}$; interorbital $2\frac{1}{2}$.

Body moderately long, sides flattened, back rather broad. Caudal peduncle small, compressed, least depth $1\frac{1}{2}$ in its length or $3\frac{2}{3}$ in total head length. Head wide above, its flattened sides converging below; width 2 in its length. Snout convex, length half its width. Eye moderate, rounded, well anterior. Mouth small, lower jaw protruding. Maxillary not quite reaching eye. Teeth minute, simple, conic, in narrow band in each jaw. Nostril large, close before eye. Interorbital broadly concave. Gill rakers 5+16, lanceolate, short. Scales rather firm, narrowly exposed, not especially reduced on body behind; basal radiating striae 7, edge scalloped; circuli 36 to 44. Head and caudal base scaly. Lateral line reaches opposite hind dorsal end. Dorsal inserted at last third between mandible tip and caudal base,

depressed fin not quite reaching caudal base; first branched ray $1 \frac{1}{8}$ in total head length. Anal inserted about opposite first $\frac{2}{5}$ of dorsal base; third branched ray 3 in head. Upper caudal lobe about $\frac{2}{5}$ of lower, which is $\frac{3}{5}$ an eye diameter longer than head. Pectoral almost reaches caudal base. Ventral inserted midway between hind eye edge and caudal base, extends back as far as pectorals, length $1 \frac{4}{5}$ in pectoral length.

Back is a dusky neutral shade, with violet reflections. Upper surface of head similar, with a distinct violet streak from upper hind edge of eye to pectoral origin. Sides of head brilliant silvery white and sides of trunk soiled or tinged dusky. Violet tints conspicuous at caudal base and at ventral axil. Iris brilliant violet. Lips dusky. Dorsal largely jet-black, paler or soiled dusky gray in front. Upper caudal lobe white, base blackish, lower lobe entirely jet-black. Pectoral largely black, axil with violet tinge, only lower edge and median portion of lower rays gray-white or whitish.

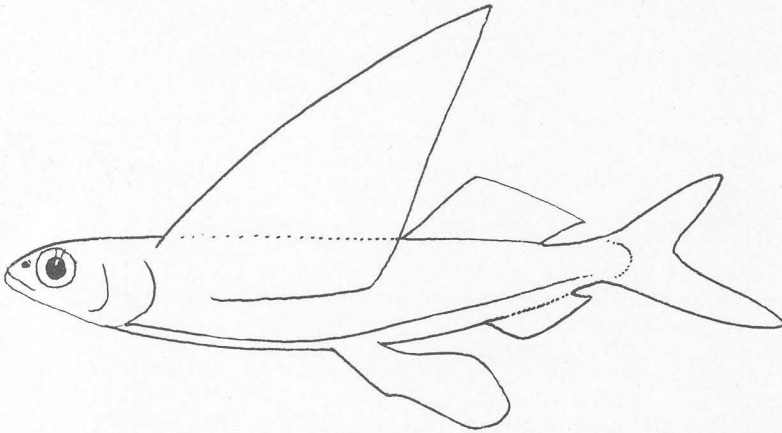


Fig. 214. *Cypselurus pinnatibarbatus*, from Murray and Hjort.

Ventrals with outer $\frac{2}{3}$ jet-black, outer and inner edges of fin whitish, median rays basally gray, this shade extending to the black terminal blotch. Anal white, hinder outer terminal part black in strong contrast. Length 172 mm.

Tropical Atlantic, Indian, and Pacific Oceans. Described above from an American example (New Jersey).

***Cypselurus lineatus* (Valenciennes)**

Goumbonn (Senegambia)

Figure 215

Exocoetus lineatus VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XIX, p. 67. Gorée, Canaries.—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 264 (Gorée).—GÜNTHER, 1866, 'Cat. Fish. Brit. Mus.,' VI, p. 287 (Madeira).—CAPELLO, 1872, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, p. 86 (St. Jago, Cape Verde Islands).—BUETTIKOFER, 1890, 'Reis. Liberia,' II, p. 480.—STEINDACHNER, 1891, Sitzs. Akad.

Wiss. Wien, C (1), p. 361 (east of Arrecife); 1895, Notes Leyden Mus., XVI, p. 75 (Grand Canary).—OSORIO, 1898, Jorn. Sci. Mat. Phys. Nat., Acad., Lisboa, (2) V, p. 199 (Cape de Verde; S. Thomé).—PELLEGRIN, 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanc, Cape Verde); 1905, Act. Soc. Linn. Bordeaux, LX, p. 28 (near Madeira); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 30 (near Canaries).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 220 (Grand Canary).

Exocoetus lineatus ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' p. 139 (Gorée, Dakar, Cape Verde).

Cypselurus lineatus FOWLER, 1919, Proc. Acad. Nat. Sci. Philadelphia, p. 15 (Funchal).

Exocoetus spilurus GÜNTHER, 1866, 'Cat. Fish. Brit. Mus.,' VI, p. 285. Habitat?

Exocoetus fucorum ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 3. N. lat. $31^{\circ} 08'$, W. long. $42^{\circ} 38'$, in sargassum; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 60, Pl. II, fig. 6 (type).

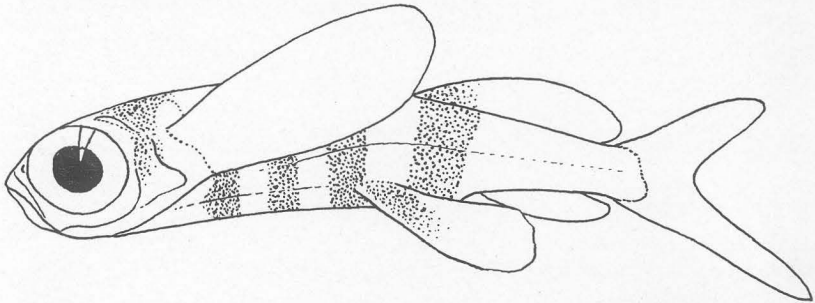


Fig. 215. *Cypselurus lineatus*, juv., from Zugmayer.

Head $4 \frac{1}{4}$; depth $5 \frac{3}{4}$; dorsal I, 11; anal I, 9; pectoral I, 13; ventral 6; scales about 68 in lateral line to caudal base and 6 more on latter; 9 scales above lateral line to dorsal origin, 3 below to anal origin; 46 predorsal scales; snout $3 \frac{4}{5}$ in head measured from upper jaw tip; eye $3 \frac{4}{5}$; maxillary $4 \frac{2}{5}$; interorbital $2 \frac{7}{8}$.

Body long, slender, compressed. Caudal peduncle compressed, least depth $3 \frac{4}{5}$ in total head length. Head moderate, compressed, width $\frac{1}{2}$ its total length. Snout broad, depressed above, length about $\frac{4}{5}$ its width. Eye moderately large, close to upper profile, center at first $\frac{2}{5}$ in head length. Mouth rather small, closed jaws apparently even? Maxillary with upper half concealed by preorbital, reaches opposite hind nostril edge. Teeth small, conic, few, in narrow bands in jaws. Interorbital flattened, slightly depressed medianly. Scales large, adherent, smaller on caudal peduncle and caudal base. Lateral line low, continuous to caudal base. Dorsal inserted at last third between pectoral origin and caudal base; first simple ray $3 \frac{1}{4}$ in head; second branched ray $2 \frac{1}{10}$. Anal inserted opposite first third of dorsal base, fin small; first branched ray $2 \frac{7}{8}$ in head. Caudal widely forked, upper lobe about $1 \frac{1}{2}$ in lower; upper lobe $1 \frac{1}{8}$ in head. Pectoral reaches back beyond dorsal and anal nearly midway in caudal peduncle length. Ventral inserted slightly nearer to last dorsal ray base than to pectoral origin.

Color olivaceous brown above, sides and below whitish. Eye white. Dorsal pale brownish, tinted slightly darker behind. Caudal dusky. Anal whitish. Pectoral largely dusky brown, hind edge broadly whitish, front edge narrowly whitish. Ventral largely whitish, front inner portion brownish above. Length 443 mm.

Tropical Atlantic. Described above from dry skin obtained one mile north of Funchal, Madeira, September 17, 1912, by Joseph Redl.

Exocoetus spilurus Günther, based on an example but 64 mm. long with a flat barbel and similar fin formula, probably a young form of the present species.

Exocoetus fucorum Zugmayer has been described from 6 examples, the largest not over 20 mm. in length. Its very large eye, pectoral extending but little beyond the front of the dorsal, and 5 transverse broad brown bands before the anal are all associated with characters of youth. The fin formula, as Zugmayer says, agrees with that of the present species, of which it is doubtless the young.

***Cypselurus bahiensis* (Ranzani)**

Vádalo (Anno Bom Island)

Exocoetus bahiensis RANZANI, 1842, Nov. Comm. Acad. Sci. Inst. Bonon., V, p. 362, Pl. xxxviii. Brazil.—OSORIO, 1895 (March), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 246 (Bom alimento); 1898, *op. cit.*, (2) V, p. 199 (Anno Bom).

Exocoetus solitarius G. BENNETT, 1860, 'Gatherings Nat. Austral.,' p. 15. St. Helena.

Exocoetus cyanopterus GÜNTHER, 1869, Proc. Zool. Soc. London, p. 239 (St. Helena).—MELLISS, 1875, 'St. Helena,' p. 110.

Head (from snout tip) about $4\frac{1}{2}$; depth about $4\frac{1}{2}$?; dorsal 11, 10?; anal 11, 5?; scales 47 in lateral line to caudal base and 4 more on latter; 6 scales above lateral line to dorsal origin; 28 predorsal scales; snout $3\frac{3}{4}$ in head measured from its own tip; eye $2\frac{7}{8}$; maxillary $3\frac{1}{3}$; interorbital $2\frac{3}{5}$; dorsal base, $1\frac{1}{4}$; least depth of caudal peduncle 3. Snout broader than long. Eye large, longer than deep, anterior in position. Teeth in jaws minute, in bands. Interorbital depressed. Scales rather large, becoming small on caudal base, striae more or less hidden at bases by overlapping; series disposed longitudinally. Lateral line low, continuous, tubes a little branched. Dorsal origin at about last $\frac{2}{7}$ between snout tip and caudal base, fin highest anteriorly. Anal origin falls apparently well behind that of dorsal, small. Upper caudal lobe $1\frac{1}{5}$ in lower. Second pectoral ray divided, fin reaching base at last dorsal ray. Ventral inserted apparently about midway between gill opening and caudal base.

Color gray-brown on back and upper surface of body, fading to whitish on sides and lower surface. Sides largely whitish and line of demarcation from gray of back distinct. Body also with more or less traces of silvery reflections. Dorsal brownish, dusky above, largely behind and marginally. Caudal dusky, upper lobe edged slightly pale. Pectoral dusky black, with oblique transverse median paler area. Lowest and shortest pectoral rays whitish, also front edge of fin pale. Ventral transparent whitish, median rays largely dusky, especially basally. Length 300 mm.

Tropical Atlantic and Pacific Oceans. Described above from a dried skin loaned by Dr. P. P. Calvert, January 29, 1907. The example "flew" aboard a vessel off the coast of Brazil.

Exocoetus cyanopterus Valenciennes, described from Bahia and Rio Janeiro, said to differ in the presence of one more anal ray, does not seem to be different.

Head of an adult, in Museum of Comparative Zoölogy, from example obtained near Cape de Verde Islands.

Bennett's account of *Exocoetus solitarius* is as follows:

At the Island of St. Helena I have seen it offered for sale from 15 to 20 inches long, where it is used, as in the West Indies, for food, and is of very sweet and delicate flavor. This species is named the Solitary Flying-fish (*Exocoetus solitarius*), from not being seen in large flocks like the others; and it appears to have other specific differences.

Hemiramphidae

Balaos

Body long, more or less compressed. Upper jaw short, lower jaw various, sometimes much produced, toothed portion at base fits against toothed premaxillaries. Teeth equal, small, compressed, often tricuspid. Maxillaries firmly united to premaxillaries, the latter form a flat triangular expansion. Gill rakers long. Air vessel large, sometimes cellular. Vertebrae 49 to 55. No finlets. Anal fin modified in viviparous forms, unmodified in others, usually like dorsal. Caudal rounded or forked when lower lobe longer. Pectorals short, rarely elongate.

Herbivorous fishes of warm seas, found mostly along shores, some few of them pelagic. Food mostly green algae. Like related forms they swim at the surface, occasionally leaping or skipping along above. Size rather small. Both genera included below have the lower jaw produced into a long slender beak. *Euleptorhamphus viridis* (Van Hasselt) is recorded from Walfish Bay, South Africa, though I know of no West African record.

KEY TO THE GENERA

- a.*—Sides of body mostly convex; air vessel simple; ventrals inserted far before dorsal..... **HYPORHAMPHUS.**
aa.—Sides of body largely flattened; air vessel cellular; ventrals inserted rather close before dorsal..... **HEMIRAMPHUS.**

HYPORHAMPHUS Gill

Halfbeaks

Hyporhamphus GILL, 1859, Proc. Acad. Nat. Sci. Philadelphia, p. 131. Type: *Hyporhamphus tricuspidatus* Gill. Monotypic.

Eulepidorhamphus FOWLER, 1919, Proc. Acad. Nat. Sci. Philadelphia, p. 7. Type: *Hemirhamphus sajori* Schlegel. Monotypic.

Body moderately compressed, sides more or less swollen or convex, dorsal profile parallel with belly. Air vessel large, simple. Dorsal and anal alike, opposite, the latter not modified in males. Ventrals small, inserted well forward, nearly midway between opercle and caudal base.

Species numerous in all warm seas, living in large schools not far from shore. Many with a distinct silvery lateral band.

***Hyporhamphus unifasciatus* (Ranzani)**

Sambajh (Senegambia), Pupulemba (Cameroon)

Hemiranphus unifasciatus RANZANI, 1842, Nov. Comm. Acad. Sci. Inst. Bonon., V, p. 326. Brazil.

Hemiramphus unifasciatus RANZANI, *op. cit.*, Pl. xxvi, figs. 1-4.

Hemiramphus schlegeli BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, (2) XVIII, p. 120, Pl. xxv, fig. 1. Gold Coast.—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LXI (1), p. 558 (St. Louis).—GUIMARÃES, 1882, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, p. 35 (Benguella, Angola); 1883-1885, 'Faune Sénégalie,' Poiss., p. 138 (Gambia, Casamence, Rio Munez).

Hemirhamphus schlegeli BUETTIKOFER, 1890, 'Reis. Liberia,' II, p. 480.—OSORIO, 1894 (February), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 181 (Bissau).—STEINDACHNER, 1895, Notes Leyden Mus., XVI, p. 74 (Fisherman Lake, Liberia).—OSORIO, 1898, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 199 (Bissau, St. Thomé, Angola).

Hyporhamphus schlegeli FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 265 (Gaboon).—MONOD, 1927, 'Faune Colon. françaises,' p. 681 (Grand Batanga).

Hemirhamphus calabaricus GÜNTHER, 1866, 'Cat. Fish. Brit. Mus.,' VI, p. 266. Old Calabar, West Africa.—PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 152 (Lagune de Bingerville, Ivory Coast); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 30 (Port Bouet, Ivory Coast).

Hemirhamphus (Hyporhamphus) calabaricus BARNARD, 1925, Ann. South African Mus., XXI, part 1, p. 262 (Cameroons).

Hemirhamphus roberti CAPELLO, 1872, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, p. 87 (Bissau, West Africa).

Head, measured from upper jaw, $4\frac{1}{5}$ to $4\frac{1}{2}$; depth $6\frac{1}{4}$ to $8\frac{2}{5}$; dorsal II, 12 to II, 14; anal II, 14 or 15; scales from gill opening in median lateral series 53 to 57 to caudal base and 5 or 6 more on latter; 7 to 8 scales above lateral line to dorsal origin; predorsal scales 34 to 37; snout $2\frac{1}{2}$ to $2\frac{7}{8}$ in head; eye $3\frac{7}{8}$ to 4; maxillary $3\frac{1}{8}$ to 4; interorbital $3\frac{1}{3}$ to 4; combined eye and postocular 2 to $2\frac{1}{3}$ in beak.

Body elongate, compressed, deepest about midway in its length. Caudal peduncle well compressed, least depth 1 to $1\frac{1}{4}$ its length or 4 in head measured from upper jaw tip. Head width $2\frac{7}{8}$ to 3 in its length. Snout depressed, width $1\frac{1}{4}$ its length. Eye large, midway to slightly advanced in head length, $1\frac{1}{3}$ to $1\frac{1}{2}$ in snout. Lower jaw long, slender, the rest of head measured from snout tip varies from less to slightly more than length of the lower jaw beyond the snout tip. Maxillary small, vertical, largely concealed, expansion slightly less than 3 in eye and hind edge

not falling beyond front of nasal cavity. Teeth fine, simple, conic, in bands in jaws. Nostril at least fourth in snout, with a moderate rounded flap behind. Interorbital broad, level. Gill rakers 9 or 10 + 20 to 25, lanceolate, $1\frac{1}{2}$ in gill filaments which 2 in eye. Scales firmly adherent, narrowly exposed, smaller on caudal peduncle. Vertical fins mostly covered with small scales. Scales with 2 basal radiating striae; circuli moderately fine. Lateral line extends as far back as tip of last depressed anal ray. Dorsal origin at last fourth between front eye edge and caudal base, first branched ray $2\frac{1}{4}$ to $2\frac{1}{2}$ in head. Anal origin very slightly in advance of dorsal origin; first branched ray $2\frac{1}{2}$ to $2\frac{3}{5}$ in head. Caudal moderately forked, lobe equal, lower lobe $1\frac{1}{8}$ to $1\frac{1}{4}$ in head. Pectoral high, $1\frac{1}{2}$ to $1\frac{2}{3}$ in head. Ventral origin midway behind hind eye edge and caudal base; fin $2\frac{2}{3}$ to $2\frac{3}{5}$ in head.

Color dark greenish above, sides and below silvery white, with a lateral bright silvery band narrower than eye. Scales of back edged dusky. Beak dusky, tip scarlet. Iris silvery white. Front dorsal and anal rays and caudal tips are blackish, fins otherwise pale. Length 157 to 253 mm.

Tropical Atlantic, Indian, and Pacific Oceans. It reaches a length of 300 mm. Described above from American (east coast United States, West Indies, Panama) examples.

Hemirhamphus schlegeli Bleeker is based on small specimens, 117 to 124 mm. His figure shows the ventral origin midway between the pectoral origin and the caudal base. The only African specimen I examined was a small one 110 mm. long, in poor condition, obtained at Gaboon, which agrees with Bleeker's account in almost every respect.

HEMIRAMPHUS Cuvier

Balaos

Hemiramphus CUVIER, 1817, 'Règne Animal,' II, p. 186. Type: *Esox brasiliensis* Linné. (Designated by Gill, 1863, Proc. Acad. Nat. Sci. Philadelphia, p. 273.)

Hemirhamphus, *Hemirhamphus* auct.

Body rather robust, sides compressed and flattened. Air vessel cellular, sometimes with many partitions. Dorsal longer than anal and inserted farther forward, its last ray usually more or less produced. Ventrals small, inserted well backward or much nearer caudal base than gill opening.

Hemiramphus brasiliensis (Linné)

Aguja (Canaries), Sombajh (Senegambia)

Esox brasiliensis LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 314. America australi [Jamaica]. (On Browne.)

Hemiramphus brasiliensis STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 402 (Santa Cruz, Teneriffe).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 139 (Gorée, Dakar, Cape Verde, Banc d'Argain, Rufisque, Joalles).—FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 276 (Loando, Angola).—MONOD, 1927, 'Faune Colon. françaises,' p. 681 (on Peters).

Hemiramphus vittatus VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II, part 2, p. 70 (Lanzarote; Arreceife).—BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, (2) XVIII, p. 118, Pl. XXI, fig. 2 (Annoukor, Boutry, Guinea).—

STEINDACHNER, 1867, Sitzs. Akad. Wiss. Wien, LV (1), p. 522 (Monrovia); *op. cit.*, LXI (1), p. 558 (Senegal).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalaise,' Poiss., p. 138 (Guet N'Dar, Pointe de Barbarie, Cape Mirik).

Hemirhamphus vittatus GÜNTHER, 1866, 'Cat. Fish. Brit. Mus.,' VI, p. 269 (Niger Expedition); 1880, 'Rept. Voy. "Challenger,"' I, p. 3 (St. Jago).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 330 (Canaries).—OSORIO, 1893 (August), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 134 (Benguella, Angola); 1898, *op. cit.*, (2) V, p. 199 (St. Thomas; Angola).

Hemirhamphus brownii DUMÉNIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 264 (Gorée).—TROSCHER, 1866, Archiv Naturg., part 1, p. 236 (Cape Verde Islands).

Hemirhamphus guineensis BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, (2) XVIII, p. 119, Pl. xxv, fig. 2. Annoukor, Boutry, Guinea.

Hemirhamphus pleii PETERS, 1876 (1877), Monatsb. Akad. Wiss. Berlin, p. 250 (Victoria, Cameroon).

Head $2\frac{2}{5}$ to $2\frac{3}{5}$; depth $8\frac{3}{4}$ to $9\frac{1}{6}$; dorsal II, 12; anal II, 10 or 11; scales 48 to 53 in lateral series to caudal base and 5 or 6 more on latter; 6 or 7 scales above lateral line; 35 to 40 predorsal scales; snout $2\frac{4}{5}$ to $3\frac{1}{8}$ in head measured from upper jaw tip; eye $3\frac{2}{5}$ to $4\frac{2}{5}$; maxillary $3\frac{2}{5}$ to $3\frac{3}{5}$; interorbital $3\frac{4}{5}$ to $4\frac{1}{5}$.

Body compressed, sides flattened. Caudal peduncle small, compressed, least depth $1\frac{1}{3}$ to $1\frac{2}{5}$ in head. Head broad, sides flattened and constricted below; width $2\frac{3}{4}$ to $2\frac{4}{5}$ in its length. Snout depressed, width about $1\frac{3}{5}$ in its length, slightly shorter in young. Eye large, a little anterior; $1\frac{1}{5}$ to $1\frac{2}{5}$ in snout. Lower jaw long, slender, rest of head measured from snout tip $\frac{2}{3}$ its length. Teeth conic, simple, in bands in jaws, moderately small. Nasal cavity large, close before eye, flap large. Interorbital flat. Gill rakers 8 to 12+23 to 25, slender, long, one-half of eye. Scales loose, rather narrowly exposed, become smaller on back and on caudal peduncle behind; base of vertical fins more or less with small scales; circuli all very fine and mostly complete. Lateral line low, complete. Dorsal inserted at about last fourth in the space between hind pupil edge and caudal base, a little more forward in young; first branched ray $2\frac{2}{5}$ to $2\frac{1}{2}$ in head. Anal inserted a little behind dorsal origin, like dorsal; first branched ray $2\frac{1}{3}$ to $3\frac{1}{2}$ in head. Caudal widely forked, lower lobe much longer, about equals head without beak. Pectoral high, reaches $2\frac{4}{5}$ to ventral, $2\frac{2}{5}$ in young; $1\frac{1}{5}$ to $1\frac{3}{5}$ in head. Ventral small, inserted much nearer caudal base than pectoral origin, slightly more forward in young; 2 to $2\frac{1}{2}$ in head.

Dark bluish green above, sides and below, without lateral band, silvery white. Scales on back edged dusky. Beak dusky, tip orange and membrane edged white. Iris silvery white. Dorsal lobe and upper caudal lobe orange-yellow and ends of last dorsal rays blackish in young. Caudal and pectoral pale. Ventral tipped yellow, young with a dull olive blotch in middle. Length 380 mm.

Tropical Atlantic. Described above from American examples (New Jersey and West Indies).

SUBORDER SCOMBERESOCOIDEA

Mouth typically large, jaws usually produced, narrowed forward. Rami of mandible united by interlocking or by a row of inner processes

(except *Cololabis*). Maxillaries firmly joined with premaxillaries. Third upper pharyngeals moderately enlarged and separate, the fourth usually present. Lower pharyngeal triangular or long and narrow. Pharyngeal teeth usually villiform or granular, some of teeth of principal plates often compressed, tricuspid. Scales small.

KEY TO THE FAMILIES

- a.*—Dorsal and anal with detached finlets SCOMBERESOCIDAE.
aa.—No finlets BELONIDAE.

Scomberesocidae

Sauries

Body elongate, compressed, appearance mackerel-like. Both jaws in adults mostly produced, forming a slender beak, the upper jaw always the longer. Teeth very feeble, pointed. Gill arches numerous, long, slender. Third upper pharyngeal greatly enlarged, separate from its fellow, both covered with large blunt tricuspid teeth. Fourth upper pharyngeal absent in adult, or joined with third, second with simple teeth and first toothless. Lower pharyngeals enlarged, united, form triangular transversely concave with large close-set blunt tricuspid teeth. Vertebrae 65 to 70. Scales thin, deciduous. Dorsal and anal low, alike, each with 4 to 9 detached finlets as in mackerels. Pectoral and ventral small.

Pelagic fishes in the open sea, swimming in large schools close to the surface in temperate regions.

SCOMBERESOX Lacépède

Sauries

Scomberesox LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 344. Type: *Scomberesox camperi* Lacépède. Monotypic.

Scombresox auct.

Sayris RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 60. Type: *Sayris recurvirostra* Rafinesque = *Esox saurus* Walbaum. (Designated by Jordan and Evermann, Stanford Publication, 1917, 'Genera of Fishes,' part 1, p. 81.)

Grammiconotus COSTA, 1862, Ann. Mus. Zool. Napoli, p. 55. Type: *Grammiconotus bicolor* Costa. Monotypic.

Body long. Both jaws produced into a very slender pointed beak, in the adult longer than rest of head. Young with short jaws, which lengthen into a beak with age. Air vessel large.

Species few.

Scomberesox saurus (Walbaum)

Delphine (Madeira)

Figure 216

Esox saurus WALBAUM, 'Arted. Pisc.,' III, p. 93. Cornwall. (On *Saury pike* Pennant.)

Scomberesox saurus LOWE, 1837 (1841), Trans. Zool. Soc. London, II, p. 188 (Madeira).

Scomberesox saurus GÜNTHER, 1866, 'Cat. Fish. Brit. Mus.,' VI, p. 257 (St. Helena).—COLLETT, 1896, Rés. Camp. Sci. Monaco, X, p. 121 (between Gulf of Gascony and Azores).—ZUGMAYER, 1910, Rés. Camp. Sci. Monaco, XXXV, p. 59 (between Azores and Spain, N. lat. 43°, W. long. 19°).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (off Morocco, Cape Blanco, Canaries, Azores).—LAMPE, 1914, 'Deutsche Südpolar Exped.,' XV (3), p. 220 (between Ascension Island and Cape Colony; Ascension Island; England to Cape Verde).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (near Point Ribeira, São Miguel, Azores).

Scomberesox scutellatus VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XVIII, p. 350 (from *Coryphaena equiselis* 25 leagues north of St. Helena).

Head $3\frac{1}{5}$ to $3\frac{1}{3}$; depth $8\frac{4}{5}$ to $9\frac{1}{4}$; dorsal II, 9 or 10+5; anal II, 10+7 or 6; scales 120 to 125 in median lateral series to caudal base and 5 to 7 more on latter; 20 scales transversely at dorsal and anal; 108 to 115 predorsal scales; snout $1\frac{3}{4}$

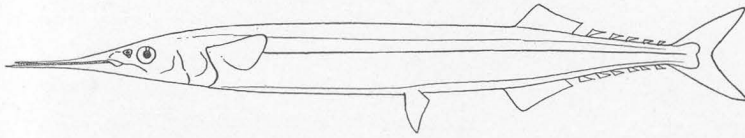


Fig. 216. *Scomberesox saurus*, from Goode.

in rest of head; eye $7\frac{1}{4}$ to $7\frac{1}{2}$; maxillary to upper jaw tip $1\frac{3}{4}$ to $2\frac{1}{4}$; interorbital 7 to $7\frac{1}{4}$.

Body elongate, greatly compressed. Caudal peduncle tapers, quite slender; least depth $1\frac{1}{4}$ to $1\frac{2}{5}$ in eye. Head well compressed, tapers to long, slender thin jaws in front, the lower jaw a little longer; head width $1\frac{3}{5}$ to $1\frac{2}{3}$ in postocular. Snout like lower jaw, only a little smaller, due to shorter length. Eye rounded, little elongate, high, about equals interorbital. Mouth narrow, teeth minute, sharp-pointed, simple, in a narrow series along each jaw edge. Maxillary not exposed as far back as nostril. Nostril large, close before eye above. Interorbital and above evenly and shallowly convex. Gill rakers fine, slender, about long as eye, v or vi+42 to 44. Scales with vertical parallel striae, fine, 40+51, without a median rift; narrowly imbricated, rather loose. Lateral line low, runs along ventral side, not extending beyond anal. Dorsal low, first branched ray $1\frac{2}{3}$ to $1\frac{3}{4}$ in postocular; origin slightly behind that of anal. Anal similar, first branched ray 2 to $2\frac{1}{5}$ in postocular. Finlets all decreasing posteriorly. Caudal well forked, lobes even, about equals combined eye and postocular. Pectoral small, high, $1\frac{1}{3}$ to $1\frac{2}{5}$ in postocular. Ventral small, inserted about midway between hind edge of eye and caudal base; length $1\frac{1}{4}$ to $1\frac{2}{5}$ in postocular.

Greenish brown on back, sides and below silvery white, color of back well contrasted. Iris silvery white. Fins pale. Reaches 305 mm.

Open Atlantic. Described from examples from the open Atlantic

and America (New England). Barnard reports it from South Africa (1925, Ann. South African Mus., XXI, part 1, p. 259).

Belonidae

Needle Fishes

Body elongate, very slender, compressed or not. Both jaws produced in beak, the lower jaw longer, much longer in young. Maxillaries firmly joined with premaxillaries. Each jaw with a band of small sharp teeth, besides a series of longer wide-set conic sharp teeth. Lower pharyngeals united to form a long slender narrow plate with a flat surface, covered with small pointed teeth. Upper pharyngeals distinct, third pair a little enlarged, each with about 15 moderate unequal pointed teeth. Fourth pair well developed, with similar teeth, without front processes. Vertebrae 55 to 77. Air vessel present. Ovary single. Body covered with small thin scales. Lateral line very low, runs as a fold along side of belly. Dorsal fin opposite anal. Both rather long. No finlets.

Carnivorous fishes with a superficial resemblance to the gar pikes, likewise very voracious. Live in all warm seas, some few in fresh water. Many are able to swim along the surface of the water with great rapidity, some even leaping or skipping short distances. Large ones, when so leaping are sometimes dangerous to fishermen and have even been known to pierce the naked abdomens of savages. Many are good food fishes, though on account of their greenish bones and flesh are avoided.

KEY TO THE GENERA

- a.*—BELONINAE. Gill rakers developed; body cylindrical or compressed; vomerine teeth present or absent; caudal forked.....BELONE.
aa.—STRONGYLURINAE. No gill rakers; no vomerine teeth; caudal lunate.
b.—Body cylindrical or scarcely compressed.....STRONGYLURA.
bb.—Body greatly compressed, nearly bandlike.....ABLENNES.

BELONE Cuvier

Belone CUVIER, 1817, 'Régne Animal,' II, 2d Ed., p. 185. Type: *Esox belone* Linné. Monotypic.

Belona auct.

Acus P. L. S. MÜLLER, 1774, 'Linné Nat. Syst.,' IV, p. 341. Atypic. Type: *Esox belone* Linné, 1776, *op. cit.*, Supplement register, p. 7.

Mastacembelus (not Gronow, 1763) KLEIN, 1776, 'Neuer Schauplatz der Natur,' III, p. 271. Type: *Esox belone* Linné. (Designated by Jordan and Evermann, 1917, 'Genera of Fishes,' part 1, p. 40.) (Inadmissible.)

Raphistoma RAFINESQUE, 1815, 'Analyse de la Nature,' p. 19. Type: *Esox belone* Linné. (*Raphistoma* Rafinesque proposed to replace "*Belone* Gronow" but this name is not used by Gronow.)

Ramphistoma SWAINSON, 1839, 'Nat. Hist. Animals,' II, p. 296. Type: *Ramphistoma vulgaris* Swainson. Monotypic.

Eurycaulus (not Fairmaire, 1868) OGILBY, 1909 (1908), Proc. Roy. Soc. Queensland, XXI, p. 91. Type: *Belone platyura* Bennett. Orthotypic.

Platybelone FOWLER, 1919 (January), Proc. Acad. Nat. Sci. Philadelphia, p. 2. Type: *Belone platyura* Bennett. Monotypic.

Tropidocaulus OGILBY, 1921, *op. cit.*, XXXI, p. 45. Type: *Belone platyura* Bennett. (*Tropidocaulus* Ogilby proposed to replace *Eurycaulus* Ogilby.)

Body very elongate, compressed or cylindrical. Caudal peduncle sometimes depressed. Premaxillaries and mandibles prolonged, forming a beak. Jaws with band of conic teeth and series of moderate pointed widely set teeth, those of mandibles much smaller than those of maxillaries, which are canines. Teeth on vomer present or absent. Gill openings wide. Gill rakers present. Scales rather small. Lateral line runs low, not forming a keel along caudal peduncle, which is sometimes with a keel above lateral line. Dorsal and anal almost opposite; all dorsal and anal rays joined with membranes. Caudal forked.

Species rather few in tropical seas.

KEY TO THE SPECIES

- a.—BELONE. Body compressed behind vent, without lateral keels; gill opening extends well forward; gill rakers moderate, lanceolate.
- b.—Branched dorsal rays 15 to 17, anal 18 or 19. *belone*.
- bb.—Branched dorsal rays 13, anal 13 or 14. *senegalensis*.
- aa.—PLATYBELONE. Body broadly depressed behind, with strong lateral keels; gill opening rather restricted; gill rakers short points; branched dorsal rays 12 to 14, anal 17. *argalus*.

Belone belone (Linné)

Aguja (Canaries), Aoura (Baie du Lévrier)

Figure 217

Esox belone LINNÉ, 1766, 'Syst. Nat.,' 12th Ed., p. 517. European Ocean.—BOWDICH, 1825, 'Excurs. Madeira,' p. 234 (Madeira).—POGGI, 1881, (articlein 'Guide-book of Canary Isls.'). 'Guia de Santa Cruz de Teneriffe,' [p. d. 35].—JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 340 (Canary Islands).

Belone belone COLLETT, 1890, Bull. Soc. Zool. France, XV, p. 222 (Funchal, Madeira).—ROULE AND ANGEL, 1920 (October 15), Bull. Inst. Océanogr. Monaco, No. 378, p. 4 (Azores).

Belone vulgaris VALENCIENNES, 1836–1844, 'Hist. Nat. Canaries,' II, part 2, p. 70 (Canaries).—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 402 (Santa Cruz, Teneriffe).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 330 (Canaries).

Belone gracilis LOWE, 1839, Proc. Zool. Soc. London, p. 86. Madeira; 1839, Trans. Zool. Soc. London, III, p. 13 (Madeira).—STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1), p. 734 (Teneriffe).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 330 (Canaries).—PELLEGRIN, 1905, Act. Soc. Linn. Bordeaux, LX, p. 28 (Mauritania, Marsa, Nouakschott); 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanco, Cape Verde); 1913, *op. cit.*, XXXVIII, p. 116 (Baie du Lévrier);

1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 29 (Baie du Lévrier, Marsa, Nouakchott, Mauritania).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 251, Fig. 15 (Baie du Lévrier).

Head, from upper jaw tip $3 \frac{1}{5}$; depth $1 \frac{1}{8}$ to $1 \frac{1}{6}$ in postocular; dorsal II, 15 or 16; anal II, 18 or 19; scales 200 to 270 in median lateral series from gill opening to caudal base; 120 to 153 predorsal scales to head; end of frontal process to eye $4 \frac{1}{2}$ to $4 \frac{3}{4}$ in rest of snout, width about $1 \frac{1}{5}$ its own length; eye $2 \frac{1}{8}$ to $2 \frac{1}{3}$ in postocular region; interorbital $2 \frac{1}{5}$ to $2 \frac{1}{2}$.

Body subcylindrical, compressed after vent. Caudal peduncle compressed, least depth $1 \frac{1}{2}$ to $1 \frac{3}{5}$ in eye. Head constricted below, width $1 \frac{3}{4}$ to $1 \frac{4}{5}$ in postocular. Jaws close completely in young, do not close basally in adult. Eye close to upper profile, but not impinging. Maxillary reaches halfway in iris to pupil, entirely concealed when closed. Narrow band of small outer teeth, inner rather close-set or uniformly larger. Triangular nasal cavity about half of pupil. Interorbital and top of head level, with a broad shallow depression medianly behind. Bones on top of

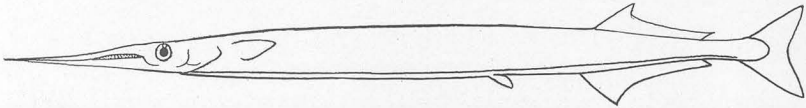


Fig. 217. *Belone belone*, from Smitt.

head above obscurely striate, even less so in young. Gill opening forward opposite front of eye. Gill rakers 4 or 5+24 to 26, lanceolate, $1 \frac{1}{2}$ in gill filaments, which are $\frac{1}{2}$ of eye. Scales small and rounded on back, with about 20 circuli (10 or less in young); large lateral elongate scales with 30 to 50 close circuli, becoming incomplete with age. Cheek with 12 or 13 rows of scales. Lateral line with a short branch up to pectoral base and obsolete or absent along lower surface of caudal peduncle behind anal. Dorsal inserted slightly behind anal or at about the last fourth between hind eye edge and caudal base (at last fourth between rictus and caudal base in young), front lobe elevated, though fin much smaller than anal. Caudal well forked, lower lobe little longer (slightly less forked in young). Pectoral equals postocular region. Ventral inserted slightly nearer caudal base than pectoral origin (nearly midway in young), fin $1 \frac{1}{4}$ in head ($1 \frac{1}{3}$ in young).

Color brown above on back, side with a broad ill-defined silvery band and whitish below. Fins all pale, dorsal and caudal slightly dusted with brown. Sides of head and iris silvery white. Length 407 mm.

Mediterranean and eastern Atlantic. Described above from Mediterranean examples.

Belone gracilis Lowe as described by Günther seems to differ only in the absence of vomerine teeth. None of my Mediterranean examples of *Belone belone* show vomerine teeth.

***Belone senegalensis* Valenciennes**

Seambasselette (Senegambia), Oumininbokore (Ivory Coast)

Belone senegalensis VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XVIII, p. 312.

Senegal.—DUMÉRIL, 1858, *Nouv. Arch. Mus. Paris*, X, p. 264 (Senegal).—GÜNTHER, 1866 'Cat. Fish. Brit. Mus.,' VI, p. 254 (Sierra Leone).—STEINDACHNER, 1870, *Sitzs. Akad. Wiss. Wien*, LXI (1), p. 557 (St. Louis).—PETERS, 1876 (1877), *Monatsb. Akad. Wiss. Berlin*, p. 250 (Victoria, Cameroon).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' *Poiss.*, p. 137 (Guet N'Dar, pointe de Barbarie, Senegal, Gorée, Dakar, Banc d'Argain).—BUETTIKOFER, 1890, 'Reis. Liberia,' II, p. 480.—STEINDACHNER, 1895, *Notes Leyden Mus.*, XVI, p. 73 (Fisherman Lake at Beuluma, Liberia).—PELLEGRIN, 1907, *Act. Soc. Linn. Bordeaux*, LXII, p. 79 (Senegal); 1913, *Bull. Soc. Zool. France*, XXXVIII, p. 152 (Lagune de Bingerville, Ivory Coast); 1914, *Ann. Inst. Océanogr. Monaco*, VI (4) p. 30 (Senegal, Bingerville, Ivory Coast).

Tylosurus senegalensis MONOD, 1927, 'Faune Colon. françaises,' p. 681 (copied Peters).

Head $2\frac{1}{2}$; dorsal 15; anal 15 or 16; pectoral 11. Body broad, subcylindrical, depth considerably less than length of pectoral, which is more than the distance of opercular margin from orbit. Free portion of tail compressed, deeper than it is broad. Eye less than interorbital width, $2\frac{3}{4}$ in postocular. Base of premaxillaries depressed, maxillary only half hidden by preorbital. Teeth moderate, none on vomer. Superciliary region faintly striated. Upper surface of head flat, with a broad shallow scaly median groove. Scales very thin, small and deciduous. Middle and hinder dorsal and anal rays subequal in length, short, the last ending a considerable distance from caudal base. Caudal emarginate. (Günther.)

West coast of Africa, from Senegal to the Cameroons.

***Belone argalus* Le Sueur**

Gu'ia gasso (Anno Bom)

Belone argalus LE SUEUR, 1821, *Jour. Acad. Nat. Sci. Philadelphia*, II, part 1, p. 125, Pl. x, fig. 1. Island of Guadaloupe.—FOWLER, 1919, *Proc. Acad. Nat. Sci. Philadelphia*, p. 135 (comparison of St. Martin's, W. I., example with Azores and Ascension Island material).

Belone trachura VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XVIII, p. 339. Ascension Island.—GÜNTHER, 1866, 'Cat. Fish. Brit. Mus.,' VI, p. 235 (no data).—TROSCHER, 1866, *Archiv Naturg.*, part 1, p. 234 (Cape Verde Islands).—GÜNTHER, 1880, 'Rept. Voy. "Challenger,"' I, p. 5 (Ascension Island).—LAMPE, 1914, 'Deutsche Südpolar Exped.,' XV (3), p. 218 (Ascension Island).—FOWLER, 1919, *Proc. U. S. Nat. Mus.*, LVI, p. 196, Fig. 1 (Horta, Azores), p. 217 (Ascension Island).

Belone loyii GÜNTHER, 1866, 'Cat. Fish. Brit. Mus.,' VI, p. 236. Cape Verde Islands; 1868, *Proc. Zool. Soc. London*, p. 226 (St. Helena).—MELLISS, 1875, 'St. Helena,' p. 110, Pl. XXI, fig. 6.—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' *Poiss.*, p. 137 (Cape Verde).—OSORIO, 1895 (March), *Jorn. Sci. Math. Phys. Nat.*, Acad., Lisboa, (2) III, p. 246 (Bom alimento); 1898, *op. cit.*, (2) V, p. 199 (St. Thomé; Anno Bom).

Head $2\frac{3}{4}$ to $3\frac{1}{3}$; depth $1\frac{1}{5}$ to $1\frac{1}{3}$ in postocular part of head; dorsal II, 12 to 14; anal II, 17; scales along lateral line 212 to 238 to caudal base; 11 scales above lateral line to dorsal origin and 4 below to anal origin; 110 to 135 predorsal scales to occiput; head width $1\frac{1}{3}$ in postocular region; eye $1\frac{2}{3}$ to 2; interorbital $1\frac{2}{3}$ to 2.

Body elongately fusiform, somewhat pentagonal in transverse section with median

dorsal and upper lateral ridges all distinct, greatest depth median. Caudal peduncle broadly depressed, width $\frac{4}{5}$ of eye and least depth $\frac{2}{3}$. Head depressed above, flattened sides moderately converging below. Snout tip shorter than lower jaw by nearly an eye diameter, basal width at rictus $7\frac{1}{3}$ its length, surface smooth. Eye ellipsoid, supraorbital cavity slightly bulging the upper profile of head; pupil large, ellipsoid. Maxillary concealed, about reaches eye. Jaws not capable of completely closing basally. Teeth small, largest of upper teeth twice the length of the lower ones, none on vomer or palatines. Nasal cavity large, about $\frac{1}{2}$ the size of pupil, triangular, and with an oblique keel down from its lower front edge over preorbital. Interorbital broadly concave, supraorbitals with fine striae slightly converging toward occiput and a few low median keels. Postocular space to preopercle edge about $\frac{7}{8}$ of eye.

Gill opening forward about opposite eye center. Gill rakers II or III, 2 or 3+6, V to XI, lanceolate, short or about $\frac{1}{3}$ of gill filaments, latter slightly over half of eye. Scales narrowly imbricated and crowded along sides and lower surfaces, down back medianly they are much larger and more broadly exposed. Broad exposed scales over most of upper surface of head, extending forward on snout for a space equal to $1\frac{2}{3}$ eye diameters. Fins scaleless, except area converging out over caudal of lateral keels, extension about $\frac{3}{4}$ of median rays from bases. Lateral line complete to caudal base, not on latter, and along caudal peduncle behind it extends along lower surface of flange or keel; each tube with several short branches below. Dorsal inserted slightly behind anal origin, nearly at last third between depressed pectoral tip and caudal base; first branched ray $1\frac{1}{4}$ in postocular; lobe of fin not quite half of fin length. Anal with large lobe in front, first branched ray about as long as postocular. Caudal moderately forked, lobes subequal. Pectoral slightly longer than postocular. Ventral inserted about midway between hind preopercle edge and caudal base; fin $1\frac{1}{3}$ in postocular.

Color deep brown on back and upper surface of head. Along upper side of postocular region there is a dusky line to end of gill opening separating silvery white color of sides and lower surface, but not extending on to trunk. All along edge of dark upper tint, which is bounded on trunk by upper lateral keel, there is a tinge of dark greenish. Iris pale. Fins pale brown with dusky terminally. Length 450 mm.

Southern and eastern Atlantic. Described above from Azores and Ascension Island examples in the U. S. National Museum.

Belone lovi Günther, from a Cape Verde example 380 mm. long, with fewer dorsal (13) and anal (18) rays. I can not see that it differs in any specific way from *Belone trachura*.

STRONGYLURA Van Hasselt

Strongylura VAN HASSELT, 1824, Bull. Sci. Nat. Férussac, 2 sect., II, p. 374. Type: *Strongylura caudimaculata* Van Hasselt. Monotypic.

Tylosurus COCCO, 1833, 'Giorn. Sci. Lett. Arti Sicilia,' XLII, No. 124. Type: *Tylosurus cantraini* Cocco = *Sphyraena acus* Lacépède. Monotypic.

Stenocaulus OGILBY, 1907 (1908), Proc. Roy. Soc. Queensland, XXI, p. 91. Type: *Belone krefftii* Günther. Orthotypic.

Body very slender, cylindrical or but little compressed. Both jaws produced as a beak, the lower jaw somewhat longer, much longer in young, very young resembling "half-beaks." Each jaw with a band of small sharp teeth, besides a series of longer

wide-set, sharp, conic, unequal teeth. No teeth on vomer or palatines. Gill openings wide. Gill rakers obsolete, Bones usually greenish. Scales small to very small, thin. Lateral line inferior, along lower side of belly, sometimes forming an elevated keel on caudal peduncle. No finlets. Dorsal fin mostly elevated in front, somewhat or even considerably behind that of anal, all rays of both fins connected by membranes. Caudal short, unequally lunated or forked, truncate or rounded. Pectorals moderate. Ventrals small, latter inserted behind middle of body.

Rather large voracious fishes, mostly in all tropical seas, few entering rivers.

KEY TO THE SPECIES

- a.*—*TYLOSURUS*. Dorsal with last rays greatly elevated in young, becoming lower with age. *acus*.
aa.—*STENOCAULUS*. Dorsal with hind rays uniformly much lower than anterior ones.
b.—Beak short and very strong, length $1\frac{1}{2}$ to $1\frac{5}{6}$ in rest of head; branched dorsal rays 20 to 23, anal 17 or 18. *raphidoma*.
bb.—Beak longer, at least twice rest of head.
c.—Branched dorsal rays 20 to 21; anal 17 to 20. *crocodila*.
cc.—Branched dorsal rays 12 or 13, anal 15 or 16. *marina*.

***Strongylura acus* (Lacépède)**

Sphyræna acus LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 327, Pl. I, fig. 3. America (Martinique).

Belone acus BAADER, 1873-1874, Ber. Senckenberg. Naturf. Gesell., p. 182 (Mogador, Morocco).

Belone caribæa PETERS, 1876 (1877), Monatsb. Akad. Wiss. Berlin, p. 250 (Victoria, Cameroon).

Head 3 to $3\frac{1}{2}$; depth $15\frac{1}{2}$ to 18; dorsal III, 20 to 22; anal III, 19 or 20; scales 340 to 355 in lateral series from gill opening to caudal base, and 10 to 12 more on latter; 18 to 22 scales above lateral line, 10 to 12 below; predorsal scales 270 to 280; upper jaw $1\frac{3}{4}$ in rest of head; eye $2\frac{1}{2}$ to $2\frac{2}{3}$ in postocular; interorbital $1\frac{7}{8}$ to 2.

Body slender, a little compressed, greatest width slightly more than depth. Caudal peduncle slightly depressed, a little wider than deep, keel along middle of side. Head wide. Jaws slender and strong. Eye ellipsoid. Maxillary largely concealed, nearly reaches front edge of pupil. Teeth in jaws knifelike, uniserial, rather long, equal, and rather broad bands of minute ones along the outer edges. Nasal cavity rather large. Interorbital flat, with a slight median depression. Gill opening extends forward to front edge of eye. No gill rakers. Scales minute, not in definite series, very minute on back. Caudal base scaly. Cheek with 15 rows of scales, opercle, and the rest of the head naked. Lateral line low, extends back into caudal keel. Dorsal inserted behind last fourth in head and trunk, last rays elevated in young, shorter in adult. Anal opposite, or its origin slightly before dorsal origin, rays lower. Caudal lunate, lower lobe nearly twice upper. Pectoral short, about equals postorbital. Ventral inserted about midway between center of eye and caudal base, equals postorbital. Dark green above, silvery white on sides and below. No lateral band. Iris silvery white. Dorsal, caudal, and pectoral greenish dusky, other fins whitish. Scales and bones greenish. Reaches 1525 mm.

Atlantic and Mediterranean. Described above from American (Middle States) and Italian examples.

***Strongylura raphidoma* (Ranzani)**

Figure 218

Belone raphidoma RANZANI, 1842, Nov. Comm. Acad. Sci. Inst. Bonon., V, p. 359, Pl. xxxvii, fig. 1. Brazil.—OSORIO, 1893 (August), Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 140 (St. Thomas Island, West Africa); 1898, *op. cit.*, (2) V, p. 199 (St. Thomas).

Head (from upper jaw tip) $3 \frac{2}{5}$ to $3 \frac{2}{3}$ (3 in young); depth $1 \frac{1}{5}$ to $1 \frac{1}{4}$ in postocular; depth $6 \frac{2}{5}$ to 7 from occiput to dorsal ($7 \frac{1}{5}$ in young); dorsal III, 20 to II, 23; anal II, 17 or II, 18; scales 330 to 388 in median lateral series from gill opening to caudal base; 200 to 260 predorsal scales; end of frontal process to eye 3 to $3 \frac{1}{4}$ in rest of snout, about $\frac{3}{4}$ to $\frac{4}{5}$ in width at front of eyes; eye $2 \frac{1}{5}$ to $2 \frac{3}{5}$ in postocular; interorbital $1 \frac{2}{5}$ to $1 \frac{1}{2}$.

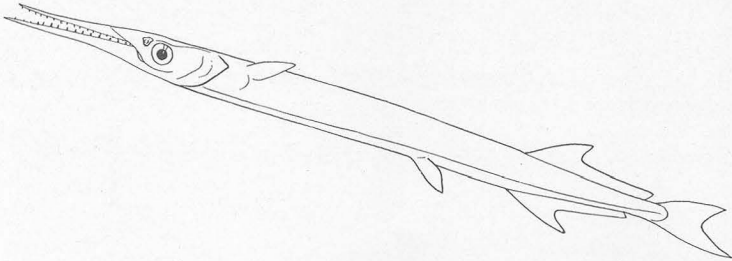


Fig. 218. *Strongylura raphidoma*, from Ranzani.

Body largely cylindrical, comparatively short and robust. Caudal peduncle cylindrical, about as wide as deep, and its least depth $1 \frac{1}{3}$ to $2 \frac{2}{3}$ in eye. Head moderately constricted below, width $1 \frac{1}{8}$ to $1 \frac{1}{3}$ in postocular. Jaws strong, powerful, not completely closing basally, more open in adult, and the space from eye front to hind opercle edge is $1 \frac{2}{3}$ to $1 \frac{3}{4}$ in snout. Eye close to upper profile, not impinging. Maxillary concealed, reaches opposite pupil in adult, a little shorter in small examples. Broad band of small outer teeth and inner row of large strong well-spaced ones. Triangular nasal cavity $\frac{3}{4}$ as long as pupil. Interorbital and top of head level, with a broad median shallow depression and bones all finely striate. Gill opening extends forward midway in nasal cavity. Gill filaments about half the length of eye. Scales small, with 35 to 40 close-set circuli, divided down the median axis of the scale. Cheek with 18 to 24 scales to opercle ridge and 2 to 4 more in front of opercle. Lateral line with a short branch to pectoral base and with a slight keel behind along caudal peduncle and caudal base. Dorsal inserted opposite anal, similar, front rays elevated, or origin near last third in space between pectoral origin and caudal base. Caudal well forked, lower lobe longer, equals postocular and $\frac{1}{3}$ to $\frac{3}{4}$ of eye. Pectoral inserted high, about long as postocular to same combined with

2/5 of eye. Ventral inserted about midway between hind eye edge and caudal base, nearly long as pectoral.

Color dull greenish brown on back, sides and below pale to silvery white. Fins brownish. Length 343 to 929 mm.

Tropical Atlantic. Described above from American examples (Jamaica and Puerto Rico).

***Strongylura crocodila* (Le Sueur)**

Aguja (Canaries), Munjanje, Noni, Munoni (Cameroon)

Belona crocodila (Peron and Le Sueur) LE SUEUR, 1821, Jour. Acad. Nat. Sci. Philadelphia, II, part 1, p. 129. Isle of France (Mauritius).

Belone choram GÜNTHER, 1866, 'Cat. Fish. Brit. Mus.,' VI, p. 357 (Cameroon).—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV (1), p. 47 (Rufisque).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 137 (copied).—VINCI-GUERRA, 1890, Lo Spallanzani, Roma, (2) XIX, p. 482 (Las Palmas, Grand Canary); 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 330 (Grand Canary).—OSORIO, 1895, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) II, 131 (St. Thomé); 1898, *op. cit.*, (2) V, p. 199 (St. Thomé).—LAMPE, 1914, 'Deutsche Südpolar Exped.,' XV (3), p. 219 (São Vicente, Cape Verde).

Tylosurus choram FOWLER, 1917 (June 24), Copeia, No. 45, p. 53 (Great Batanga, Cameroon); 1919, Proc. U. S. Nat. Mus., LVI, p. 261 (Great Batanga).—MONOD, 1927, 'Faune Colon. française,' p. 680 (Cameroon).

Head (damaged) 3 1/5; depth 12 1/2 in trunk, without head and caudal fin; dorsal II, 20?; anal II, 20; pectoral I, 13; scales 385 to caudal base, counted in median lateral row from gill opening; 18 scales above lateral line to dorsal origin, 5 below; 310 predorsal scales; eye 2 1/8 in postocular; interorbital 1 7/8.

Body moderately compressed. Caudal peduncle about as wide as least depth and keel slightly developed on each side. Head convergent below, broad above, width 1 1/2 in postocular. Eye large, ellipsoid. Jaws long, slender, not completely closing so that base of upper leaves distinct open gape. Single row of enlarged and erect canines in each jaw, and surfaces all about have small denticles and asperities externally. Tongue small, slender, end free. Maxillary largely concealed, reaches first third in eye. Nasal cavity large, longest diameter equals diameter of pupil. Interorbital slightly depressed medianly. Cheek a little wider than opercle. No gill rakers. Scales small, narrowly imbricated, with basal and apical striae distinct, not convergent or joined over median vertical axis. Head naked, except 22 rows of scales across cheek. Lateral line low, even over caudal base. Dorsal inserted a little behind anal origin, lobe about 1 1/4 in postocular space and hind rays at least twice depth of caudal peduncle, though not longer than median rays. Anal lobe in front like dorsal, equals postocular, other rays lower than dorsal. Caudal (damaged) with lower lobe evidently longer. Pectoral about equals postocular, ventral 1 1/4.

Color dark brown above, paler to whitish below with silvery reflections. Along side from shoulder to caudal base is a pale leaden band, below dorsal apparently wide at pupil, but ill defined. Iris pale. Fins brownish; dorsal, pectoral, and caudal darker, and dorsal nearly blackish behind. Length 545 mm. (damaged).

Eastern Atlantic, Indian, and Pacific Oceans. Described above from a Cameroon example.

Strongylura marina (Walbaum)

Esox marinus WALBAUM, 1792, 'Arted. Pisc.,' III, p. 88 (on Schoepf). Long Island, New York.

Belone truncata BOULENGER, 1903 (1905), Mem. Soc. Españ. Hist. Nat., Madrid, I, p. 187 (Rio Benito, Spanish Guinea).

Head $2\frac{1}{2}$ to $2\frac{3}{4}$; depth $13\frac{1}{4}$ to $19\frac{1}{2}$; dorsal II, 12 or 13; anal II, 15 or 16; scales 250 to 300 in lateral series to caudal base; 250 to 260 predorsal scales to head; eye 2 to 3 in postocular region; interorbital 2 to $2\frac{1}{4}$.

Body slender, nearly cylindrical. Caudal peduncle wider than deep, moderately depressed. Head long, depressed above, wide shallow median groove present. Jaws narrowly tapered to ends, the lower jaw a little longer. Eye high, near last fourth in head, at last $\frac{2}{5}$ in young. Mouth large, cleft about $\frac{2}{3}$ of head, lower jaw greatly protruded in young. Maxillary reaches eye in adult, not quite to pupil in young. Teeth sharp, simple, mouth not entirely closing. Interorbital level. Scales thin, small, cycloid, narrowly exposed. Lateral line low along trunk, formed on a low keel along caudal peduncle side. Dorsal inserted near last fourth in entire length. Anal larger, inserted a little before dorsal origin. Caudal emarginate. Pectoral high, reaches a third to ventral, shorter in young. Ventral inserted nearer caudal base than eye, about midway in young, and reaches less than a third to anal, shorter in young. Hyaline greenish above, sides and below silvery white. Narrow silvery stripe along side above. Iris and sides of head silvery white. Opercle with a dusky bar. Vertical fins pale olive, others whitish. Reaches 1220 mm.

Atlantic coast of North America. Reported by Boulenger from Spanish Guinea. Described above from American (Middle States) examples.

ABLENNES Jordan and Fordice

Athlennes JORDAN AND FORDICE, 1886, Proc. U. S. Nat. Mus., IX, p. 342. Type: *Belone hians* Valenciennes. Monotypic. (Err. typog.)

Ablennes JORDAN AND FORDICE, *idem*.

Body very elongate, extremely compressed, almost bandlike. Premaxillaries and mandibles prolonged, forming a slender beak; premaxillaries slightly constricted toward bases where they are strengthened by a conical swelling of the bone, the point directed forward. Jaws with a band of conic pointed teeth intermixed with larger ones, which form slender canines. No teeth on vomer. Gill openings wide. No gill rakers. Scales very small, adherent. Lateral line running low, without a distinct keel on caudal peduncle. Anal origin somewhat advanced to dorsal origin, all rays joined by membranes. Caudal forked.

One species.

Ablennes hians (Valenciennes)

Figure 219

Belone hians VALENCIENNES, 1846, 'Hist. Nat. Poiss.,' XVIII, p. 432. Havana, Bahía.—TROSCHER, 1866, Archiv Naturg., part 1, p. 233 (Cape Verde Islands).

Athlennes hians FOWLER, 1918, Proc. U. S. Nat. Mus., LVI, p. 208 (Porto Grande, Cape Verde Islands).—ROULE, 1918, Rés. Camp. Sci. Monaco, LII, p. 40 (southwest of St. Lucia, Cape Verde Islands, in 16 m.).

Head (from tip of broken upper jaw) about $3\frac{3}{4}$; depth $8\frac{4}{5}$ in space from hind edge of gill opening to caudal base; dorsal II, 23; anal II, 23; pectoral I, 13; ventral I, 5; scales about 448 from shoulder to caudal base medianly; 25 scales in vertical series between dorsal origin and lateral line, about 5 below to anal origin; 36 predorsal scales; head width $1\frac{1}{2}$ in postocular region; eye 2; interorbital $1\frac{7}{8}$.

Body very elongate, strongly and narrowly compressed with flattened sides converging much more below, edges all rounded and deepest at ventral bases. Caudal peduncle strongly compressed, least depth about one-half its length or $1\frac{1}{2}$ in eye. Head strongly compressed, depressed or flattened above and the flattened sides narrowly constricted below. Snout produced, slender (damaged at tip) and apparently at least twice space between front eye edge and hind edge of gill opening, width about half its length at apex of maxillaries. Eye ellipsoid, close to upper profile, slightly nearer gill opening than apex of maxillaries. Maxillary concealed below preorbital,

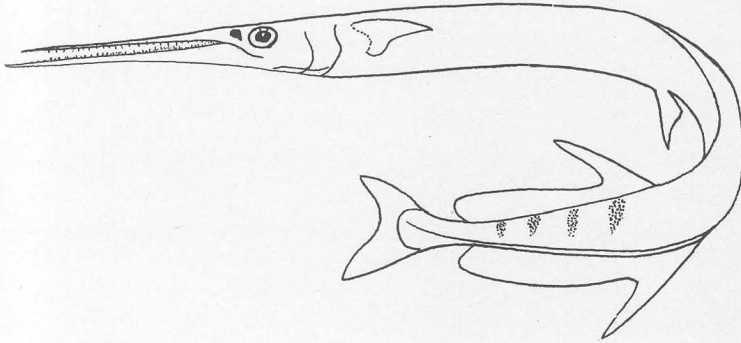


Fig. 219. *Ablennes hians*, from Jordan and Evermann.

extends back very slightly beyond front eye edge. Jaws not capable of closing basally. Teeth small, largest of upper jaw about midway in upper jaw and twice length of lower or about equal depth of upper jaw at their sockets. Mandible deep basally, depth about equals eye, and maxillary groove extends about opposite eye center. Nasal cavity about one-half of vertical eye diameter. Interorbital depressed, broadly and shallowly concave, and frontal region to bases of maxillaries medially rugose. Supraorbitals with fine striae slightly converging toward occiput.

Gill opening forward opposite front edge of nasal cavity. Gill rakers absent, or present only as a few rudimentary papillae. Gill filaments $1\frac{1}{4}$ in eye. Scales minute, narrowly imbricated, largest along lower portions of side where also longer and more narrow than on back. Circuli very fine, parallel, equally developed basally and apically but not confluent, so median smooth area variously narrow, but always distinct; only on smaller dorsal scales of greater width are apical circuli absent, and then basal ones parallel convexly. Occiput and cheeks scaly, in 6 rows on latter, head otherwise naked. Caudal base scaly. Lateral line low, complete to caudal base

medianly; each tube with several short branches below. Dorsal inserted slightly behind anal origin, about midway between base of twenty-second branched dorsal ray and ventral origin, front lobe slightly more than half of fin base or equals space between front nostril edge and hind edge of gill opening. Seventeenth dorsal ray longest of hind rays, about equals postocular. Anal lobe about $\frac{3}{4}$ of dorsal. Caudal well forked, lower lobe slightly longer, and upper lobe about as long as the dorsal. Pectoral falcate, very slightly less than dorsal lobe. Ventral origin nearly midway between hind eye edge and base of last anal ray, fin about equals postocular and one-half of eye. Vent is an eye diameter before anal.

Color, top of head, and back brown, iris, sides, and lower surface silvery white. Fins pale brownish, dorsal and caudal a little dusky, and all fins with the outer portions tinted dusky. Five large bluish-black blotches on back, just below brown color above, third and fourth largest, all close below dorsal base. Length 760 mm. (jaws damaged).

Widely distributed in tropical seas in the Atlantic, Indian, and Pacific Oceans. Described above from an example obtained at Porto Grande, St. Vincent Island, Cape Verde Group, November 12, 1889, by the U. S. 'Eclipse' Expedition, now in the U. S. National Museum.

ORDER ANACANTHINI

Spineless Jugular Fishes

Gills pectinate. No pseudobranchiae. Rostral and orbital portion of cranium longer than hind part. Cranial cavity wide in front. Supra-occipital well developed, horizontal and keel-like behind, separates parietals. Pectoral arch suspended from skull. Pelvic bones behind clavicular symphysis, only loosely joined by ligament. Posterior vertebrae progressively smaller. Fins spineless. Caudal, when present, without an expanded hypural, symmetrical, and supported by neural and haemal spines of hind vertebrae and by basal bones like those supporting dorsal and anal rays. Ventrals below or before pectorals.

A large group of fishes living in the cold waters of northern seas.

KEY TO THE FAMILIES

- a.*—Caudal absent; tail very long, tapering behind; suborbitals very broad; chin with barbel, rarely absent. . . . CORYPHAENOIDIDAE.
- aa.*—Caudal present; tail not greatly elongate; body tapering or coniform behind, with numerous procurrent rays above and below; suborbitals moderate.
 - b.*—Chin with barbel, rarely obsolete; frontal bones without triangular excavated area above. GADIDAE.
 - bb.*—No barbels; frontal bones paired, with triangular excavated area above; divergent frontal crests continuous from forked occipital crest. MERLUCCIIDAE.

Coryphaenoididae

Grenadiers

Body elongate, tapering into the very long compressed tail, which ends in a point. Head large and robust. Premaxillary protractile. Teeth villiform or cardiform, in bands, in jaws only. Lower jaw tip with barbel. Suborbital bones enlarged, sometimes cavernous. Gill membranes free or narrowly united to isthmus, usually more or less connected. Gills 4, slit behind fourth. Gill rakers small. Pseudo-branchiae rudimentary or absent. Branchiostegals 6 or 7. Air vessel present. Pyloric appendages numerous. Scales moderate, usually keeled or spinous, sometimes smooth. Lateral line present. Dorsals 2, first one short and high, of stiff, spinelike, branched rays. Second dorsal very long, usually of very low feeble rays, continued to end of tail. Anal like second dorsal, usually much higher. No caudal. Ventrals small, subjugular, each of about 8 rays.

A large family, all of the deep seas.

KEY TO THE GENERA

- a.*—BATHYGADINAE. Gill rakers not tubercular; no fold of membrane attached to first gill arch and restricting gill slit; second dorsal ray not modified and spine-like; anal low throughout; no vomerine teeth.
- b.*—Mouth terminal; gill rakers long and slender; no scaleless fossa at side of nape; scales all cycloid, not modified along dorsal and anal bases; second dorsal much higher than anal; pectoral actinosts 3.
- c.*—Teeth moderate; barbel very short or absent. BATHYGADUS.
- cc.*—Teeth exceedingly minute; barbel very long. GADOMUS.
- bb.*—Mouth entirely inferior, snout greatly produced; gill rakers styliform; scaleless fossa on each side of nape; scales rough, especially enlarged along front portions of dorsal and anal bases; second dorsal not much higher than anal; pectoral actinosts 6. TRACHYRINCHUS.
- aa.*—CORYPHAENOIDINAE. Gill rakers tubercular; fold of membrane attached to first gill arch, restricting first gill slit; second dorsal ray is a modified spine, often serrate on front edge; anal better developed than second dorsal.
- d.*—Branchiostegals 6; vent usually close before anal fin.
- e.*—Snout a little produced; no strongly marked ridges on head, suborbital ridge not reaching preopercle; dorsal spine trenchant and serrate anteriorly. CORYPHAENOIDES.
- ee.*—Snout usually greatly produced; head with prominent ridges, armed with modified scales, suborbital ridge reaching preopercle; dorsal spine smooth and rounded anteriorly.
- COELORHINCHUS.
- dd.*—Branchiostegals 7.
- f.*—More than 15 gill rakers on lower limb of second arch; gill membranes narrowly united, gill opening extended

forward ventrally; vent immediately before anal.

HYMENOCEPHALUS.

ff.—Fewer than 15 gill rakers on lower limb of second arch; gill membranes broadly united, extended forward a little ventrally; vent remote from anal.

g.—Premaxillary teeth biserial, mandibular uniserial; pyloric caeca numerous and profusely branched; dorsal spine smooth and rounded.

MALACOCEPHALUS.

gg.—Premaxillary teeth in band, mandibular variably irregular to band; pyloric caeca moderate, fewer than 100, not branched.

h.—Head not cavernous, or very massive; body usually slender, tail not rapidly constricted; barbel moderate or long; gill cavity not restricted in size; preopercle edge not adnate; lateral line pores in a continuous well-marked groove.

i.—Scales well imbricated, spinules mostly directed backward; dorsal spine trenchant in front, usually serrate.

MACRUROPLUS.

ii.—Scales not imbricate, spinules erect; dorsal spine slender, smooth, rounded.

TRACHONURUS.

hh.—Bones of head soft, cavernous, massive; body very robust, tail rapidly constricted from trunk; barbel very short; gill cavity restricted in size; preopercle edge adnate with interopercle; lateral line of widely spaced pores, without groove.

CETONURUS.

BATHYGADUS Günther

Bathygadus GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 23. Type: *Bathygadus cottoides* Günther. Monotypic.

Melanobranchnus REGAN, 1903, Ann. Mag. Nat. Hist., London, (7) XI, p. 459. Type: *Bathygadus melanobranchnus* Vaillant. Monotypic.

Regania (Jordan) JORDAN AND STARKS, 1902 (1904), Bull. U. S. Fish Comm., XXII, p. 604. Type: *Regania nipponica* (Jordan and Gilbert) Jordan and Starks. Monotypic.

Head large, with an elevated humplike nape. Snout wide and obtuse. Mouth very large. Teeth in bands in jaws, none on vomer. Gill rakers long, slender, rather numerous. Branchiostegal membranes free from isthmus. Branchiostegals 6 or 7. Two separate dorsals, and hind portion of dorsal better developed than anal. Anal low throughout its length.

***Bathygadus melanobranchus* Vaillant**

Figure 220

Bathygadus melanobranchus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 206, Pl. XVIII, fig. 1, *a-e*. Off Morocco, Canaries, coast of Soudan, Banc d'Arguin, in 830 to 1590 m.—RICHARD, 1910 (February), Bull. Inst. Océanogr. Monaco, CLXII, p. 149 (Azores, 1557 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 399 (off Morocco, 1215 m.; off Canaries, 1365 m.).—ROULE, 1918, Rés. Camp. Sci. Monaco, LII, p. 89 (3 miles east of Lanzarote, 1098 m.; near Maio, Cape Verde Islands, 1300 m.; 6 miles south of São Miguel, 1187 m.; north of São Jorge 3 1/2 miles, 1095 m.; between Pico and São Jorge, 1250 m.).

Head 5; depth 7; dorsal ix-102; anal 97; ventral 8; scales 140? in a lateral line, 7 above, 17 below. Head with sides feebly roughened, nearly papery. Snout obtuse, 4 in head, shorter than eye. Eye large, 3 1/2 in head. Mouth large, mandible a little protruded. Maxillary passes slightly beyond center of eye, about one-half the length of head. Jaws with fine equal pluriserial teeth. No barbel. Nostrils

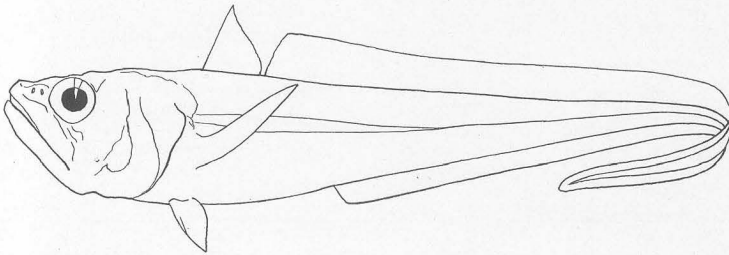


Fig. 220. *Bathygadus melanobranchus*, from Vaillant.

largely open, together; front one rounded; hind one oval, vertical, close to eye. Interorbital slightly less than eye. Suborbitals swollen with mucous canals. Preopercle very large. Opercle less developed than subopercle. Gill opening widely cleft. Branchiostegals 6. First dorsal height 2 3/5 in head. Second dorsal well separated from first, also a little lower. Anal begins opposite tenth dorsal ray, much lower than second dorsal. Pectoral falciform, reaches vent, 1 3/5 in head. Ventral inserted before pectoral, 2 3/4 in head. Vent at first third of body, behind second dorsal origin. Gray silvery rose, with brilliant iridescent reflections, blue and green on opercle. Inside mouth and gill opening black. Length 440 m. (Vaillant.)

Eastern Atlantic. Barnard reports it from off Table Bay and Natal (1925, Ann. South African Mus., XXI, part 1, p. 334).

GADOMUS Regan

Gadomus REGAN, 1903, Ann. Mag. Nat. Hist., London, (7) XI, p. 459. Type: *Bathygadus longifilis* Goode and Bean. Monotypic.

Differs from *Bathygadus* in the long barbel and very minute teeth.

KEY TO THE SPECIES

- a.—Barbel $1/3$ of head; interorbital $4 \frac{3}{4}$ *longifilis*.
 aa.—Barbel nearly long as head; interorbital 6..... *dispar*.

***Gadomus longifilis* (Goode and Bean)**

Figure 221

Bathygadus longifilis GOODE AND BEAN, 1885, Proc. U. S. Nat. Mus., VIII, p. 599. N. lat. $28^{\circ} 47' 30''$, W. long. $87^{\circ} 27'$, in 724 fathoms, Gulf of Mexico.—COLLETT, 1896, Rés. Camp. Sci. Monaco, X, p. 90 (between Pico and São Jorge in 1287 m.).—RICHARD, 1910 (February), Bull. Inst. Océanogr. Monaco, CLXII, p. 149 (Azores, 1557 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 399 (off Morocco, 1215 and 1615 m.; off Canaries, 1365 m.).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 88 (south of Pico, 1550 m., southeast of Flores, 1360 m.; south of Portugal, 1440 m.; 50 miles off Mogador, 2165 m.; $1 \frac{1}{2}$ miles off Hierro, Canaries, 1786 m.; north of São Jorge, $3 \frac{1}{2}$ miles, 1095 m.).

Hymenocephalus longifilis VAILLANT, 1888, 'Expéd. "Travailleur" et du "Talisman," Poiss., p. 218, Pl. XXIII, fig. 1a-c (coasts of Morocco and Soudan, 1084 to 1635 m.).

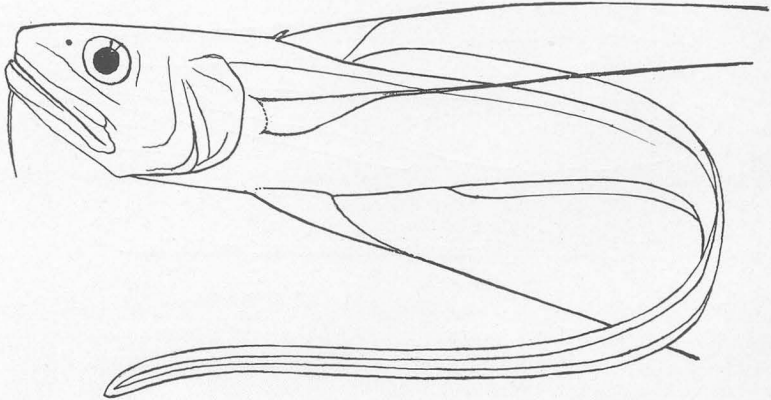


Fig. 221. *Gadomus longifilis*, modified from Vaillant.

Head 6; depth 8; dorsal II, 7—?; pectoral I, 8; scales 135 in lateral line, 7 above, 18 below; snout $3 \frac{2}{3}$ in head; eye $4 \frac{1}{4}$; maxillary $1 \frac{3}{5}$. Body with greatly elongated, slender, tapering tail. Snout a little prominent, keeled to end. Eye diameter a little less than snout, a little greater than interorbital. Mouth well cleft. Maxillary extends but slightly beyond eye. Jaws with equal, fine, villiform teeth; palate smooth. Barbel a little over $1/3$ of head. Suborbitals swollen, cavernous, with keel. Preopercle and suborbitals roughened. Opercle with a strong spine. Gill opening wide. Head naked. Scales on trunk thin and feeble. First dorsal with second spine extremely long, $1/3$ length of body, others all low. Second dorsal well separated from first, but little lower than lower dorsal spines. Anal begins well behind vent, about

opposite eleventh dorsal ray, lower than second dorsal. Pectoral origin little before that of first dorsal, first ray elongate, like second dorsal spine. Ventral origin a little behind pectoral base, first ray elongate, like first pectoral ray. Vent a little behind first fourth in length. Bluish silvery white. Gill opening deep purplish black. Iris golden green. Length 292 mm. (Vaillant.)

Bathypelagic in the warmer Atlantic.

Gilbert and Hubbs state: "the western Atlantic species, *G. longifilis*, has been recorded from the eastern Atlantic by Vaillant and Collett, but the descriptions of these authors indicate that they have had another species, in which the interorbital is nearly as wide as the orbit. In addition Vaillant counted 9 ventral rays ("I, 8") and Collett 7+27 gill rakers in the outer arch, while *G. longifilis* has but 8 ventral rays, and 30 to 35 gill rakers below the angle of the outer arch."¹

Subsequently Roule places both these references to Vaillant and Collett, with the present species.

Gadomus dispar (Vaillant)

Hymenocephalus dispar VAILLANT, 1888, 'Expéd. "Travailleur" et du "Talisman,"' Poiss., p. 221, Pl. xxiv, fig. 1. Off Morocco in 1105 m.

Head 7; depth 8; dorsal II, 8—?; pectoral 17; ventral 8 or 9; scales 146 in lateral line, 7 above, 21 below; snout 4 in head; eye 3 1/8; maxillary 1 2/3; interorbital 6. Body somewhat compressed, tail elongated, moderately tapering. Snout a little less than eye. Eye large and high. Mouth well cleft, jaws about equal. Maxillary reaches opposite hind eye edge. Teeth fine, villiform in jaws, none on palate. Barbel nearly as long as head. Hind nostril large, close to eye. Roughened groove on lower border of suborbitals. Opercular spine flattened. Gill opening wide. Head and body with scales, mostly fallen. First dorsal origin a little behind pectoral origin; second dorsal anteriorly nearly as high as first. Anal begins well behind vent, below ninth dorsal ray. Upper pectoral ray filamentous, 3 3/4 in total length. Ventral inserted behind pectoral base, outer ray elongate. Vent at first third in length. Dusky. Length 195 mm. (Vaillant.)

Off Morocco.

TRACHYRINCHUS Giorna

Trachyrinchus GIORNA, 1803, Mem. Accad. Imp. Torino, XVI, p. 178. Atypic. Type: *Lepidoleprus trachyrinchus* Risso. Tautotypic.

Trachyrhynchus, *Trachyrinchus*, *Trachirincus* auct.

Oxycephas RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 31. Type: *Oxycephas scabrus* Rafinesque. Monotypic.

Lepidoleprus Risso, 1810, 'Ichth. Nice,' p. 197. Type: *Lepidoleprus trachyrinchus* Risso. Monotypic.

Lepidosoma (Risso) SWAINSON, 1838, 'Nat. Hist. Animals,' II, p. 261. Type: *Lepidoleprus trachyrinchus* Risso. Monotypic.

Snout greatly produced in front to a long sharp point, and sharp lateral edge

¹1920, Bull. U. S. Nat. Mus., I, No. 100, part 2, pp. 391, 392.

extends straight along suborbital. Mouth inferior. Teeth in jaws in villiform bands, none on vomer. Chin with barbel. Opercle small. Gill membranes scarcely united. Gills 4. Scales moderate, spinigerous. Second dorsal well developed. Anal low throughout its length.

Species few, noted especially for the row of large spinelike scales along each side of base of both dorsal and anal.

Trachyrinchus scabrus (Rafinesque)

Oxycephus scabrus RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' p. 13, Pl. I, fig. 2. Sicily.

Macrurus trachyrhynchus VAILLANT, 1888, 'Expéd. "Travailleur" et du "Talisman,"' Poiss., p. 250, Pl. XXI (scale) (off Morocco, Soudan, Banc d'Arguin, Cape Verde Islands, in 405 to 1495 m.).—RICHARD, 1904 (October 15), Bull. Mus. Océanogr. Monaco, No. 19, p. 7 (N. lat. 38° 20', W. long. 9° 19', at surface).

Trachyrhynchus trachyrhynchus MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 397 (off Morocco, 1215 m.).

Head $3\frac{1}{2}$; depth 7; dorsal II, 10—?; ventral 6; scales 126? in lateral line, 3 above, 19 below. Body moderately compressed. Head divided in 2 regions by crests extending from snout tip to opercle angle; upper region elevated, crest from above eye to gill opening above; surface regularly convex, except more depressed on snout; lower surface uniformly and slightly convex. Snout pointed, flattened. Eye large, less than 4 in head, nearly equals interorbital. Mouth very large, horseshoe-shaped; front edge somewhat more distant from snout tip than branchiostegal angle, or begins slightly before front eye edge, though gape not reaching quite opposite hind eye edge. Barbel small, short, $3\frac{1}{2}$ in eye. Nostrils together, oval, vertical, hind one less than 3 times as large as front one. Gill opening wide. Branchiostegals 7. Head nearly entirely covered with long scales, each with a strong spiny keel. Body scales greatly spinescent and keeled on head above, except a small naked area of nostrils. Lateral line begins at upper fourth in depth, becomes median on tail behind. Dorsal spines feeble, second $2\frac{1}{2}$ in head. Second dorsal greatly lower, though highest medianly. Anal like second dorsal. Pectoral origin slightly before first dorsal origin, fin about equals eye. Ventral origin opposite first dorsal origin, short, first ray prolonged in filament. Vent at first $\frac{2}{5}$ of length. Uniformly gray, with bluish tints. Length 430 mm. (Vaillant.)

Eastern Atlantic and Mediterranean.

CORYPHAENOIDES Gunner

Grenadiers

Coryphaenoides GUNNER, 1761, Dronthj. Selsk. Skrift., III, pp. 43, 50. Type: *Coryphaenoides rupestris* Gunner. Monotypic.

Macrurus BLOCH, 1787, 'Naturg. Ausl. Fische,' III, p. 150. Type: *Coryphaena rupestris* (not Gunner) Fabricius = *Macrurus berglax* Lacépède. Monotypic.

Macrurus SCHNEIDER, 1801, 'Syst. Ichth. Bloch,' p. 103. Type: *Coryphaena rupestris* (not Gunner) Fabricius.

Lepturus GRAY, 1854, 'Cat. Fish Gronow,' p. 165. Type: *Lepturus brevirostris* Gray = *Coryphaenoides rupestris* Gunner. Monotypic.

Chalinura GOODE AND BEAN, 1883, Bull. Mus. Comp. Zoöl., X, No. 5, p. 198.
Type: *Chalinura simula* Goode and Bean. Monotypic.

Chalinurus GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, pp. 122, 144.
Type: *Chalinura simula* Goode and Bean.

Optonurus GÜNTHER, *op. cit.*, pp. 124, 147. Type: *Macrurus denticulatus* Richardson. Monotypic.

Nematonurus GÜNTHER, *loc. cit.*, pp. 124, 150. Type: *Macrurus armatus* Hector.
(Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' part 4, p. 437.)

Moseleya (not Quelch, 1884) GOODE AND BEAN, 1895, 'Ocean. Ichth.,' p. 417.
Type: *Coryphaenoides longifilis* GÜNTHER. Monotypic.

Albatrossia JORDAN AND EVERMANN, 1898, Bull. U. S. Nat. Mus., No. 47, III, p. 2573. Type: *Macrurus (Malacocephalus) pectoralis* Gilbert. Monotypic.

Bogoslovius JORDAN AND EVERMANN, *op. cit.*, p. 2574. Type: *Bogoslovius clarki* (Jordan and Gilbert) Jordan and Evermann. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' part 4, p. 482.)

Dollosa JORDAN, 1900, Amer. Nat., XXXIV, p. 897. Type: *Coryphaenoides longifilis* Günther. (*Dollosa* Jordan proposed to replace *Moseleya* Goode and Bean.)

Body rather robust. Head short. Snout variably short or long, obtuse or truncated, high; projects beyond mouth, not produced; usually soft to touch, except the bony center. Mouth small to moderate, inferior to terminal. Barbel present. Teeth various, uniserial or partly so, sometimes uniserial only in lower jaw; sometimes in villiform bands, in which case the outer series may be enlarged. Gill rakers sometimes strong and spiny, fewer than 15 on lower limb of second arch. Branchiostegals 6. Bony ridges of head sometimes prominent and rough, or membrane bones of sides may be soft and papery. Scales moderate or large, spinous, keeled, imbricated, very rough; sometimes cycloid, fluted longitudinally with slightly radiating striae. Second or elongate dorsal ray finely spinous to serrate in front.

Species of large size, widely distributed, upward of 70 described. The oldest and best-known genus, usually admitted under the later name *Macrourus* or *Macrurus*.

KEY TO THE SPECIES

- a.—Head and trunk robust; snout but slightly projecting beyond mouth; second dorsal and anal equally high; second dorsal begins well behind anal origin or behind first dorsal space equal to 1/2 or 3/4 head length. *armatus*.
aa.—Head and trunk more elongate; anal much higher than second dorsal.
b.—Snout pointed, protrudes slightly beyond mouth; second dorsal begins nearly opposite anal origin, or behind first dorsal space less than 1/4 of head; scales larger. *murrayi*.
bb.—Snout obtuse, scarcely protruded beyond mouth; second dorsal begins behind anal origin, or behind first dorsal space equal to 1/3 of head length; scales small. *simulus*.

Coryphaenoides armatus (Hector)

Figure 222

Macrurus armatus HECTOR, 1873 (1874), Trans. New Zealand Inst., VII, p. 249, Pl. XI, fig. 78a. Off Cape Farewell, in 400 fathoms.

Macrurus (Nematonurus) armatus MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 397 (off Cape Blanco, in 2603 m.).

Coryphaenoides gigas VAILLANT, 1888, 'Expéd. "Travailleur" et du "Talisman,"' Poiss., p. 232, Pl. xx, fig. 2. Between Azores and France, in 4165 to 4255 m.

Nematonurus gigas ROULE, 1916 (May 20), Bull. Inst. Océanogr. Monaco, No. 320, p. 21 (off Azores, 3020 m.); 1919, Rés. Camp. Sci. Monaco, II, p. 87, Pl. III, fig. 1-a (50 miles north of São Miguel, 3020 m.).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 134 (N. lat. 34° to 38°, W. long. 8° to 23°, in 3610 to 4020 m.).

Macrurus (Coelorhynchus) talismani MURRAY AND HJORT, *op. cit.*, p. 397 (off Morocco, 1615 m.; off Canaries, 1365 m.).

Head 6; depth 6; dorsal II, 8-87; anal 107; ventral 10; scales 138 in lateral line, 9 above, 34 below. Head globular, weakly depressed. Snout obtuse, rounded, short, a little less than eye. Eye with center near first fourth in head, length 5. Mouth inferior, large, rictus well before hind eye edge. Lips soft, papillose. Teeth conic, uniserial in jaws, about 40 to 45 in each. Barbel short, as long as eye. Nostrils

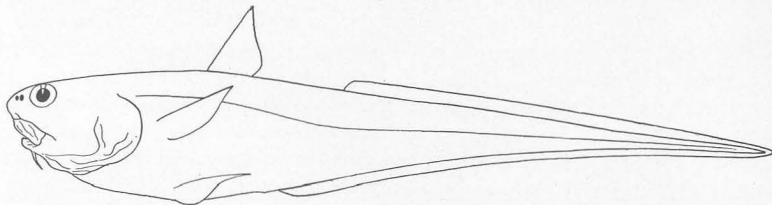


Fig. 222. *Coryphaenoides armatus*, modified from Vaillant.

together, moderate, alike, close before eye. Interorbital 4 in head. Preopercle rounded. Gill opening moderately wide. Branchiostegals 6. Mandible with 5 or 6 pores. Scales moderately adherent, similar on head. Lateral line elevated at first, becomes median on tail. First dorsal elevated, second spine $1\frac{2}{3}$ in head; origin about over the middle of depressed pectoral. Origin of second dorsal distant from base of first space equal to $\frac{3}{4}$ of head; fin greatly lower than first dorsal. Anal similar, placed well before second dorsal origin. Pectoral not reaching ventral, $1\frac{1}{2}$ in head. Ventral inserted slightly behind pectoral origin, slightly shorter and not reaching vent. Outer ray of each paired fin a little prolonged. Vent somewhat behind first third in length. Mouse-gray. Branchiostegal membranes and fins brownish. Length 730 mm. (Vaillant.)

Atlantic and Pacific Oceans, in the former, off the Azores and Canaries.

***Coryphaenoides murrayi* Günther**

Coryphaenoides murrayi GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, (5) II, p. 26. Deep sea east of New Zealand, in 1100 fathoms.

Macrurus (Chalinura) murrayi MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 397 (off Morocco, in 2300 m.).

Snout short, longer than eye, which is small, 5 in head, much less than interorbital.

Mouth cleft anterior, lateral, extends below eye center. Outer series of teeth stronger than inner villiform band; mandibular teeth uniserial. Barbel longer than eye. Scales with 5 to 7 crenulated radiating keels, some projecting beyond rounded hind edge of scale; 7 or 8 scales above lateral line. Upper and lateral parts of head, except end of snout, covered with small rough scales. Canthus rostralis obtuse, without median tubercle. First dorsal 12; anterior spine slightly prolonged, armed with numerous distant barbs pointing upward. Second dorsal begins well behind first, which is rather less than the length of head. Pectoral rays 20. Ventral rays 12, outer ray produced in a filament. Distance between vent and isthmus rather less than length of head. Lower parts of head, buccal, and branchial cavities black. Length 383 mm. (Günther.)

Atlantic and Pacific Oceans, in the former off Morocco.

Coryphaenoides similus (Goode and Bean)

Chalinura simula GOODE AND BEAN, 1883, Bull. Mus. Comp. Zoöl., X, No. 5, p. 189. N. lat. 41° 25' 45'', W. long. 65° 35' 30'', in 1242 fathoms (Gulf Stream).—ROULE, 1918, Rés. Camp. Sci. Monaco, LII, p. 86 (west of Graciosa, 2102 m.; west of São Miguel, 1919 m.).

Macrurus (Chalinura) similus MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 397 (off Azores, 2865 m.).

Head 5; depth 6; dorsal II, 9–113; anal 118; pectoral 20; ventral 9; scales 150 in lateral line, 8 above, 17 to 19 below. Body rather stout, back somewhat gibbous in profile. Snout 6 in head, broad, obtuse, scarcely projects beyond mouth, width nearly as great at tip as at front of eyes. Eye 3 in postorbital region. Teeth above in a broad villiform band with the outer series much enlarged, lower uniserial. Barbel longer than eye. Nostrils nearer eye than snout tip. Interorbital much greater than eye, which is nearly twice the snout. Median ridge of head very prominent, convex in profile; lateral ridges start at almost a right angle with the median ridge, not continued on sides of head; suborbital prominent, forming broad subocular ridges; no supraorbital ridges. Branchiostegals 6. Scales rather small. Origin of first dorsal distant from front eye edge a space equal to head length; second spine 2 1/2 in head, rather stout, with simple serration anteriorly, serrae closely appressed to spine. Second dorsal begins at a space from first dorsal equal to the length of upper jaw. Anal inserted slightly behind last ray of first dorsal, rays 3 times as long as those of dorsal. Ventral inserted almost below pectoral, very slightly advanced; outer ray is a prolonged filament reaching eighteenth anal ray. Length 458 mm. (Goode and Bean.)

Atlantic Ocean, Gulf Stream off eastern United States and the Azores.

COELORHINCHUS Giorna

Coelorhynchus GIORNA, 1805, Mem. Accad. Sci. Torino, XVI, p. 179. Atypic. Type: *Lepidolepris coelorhynchus* Risso. Tautotypic.

Coelorhynchus auct.

?*Krohnii* COCCO, 1844, 'Intorno ad alcuni nuovi pesci del mare di Messina' (letter from Prof. Cocco to Signor Krohn), p. 1. Type: *Krohnii filamentosus* Cocco. Monotypic.

Oxymacurus BLEEKER, 1874, Verh. Kon. Akad. Wet. Amsterdam, VIII, p. 370.
Type: *Macrurus japonicus* Schlegel. Monotypic.

Paramacurus BLEEKER, *idem*. Type: *Lepidolepris australis* Richardson.
Monotypic.

Differs from *Coryphaenoides* in that the small mouth is wholly below the long, pointed, sturgeon-like snout.

KEY TO THE SPECIES

- a.*—Eye large, about equals snout, 3 in head. *coelorhynchus*.
aa.—Eye smaller, much less than snout, 1 2/3 to 2 in snout, about 4 in head. *vaillanti*.

Coelorhynchus coelorhynchus (Risso)

Pagra, Lagatricha do mar (Madeira)

Lepidolepris coelorhynchus RISSO, 1810, 'Ichth. Nice,' p. 200, Pl. VII, fig. 22. Nice.

Macrourus coelorynchus JOHNSON, 1862, Ann. Mag. Nat. Hist., London, (3) X, p. 169 (Madeira).

Macrurus coelorhynchus GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 128 (Madeira).—VAILLANT, 1888, 'Expéd. "Travailleur" et du "Talisman,"' Poiss., p. 247, Pl. XXI, fig. 3, *a-b* (scales) (coasts of Soudan, Banc d'Arguin, Cape Verde Islands, Azores, 140 to 580 m.).—COLLETT, 1890, Bull. Soc. Zool. France, XV, p. 223 (Funchal).

Macrurus (Coelorhynchus) coelorhynchus MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 397 (off Morocco, 535 m.).

Macrourus atlanticus LOWE, 1839, Proc. Zool. Soc. London, p. 88. Madeira; 1839 (1849), Trans. Zool. Soc. London, III, p. 15 (Madeira).

Macrurus atlanticus GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' VI, p. 392 (Madeira).

Macrourus rupestris (not Bloch) LOWE, 1837 (1841), Trans. Zool. Soc. London, II, p. 190 (Madeira).

Head 4; depth 7 1/2; dorsal 10–98; anal 82 to 110; pectoral 15 to 20; ventral 7. Body compressed, much attenuated behind, ends in a point. Head thick, subconic. Snout projects, subcarinate above and below, subtrilobate at tip. Eye large, 3 in head, about equals snout. Mouth inferior, upper jaw very protractile. Villiform band of teeth in each jaw, none on palate or tongue. Chin with short barbel. Nostrils in naked area. Interorbital concave, about equals eye. Two crests begin over middle of eyes and extend backward, spinescent; crest above and posterior from eye; lower lateral spinescent ridge well developed. Branchiostegals 6. Scales small, rough with numerous small spines, but not keeled. Head covered with minute villiform spines. Scaleless depression between ventral fins. Lateral line high at first, midway along tail. First dorsal begins a little behind pectoral base or about first fourth in total length. Second dorsal begins behind anal origin, much lower than anal. Pectoral 2 in head, reaches anal origin. Ventral inserted below pectoral, first ray produced and reaches vent. Vent at first third in body.

Dark gray above, belly paler gray. Anal, pectoral, and ventral black. Pharynx and inside gill opening black. Length 250 to 338 mm. (Johnson.)

Eastern Atlantic and Mediterranean.

Coelorhynchus vaillanti Roule

Figure 223

Coelorhynchus vaillanti ROULE, 1916 (May 20), Bull. Inst. Océanogr. Monaco, No. 320, p. 20. Azores, in 1187 m.; 1918, Rés. Camp. Sci. Monaco, LII, p. 81, Pl. III, fig. 3 a-c (6 miles south São Miguel, 1187 m.; north of São Jorge 3 1/2 miles, 1905 m.).

Macrurus japonicus VAILLANT, 1888, 'Expéd. "Travailleur" et du "Talisman,"' Poiss., p. 254, Pl. XXI, fig. 1 a-f (coasts of Soudan, Banc d'Arguin, Cape Verde Islands, Azores, in 460 to 2220 m.).

Macrurus affinis VAILLANT, *op. cit.*, p. 51. South of Azores, in 1442 m.

Head 3 3/4; depth 9; dorsal 9—?; pectoral 17; ventral 7; scales 106 (?) in lateral line, 5 above, 15 below. Head pointed, width one-half its length, in the form of a quadrangular pyramid. Ridge on each side from snout tip to preopercle angle, and two on each side above beginning a little before the eye and widening at nape. Snout triangular, spatuliform, width 1 2/5 its length, which is 2 1/3 in head. Eye

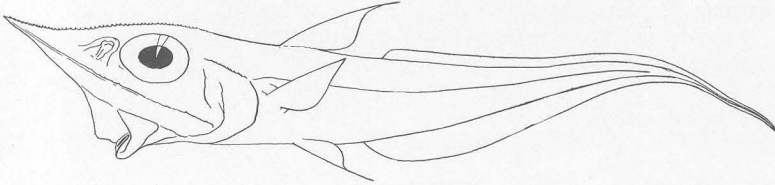


Fig. 223. *Coelorhynchus vaillanti*, from Roule.

large, greater than interorbital, 4 in head. Mouth small, horseshoe-shaped, gape as wide as long. Teeth in villiform bands in jaws, none on palate or tongue. Barbel 1/4 of eye. Nostrils together, oval, vertical, hind one more than 3 times anterior; in a naked area 2/3 of eye in extent. Interorbital 5 in head. Gill opening very large. Branchiostegals 4. Upper surface of head and body entirely with rough crested scales; lower surface of head scaleless and smooth. Lateral line a little high at first, midway along tail. Second dorsal spine smooth, 2 1/3 in head, begins about over vent and its distance from first dorsal is a little less than 1/2 of eye. Second dorsal a little lower than anal, the latter beginning immediately behind vent. Pectoral small, ends at middle of space which separates dorsals. Ventral inserted behind pectoral, prolonged outer ray passes vent. Vent at anterior 2/5 of body. Uniformly rosy gray, with first dorsal and ventral dusky. Hind nostril edge black in front. Length 370 mm. (Vaillant.)

Eastern Atlantic.

HYMENOCEPHALUS Giglioli

Hymenocephalus GIGLIOLI, 1884, 'Pelagos, Saggi Vita Prod. Mare,' Genova, p. 228. Type: *Hymenocephalus italicus* Giglioli. Monotypic.

Mystacourus GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 124. Type: *Mystacourus longibarbis* Günther. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' part 4, p. 437).

Head large, soft, cavernous. Snout abrupt, perpendicular, parabolic. Eye very large, orbital margin forming part of profile of head. Mouth wide, lateral. Barbel long. Bones of head membranaceous. Scales thin, deciduous, with fine short spines. Preventral region of abdomen wholly or partly naked. Head naked. First dorsal broad, advanced far forward over pectoral base, spine smooth. Second dorsal and anal origins nearly opposite, well separated from end of first dorsal. Pectoral rather narrow, rays 10 to 16.

Distinguished by the soft thin bones of the head. Small fragile species, tropical, usually less than 300 mm.

Hymenocephalus italicus Giglioli

Figure 224

Hymenocephalus italicus GIGLIOLI, 1884, 'Pelagos, Saggi Vita Prod. Mare,' Genova, p. 228, Fig. Genoa.—VAILLANT, 1888, 'Expéd. "Travailleur" et du "Talisman,"' Poiss., p. 211, Pl. XIX, fig. 1 (off Morocco, Soudan, Cape Verde, and Azores, 410 to 2083 m.).—ROULE, 1919, Rés. Camp. Sci. Monaco, II, p. 86 (forty miles off Casablanca, Morocco, 851 m.).

Macrurus italicus COLLETT, 1896, Rés. Camp. Sci. Monaco, X, p. 85, Pl. II, fig. 7, b-c (off Pico-Fayal, Azores, 800 to 927 m.).

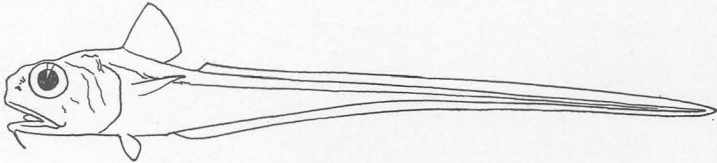


Fig. 224. *Hymenocephalus italicus*, modified from Vaillant.

Head deeper than wide, with vertical sides and wide muciferous cavities. Snout short, obtuse, projecting slightly beyond mouth, of which the cleft is oblique, anterior and lateral and extends to behind the eye center. Teeth in jaws minute, equal, in narrow villiform bands. Barbel small. Interorbital as wide as eye, which is 3 in head and exceeds snout length. Preopercle edge not serrated. Scales extremely thin, deciduous, spiny, rather large. Triangular scaleless space between ventrals, nearly extending to vent; small round naked space, surrounded by spiny scales in middle of preventral region. First dorsal ray 12, anterior spine smooth, filamentous. Interspace between dorsal rays but little more than the length of first dorsal base. Pectoral rays 16, fin about half as long as head. Ventral rays 10, reach vent, outer ray produced in a filament. Space between vent and isthmus $\frac{3}{4}$ of head. Body and tail colorless. Sides of head and abdomen silvery. Lower parts, to vent, blackish. Length 140 mm. (Günther.)

Eastern Atlantic and Mediterranean.

MALACOCEPHALUS Günther

Malacocephalus GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 396. Type: *Macrurus laevis* Lowe. Monotypic.

Snout short, obtuse. Mouth lateral. Upper teeth biserial, lower uniserial. No prominent ridges on head, muciferous cavities wide. Scales small, bristly. Lateral line begins at upper angle of gill cleft. Dorsal fin over pectoral origin, longest spine smooth and dorsals widely separated. Pectorals short, high, opposite upper angle of gill cleft.

Species few, tropical or subtropical.

Malacocephalus laevis (Lowe)

Macrourus laevis LOWE, 1843, Proc. Zool. Soc. London, XL, p. 92. Madeira.—JOHNSON, 1862, Ann. Mag. Nat. Hist., London, (3) X, p. 171 (Madeira).

Malacocephalus laevis GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 397 (type: Madeira).

Macrurus (Malacocephalus) laevis MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 397 (off Morocco, 535 m.).

Head less than 6; dorsal 14–200; anal 200; ventral 8. Trunk very short, shorter than head and tail tapers to very long narrow band. Head large, rather short, width 1 1/2 its length. Snout obliquely truncated in front, 1/2 to 2/3 of eye. Eye nearly 3 in head. Mouth cleft wide. Maxillary extends to nearly opposite hind eye edge. Both jaws with series of rather wide-set teeth; second inner series of small teeth above; vomer smooth. Barbel very slender, nearly as long as eye. Nostrils close together, immediately before eye. Interorbital flat, as wide as eye. Bones of head thin and fragile, scarcely project on surface. Preopercle angle produced backward, rounded. Opercle with a short stiff spine pointing obliquely upward; another small spine a short distance above, directed upward. Gills 4, a slit behind the fourth. No pseudobranchiae. Branchiostegals 7. Gill membranes not attached to isthmus, united by narrow cutaneous bridge. Scales very small and rough. Head covered all over with minute rough scales and with tough skin rendering the skull ridges barely visible externally. First dorsal begins over pectoral base, fin twice as high as it is long, second ray 1 1/2 in head. Second dorsal rudimentary forward, very low. Interdorsal space about equals the height of first dorsal. Anal begins close behind vent, below hind half of first dorsal, rays less than eye. Pectoral nearly half of head. Ventrals close together, rather short, jugular. Vent below pectoral base. Brownish. Edges of opercles shining silvery. Axil of ventrals, and region before black. Dorsal and pectoral blackish. Anal with a black edge. Inside of mouth white, of gill cavity black. Length 482 mm. (Günther.)

Eastern Atlantic.

MACRUROPLUS Bleeker

Macruroplus BLEEKER, 1874, Verh. Kon. Akad. Wet. Amsterdam, VIII, p. 369. Type: *Macrourus serratus* Lowe. Monotypic.

Lionurus GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, pp. 124, 141. Type: *Coryphaenoides filicauda* Günther. (Designated by Jordan, 1920, Stanford Publications, 'Genera of Fishes,' IV, p. 437.)

Nezumia (Jordan) JORDAN AND STARKS, 1902 (1904), Bull. U. S. Fish Comm., XXII, p. 620. Type: *Nezumia condylura* (Jordan and Gilbert) Jordan and Starks. Monotypic.

Sphagemacrurus FOWLER, 1925 (March 31), Amer. Mus. Novit., No. 162, p. 3.
Type: *Macrurus hirundo* Collett. Orthotypic.

Body usually slender, tail not rapidly tapering. Head not very massive. Snout moderately produced, not greatly widened and high. Bones of head firm, sensory canals moderately developed and skull without high crests. Gill rakers less than 15 on lower limb of second arch. Branchiostegals 7. Scales small, everywhere well imbricated, their spinules usually directed backward. Dorsal spine trenchant on front edge and usually serrate. Vent remote from anal fin and preceded by a naked area.

A large genus, tropical or subtropical. The species are usually of small size, less than 400 mm.

KEY TO THE SPECIES

- a.—*MACRUROPLUS*. Snout tip distinctly in advance to front of mouth; anal origin behind that of first dorsal.
- b.—Second dorsal rays 97 to 100; vent entirely behind base of first dorsal.
- c.—Eye $3\frac{2}{5}$ in head; second dorsal spine a little longer than head; basal length of first dorsal a little less than interdorsal space. *sclerorhynchus*.
- cc.—Eye $2\frac{3}{5}$ in head; second dorsal spine $1\frac{2}{5}$ in head; basal length of first dorsal over 3 times in interdorsal space. *guentheri*.
- bb.—Second dorsal rays 140 to 180; vent opposite first dorsal origin.
- d.—Depth of body 7 times in its length; second dorsal rays 180; second dorsal spine with 34 to 37 serrae. *serratus*.
- dd.—Depth of body $7\frac{2}{3}$ times in its length; second dorsal rays 165; second dorsal spine with 14 to 20 serrae. *violaceus*.
- aa.—*SPHAGEMACRURUS*.¹ Snout very short, tip nearly opposite that of mouth; anal origin opposite that of first dorsal; ventral inserted below middle of opercle; vent before first dorsal origin. *hirundo*.

***Macruroplus sclerorhynchus* (Valenciennes)**

Macrourus sclerorhynchus VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' Poiss., II, part 2, p. 80. Lanzarote, Arrecife, Canary Islands.

Macrurus sclerorhynchus GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 394 (copied).—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 237, Pl. xxii, fig. 2, a-c (scale) (off Morocco, Canaries, Soudan, Banc d'Arguin, Cape Verde, Cape Verde Islands, Azores, 540 to 3655 m.).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 328 (Canaries).—COLLETT, 1896, Rés. Camp. Sci. Monaco, X, p. 78 (between Pico and Fayal, 800 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 397 (off Morocco, 2300 m.; west of Canaries, 1365 m.).

Macrurus sclerorhynchus ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 79 (south-east of Flores; 60 miles south-southeast of Cape St. Vincent; 55 miles north-northwest of Fayal; 1473 to 1900 m.).

Lepidoleprus sclerorhynchus VALENCIENNES, *op. cit.*, Pl. xiv, fig. 1.

Head $6\frac{2}{3}$; depth $6\frac{2}{3}$; dorsal 11-100; anal 100; pectoral 16; ventral 8; scales 110 to 115 in lateral line, 6 above, 21 to 23 below. Body compressed, long, tapering behind in a long slender pointed tail. Head equals its distance from first to twentieth anal ray. Snout short, triangular, tip obtuse and rounded. Eye about $2\frac{3}{5}$ in head, greater than snout or interorbital. Mouth inferior, upper jaw begins a little

¹Σφαγή throat; *Macrurus*; with reference to the advanced ventrals.

before vertical in eye. Row of villiform teeth in each jaw. Barbel a little less than eye. Nostrils close before eye, rather large. Suborbital ridge extends below eye. Preopercle angle rounded. Gill opening wide. Branchiostegals 6. Scales with 11 rows of apical denticles, 15 transversely in each row, circuli fine. First dorsal origin a little behind that of pectoral and ventral; second spine a little longer than head, with 15 serrae along its front edge. Second dorsal greatly lower than anal. Interdorsal space little greater than basal length of first dorsal. Anal inserted little behind first dorsal base, height longer than eye. Pectoral 1 1/2 in head; ventral 2 1/2. Vent opposite first dorsal origin. Uniform brown. Throat and gill membrane black. Fins pale, transparent. Length 198 mm. (Vinciguerra.)

Eastern Atlantic.

Macrurplus guentheri (Vaillant)

Macrurus guentheri VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 386 (on *Macrurus holotrachys* Vaillant).

Macrurus guntheri COLLETT, 1896, Rés. Camp. Sci. Monaco, X, p. 80, Pl. III, fig. 10 (north of Graciosa, Azores, 1850 m.).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 79 (west of São Miguel; between São Miguel and Terceira; 1482 to 1919 m.).

Macrurus sclerorhynchus (not Valenciennes) GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 133, Pl. xxxii, fig. A (90 miles southeast of Cape St. Vincent, in 1090 fathoms).

Macrurus holotrachys (not Günther) VAILLANT, *op. cit.*, p. 241, Pl. xxii, fig. 3 (scale) (off Morocco, in 2115 to 2200 m.).

Head compressed, width half its length. Snout 3 2/5 in head, conically projecting beyond mouth. Eye 3 2/5 in head. Mouth rather small, inferior, cleft not reaching opposite eye center. Teeth in villiform bands in jaws, outer series scarcely enlarged. Barbel short and slender, about 2/5 of eye. Interorbital flat, 4 2/5 in head. Canthus rostralis sharp and smooth, rough protuberance in front and one each side infraorbital ridge sharp, prominent its whole length. Scales with 9 rows of apical denticles, 3 or less to each row; circuli fine. Scales in 6 rows above lateral line, 15 below. First dorsal inserted little behind pectoral origin but before that of ventral; second spine 1 2/5 in head, armed in front with rather closely set barbs; rays 11. Interdorsal space equals head length, snout not included. Anal rays 95. Pectoral rays 17, length 2 in head. Ventral rays 7, length 2 2/5 in head, outer ray produced in filament. Brown. Length 280 mm. (Günther.)

Eastern Atlantic.

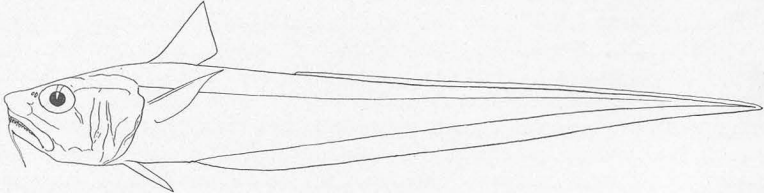
Macrurus zaniophorus Vaillant¹ is incompletely described as follow:

Head 5 1/2; depth 7; dorsal 11, 9-?; ventral 8; scales 133 ? in a lateral line, 7 above, 19 ? below. Body somewhat elongate. Snout short, 3 2/3 in head, with 3 spinescent prominences. Eye, nostrils, and interorbital as in *Macrurus sclerorhynchus*. Branchiostegals 6. Scales with about 24 apical rows of denticles, as many as 5 transverse in each; circuli fine. Second dorsal spine likely spinescent and very robust. Interdorsal varying from less than double to more than base of first dorsal. Sienna, with softened reflections produced by scales. Length 180 to 430 mm.

¹1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 245, Pl. xxii, fig. 4, a (scale). Coasts of Morocco, Soudan, and Banc d'Arguin, in 830 to 1350 m.—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 397 (west of Canaries, in 1365 m.).

Macruroplus serratus (Lowe)

Figure 225

Macrourus serratus LOWE, 1843, Proc. Zool. Soc. London, XI, p. 91. Madeira.*Macrurus serratus* ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 79 (50 miles off Mogador; 3 miles east of Lanzarote; 5 miles northeast of Maio; 7 miles southwest of Ile de Sal, Cape Verde Islands; 6 miles south of São Miguel; 30 miles east of Terceira; 3 miles north of Fayal; north of São Jorge; between Pico and São Jorge; 950 to 2165 m.).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 134 (N. lat. 37° to 38°, W. long. 23° to 25°, in 1230 to 1622 m.).*Coryphaenoides serratus* GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 396 (copied).*Coryphaenoides aequalis* GÜNTHER, 1878, Ann. Mag. Nat. Hist., London, II, p. 25. Off Portugal, in 600 fathoms.—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 225, Pl. XIX, fig. 2, *a-e* (off Morocco, Soudan, Banc d'Arguin, Cape Verde Islands, in 140 to 2200 m.).—COLLETT, 1896, Rés. Camp. Sci. Monaco, X, p. 75, Pl. II, fig. 9-*b* (north of São Jorge, Azores, in 861 m.).*Macrurus aequalis* MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 397, Fig. 270 (off Morocco, in 1215 to 2300 m.; off Cape Blanco, 2603 m.; west of Canaries, 1365 m.).*Macrurus smiliphorus* VAILLANT, 1888, *op. cit.*, p. 242, Pl. XXII, fig. 1, *a-d*. Gulf of Gascony, Morocco, Soudan, Cape Verde Islands, 460 to 1319 m.Fig. 225. *Macruroplus serratus*, modified from Vaillant.

Upper profile rises rather suddenly toward anterior dorsal spine. Snout conically projecting beyond mouth, with rather obtuse and rough upper edge. Mouth cleft extends nearly below eye center. Outer row of teeth slightly enlarged. Barbel slender, less than eye. Interorbital flat, less than eye, which well exceeds the snout length, or 1/3 or more of head. Scales equally rough over whole surface, spinelets subequal, densely packed, in 8 to 12 series with median series not more prominent than others; entire scale edge spinous; 8 scales above lateral line. First dorsal with 12 rays, second spine somewhat produced, armed along front edge with barbs pointing upward and rather closely set. Second dorsal begins distant from first space less than head length. Anal rays 90 to 118. Pectoral 17. Ventral 9, outer ray not or but slightly produced. Lower part of head and anteroportion of first dorsal black. Length 203 to 228 mm. (Günther.)

Eastern Atlantic, from the Faroe Islands to Cape Verde Islands and Soudan.

Macruroplus violaceus (Zugmayer)

Macrurus violaceus ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 9. N. lat. 36° 42', W. long. 8° 40', in 750 m.; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 123, Pl. VI, fig. 2, a-b (types).

Head 7 3/5; depth 7 2/3; dorsal II, 9-165; anal 150; pectoral 17; ventral 9; scales 140 in lateral line, 13 above, 25 below; snout 3 in head; eye 3. Snout with a sharp point; lower surface to lips equals eye diameter. Maxillary reaches front eye edge. Barbel less than snout. Lateral crest of head spinescent and scaly, extends below eye. Scales with fine circuli, 11 rows of apical denticles. Lateral line little convex at first, extends midway along tail. First dorsal begins little nearer eye than origin of second dorsal; second spine slightly longer than head and with 14 to 20 serrae along front edge directed upward. Second dorsal begins well behind anal origin, low. Interdorsal space 1 2/3 in head. Anal origin nearer base of last ray of first dorsal than origin of second dorsal, rays little longer than eye. Pectoral 1 3/5 in head, reaches anal. Ventral inserted little behind pectoral base, first ray elongated in a short filament. Clear violet, except bluish on thorax. Trunk and tail with numerous parallel deeper streaks. Base of first dorsal reddish. Iris pale blue, sclerotic deep blue. Side between base of mandible and pectoral base black. Length 270 mm. (Zugmayer.)

Eastern Atlantic, off Morocco.

Macruroplus hirundo (Collett)

Macrurus hirundo COLLETT, 1896, Rés. Camp. Sci. Monaco, X, p. 72, Pl. II, figs. 8-8b. Between Pico and São Jorge, Azores, in 1266 m.—RICHARD, 1910 (February), Bull. Inst. Océanogr. Monaco, No. 162, p. 149, Fig. 107 (Azores in 1266 m.).—ROULE, 1918, Rés. Camp. Sci. Monaco, LII, p. 80 (south of Pico, 1550 m.; southeast of Flores, 1360 m.; near Maio, 1300 m.; 55 miles northwest of Fayal, 1900 m.).

Head 8 2/5 to 8 1/2; depth 11; dorsal 12-?; pectoral 16; ventral 11. Body tapering in long slender band behind. Head short, obtuse. Snout very short, less than eye. Eye large, 2 3/4 in head, greater than interorbital. Mouth oblique. Mandible tip nearly opposite that of snout. Teeth very fine, uniform. Barbel a little over half of eye. Short suborbital ridge, with 3 obtuse median tubercles. Scales with 7 series of apical denticles, circuli fine. Dorsal with second ray spinous, 1 1/3 in head, serrated. Interdorsal space about half of head. Anal begins slightly before first dorsal origin, close behind vent, height 3 2/5 in head or 1 1/5 in eye. Pectoral 2 1/2 in head. Ventral inserted on throat, below middle of opercle. Vent very advanced, placed below pectoral or before first dorsal. Head and abdomen blackish. Fins transparent. Vent black. Length 208 mm. (Collett.)

Off Azores.

TRACHONURUS Günther

Trachonurus GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, pp. 124, 142. Type: *Macrurus villosus* Günther. Monotypic.

Snout obtuse. Mouth subinferior. Teeth in villiform bands in jaws. Suborbital ridge little developed. Scales not imbricated, separated by furrows, densely covered

with sharp spinules, apparently villous to touch. Dorsal much lower than anal, spine smooth.

Species few, tropical or subtropical.

Trachonurus asperrimus (Vaillant)

Figure 226

Coryphaenoides asperrimus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 229, Pl. XVIII, fig. 2, a-b. Coasts of Morocco and Azores, in 1257 to 1590 m.

Macrurus (Coryphaenoides) asperrimus MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 397 (west of Canaries, 1365 m.).

Trachonurus asperrimus ROULE, 1916 (May 20), Bull. Inst. Océanogr. Monaco, No. 320, p. 21 (off São Miguel, Azores, 1494 m.; east of Lanzarote, 1097 m.); 1918, Rés. Camp. Sci. Monaco, LII, p. 82, Pl. III, figs. 2-2a (above examples).

Chalinura mediterranea ROULE, 1918, *op. cit.*, p. 87 (southeast of Flores, 1846 m.; off Terceira, 1940 m.).

Head 6; depth 8; dorsal II, 8-?; ventral 7; scales 184 ? in lateral line, 8 above, 23 below. Body very elongate, tapering behind. Head short, robust. Snout 3 1/2

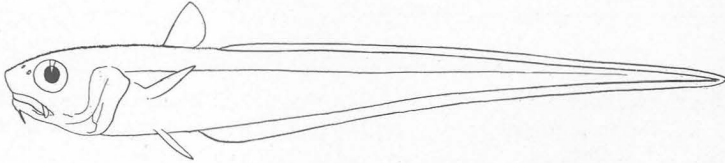


Fig. 226. *Trachonurus asperrimus*, from Vaillant.

in head, obtuse, but slightly produced before mouth. Eye 4 in head. Maxillary reaches front pupil edge. Band of villiform teeth in jaws, with strong outer series. Barbel half of eye. Nostrils together, close before eye, hind one lower and a little larger. Interorbital 3 1/2 in head. Gill opening wide. Branchiostegals 7. Scales with 5 or 6 large denticles, sometimes 2 or 3 more medianly. Scales on head like those on trunk, snout especially roughened; on trunk small, all spinose, very adherent. Lateral line a little high at first, midway along side of tail. Second dorsal spine 2 1/2 in head, smooth. Second dorsal fin begins behind anal origin, about half of height of anal. Interdorsal space slightly greater than base of first dorsal. Anal height eye diameter. Pectoral about reaches anal, 2 1/2 in head. Ventral inserted behind pectoral base, though before origin of first dorsal, 3 in head length. Vent behind first dorsal base. Mouse-gray, more blackish in young, especially on abdomen and head. Length 301 mm. (Vaillant.)

Eastern Atlantic.

CETONURUS Günther

Cetonurus GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, pp. 124, 143. Type: *Coryphaenoides crassiceps* Günther. Monotypic.

Body very robust, thickened, tail rapidly constricted from trunk. Head massive. Bones of head soft, sensory canals greatly developed, skull with high crests. Snout wide and high. Premaxillary teeth in a band; mandibular teeth vary from an irregular series to a band. Barbel very short. Preopercle adnate to interopercle. Gill cavity restricted. Branchiostegals 7. Pyloric coeca moderate. Spinules of scales erect. Lateral line of wide-spaced pores, without a superficial groove; an accessory dorsal branch of lateral line pores. Scales enlarged and modified all along base of dorsal. Dorsal spine serrated. Vent remote from anal fin.

Species few, tropical or subtropical.

Cetonurus globiceps (Filhol)

Figure 227

Macrurus globiceps (Vaillant) FILHOL, 1884, *La Nature*, No. 559, p. 185, Fig. 2.

Hymenocephalus globiceps VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 386 (on *Hymenopcephalus crassiceps* Vaillant); 1919, Rés. Camp. Sci. Monaco, LII, p. 134 (N. lat. 36° 55', W. long. 22° 22' 45'', in 4261 m.).

Macrurus (Cetonurus) globiceps MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 397 (west of Canaries, in 1365 m.).

Hymenocephalus crassiceps (not Günther) VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 214, Pl. xx, fig. 1, a-e (Gulf of Gascony in 1600 m.; Soudan, in 139 to 1435 m.; off Azores, in 2995 m.).

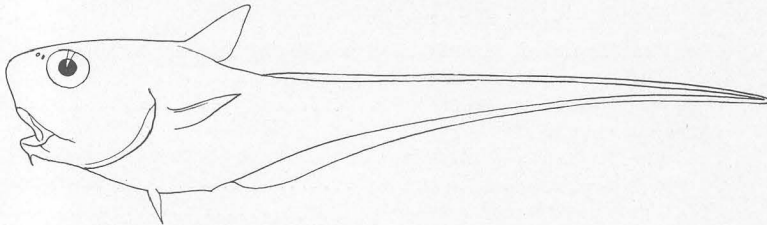


Fig. 227. *Cetonurus globiceps*, modified from Vaillant.

Head 5; depth 5 1/2; dorsal II, 9—?; anal 103?; ventral 10; scales 200 in lateral series, 51 transversely. Body with a short, thick trunk, tapering in a long slender tail. Head spherical. Snout convex, obtuse. Eye 4 in head. Mouth inferior, oblique, low, moderately cleft, tip of upper jaw about opposite middle in snout length. Jaws with bands of fine villiform teeth; none on palate. Barbel 1/3 to 1/4 of eye. Nostrils together, close before eye, small, posterior larger. Interorbital 2 1/2 in head. Gill opening wide. Scales with 8 or 9 rows of denticles, sometimes 2 or 3 medianly. Scales very rough, small, entirely cover head. First dorsal inserted behind pectoral origin, second spine 2 1/5 in head and front edge serrate. Second dorsal lower, begins a little behind anal. Interdorsal a little greater than base of first dorsal. Height of anal but slightly less than eye. Pectoral reaches a little beyond front of anal, 2 1/4 in head. Ventral inserted a little before pectoral, 3 3/4 in head. Vent close behind base of first dorsal. Mouse-gray or rose-gray. Inside of mouth, gill opening, and peritoneum black. Length 350 mm. (Vaillant.)

Eastern Atlantic.

Cetonurus microps is reported¹ from near Teneriffe. Though the species has been credited to Vaillant, I have not located the original description.

Gadidae

Cod Fishes

Body more or less elongate, caudal region moderate, coniform behind. Mouth large, terminal. Chin with more or less developed barbel. Preopercle edge usually covered by skin of head. Suborbitals moderate. Gill openings very wide. Gill membranes separated or somewhat united, commonly free from isthmus. Gills 4, a slit behind the fourth. No pseudobranchiae. Air vessel usually well developed. Pyloric appendages numerous, sometimes few or none. Scales small, cycloid. No spines, fin rays all articulated. Dorsal extends almost length of back, forms 1, 2, or 3 fins. Anal long, single or divided. Caudal distinct or confluent with dorsal and anal. Ventrals jugular, joined to pubic bone, with 1 to 8 branched rays.

Fishes chiefly of northern seas, some living in the oceanic abysses. Many are important food fishes.

KEY TO THE GENERA

- a.—GADINAE. Dorsals 3, anals 2; lower jaw shorter than upper.
 - b.—Vomer toothed; barbel present or absent. TRISOPTERUS.
 - bb.—Vomer toothless; no barbel. GADICULUS.
- aa.—Dorsals 2, anals 1.
 - c.—PHYCINAE. Ventrals narrow, filamentous, with 2 or 3 rays.
 - d.—First dorsal with 5 rays. LAEMONEMA.
 - dd.—First dorsal with 8 to 10 rays. PHYCIS.
 - cc.—Ventrals broad, with 5 to 8 rays.
 - e.—LOTINAE. Anal entire; mouth terminal.
 - f.—Vomer and mandibles with enlarged teeth; palatines toothless; chin with barbel. MOLVA.
 - ff.—Vomer and palatines toothless.
 - g.—Teeth in jaws in villiform bands, equal; barbel present. PHYSICULUS.
 - gg.—Outer series of strong curved teeth in each jaw; no barbel. GADELLA.
 - ee.—MORINAE. Anal deeply notched, in 2 parts; mouth inferior or subinferior.
 - h.—Anal in 2 parts; teeth cardiform, in band above. MORA.
 - hh.—Anal more or less deeply notched.
 - i.—Snout obtuse; teeth on vomer; barbel present. HALOPORPHYRUS.

¹Richard, 1905 (June 21), Bull. Inst. Océanogr. Monaco, No. 41, p. 3. (N. lat. 28° 4', W. long. 16° 49' 30", in 1530 to 1340 m.).

ii.—Snout obtusely conic; no teeth on vomer; no barbel... HALARGYREUS.

aaa.—GAIDROPSARINÆ. First dorsal of a single ray and band of fringes; second dorsal and anal distinct; teeth in band in jaws and on vomer; several barbels on muzzle. GAIDROPSARUS.

aaaa.—BROSMINÆ. Dorsal and anal fin each single and distinct from caudal; teeth biserial in jaws, none on palate; no barbel. BROSMICULUS.

TRISOPTERUS Rafinesque

Trisopterus RAFINESQUE, 1814, 'Préc. découv. somiologiques,' p. 16. Type: *Gadus capelanus* Lacépède = *Gadus minutus* Linné. Monotypic.

Merlangus (not Rafinesque, 1810) OKEN, 1817, Isis, p. 1182. Type: *Gadus merlangus* Linné. Tautotypic. (On *Les Merlans* Cuvier, 1817, 'Régne Animal,' II, p. 213.)

Morua RISSO, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 225. Type: *Gadus capelanus* Lacépède. Monotypic.

Brachygadus GILL, 1863, Proc. Acad. Nat. Sci. Philadelphia, p. 280. Type: *Gadus minutus* Linné. Monotypic.

Gadulus MALM, 1877, 'Göteborgs Bohusaläns fauna,' Göteborgs, p. 482. Type: *Gadus luscus* Linné.

Body moderately long, compressed, tapering behind. Head moderate. Snout moderate. Eye large. Mouth moderate, jaws subequal. Teeth cardiform in jaws, outer row enlarged. Vomer toothed. Palatines naked. Chin with or without barbel. Scales very small. Lateral line present, pale. Dorsals 3, well separated; base of first 1/3 or more of first anal base. Second dorsal base 2/3 or more of first anal base. Length of first anal base more than half of space between snout tip and anal origin. Caudal truncate or slightly emarginate.

Fishes of moderate or small size, mostly from the Atlantic shores of Europe. They differ from *Gadus* chiefly in the larger second dorsal and first anal. Valued as food.

Trisopterus luscus (Linné)

Figure 228

Gadus luscus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 252. European ocean.—PIETSCHMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 101 (Atlantic coast of Morocco).

Head $3\frac{1}{2}$ to $3\frac{2}{3}$; depth $3\frac{1}{4}$ to $4\frac{1}{3}$; dorsal 11 or 12—20 or 21—17 or 18; anal 26 or 27—18 or 19; scales 86 close along and above lateral line to caudal base; 10 scales above lateral line to second dorsal origin, 23 below; about 55 predorsal scales; snout $3\frac{1}{2}$ in head; eye $2\frac{4}{5}$ to $3\frac{1}{2}$; maxillary $1\frac{7}{8}$ to 2; interorbital $5\frac{1}{5}$ to $5\frac{2}{5}$.

Body well compressed, elongate, ovate, deepest at first dorsal origin, trunk and tail narrowing rather slenderly back. Caudal peduncle well compressed, least depth $4\frac{1}{2}$ to $5\frac{1}{2}$ in head. Head width 2 to $2\frac{1}{5}$ in its length. Snout conic, length $\frac{4}{5}$ to $\frac{7}{8}$ its width. Eye large, center at first $\frac{2}{5}$ in head; equals snout, a little longer in young; greater than interorbital. Mouth large, lower jaw slightly shorter. Maxillary reaches eye center, expansion $2\frac{1}{2}$ to 3 in eye. Teeth in jaws with an inner

villiform band and an outer enlarged series, which is a little larger above; vomer with a band of small teeth; palatines naked, sometimes with a slight patch of teeth anteriorly; tongue edentulous. Barbel equals eye, or is slightly longer. Front nostril at last fourth in snout; hind nostril midway between front nostril and eye. Interorbital convex.

Gill rakers 2+13, lanceolate, $1\frac{1}{2}$ in gill filaments, which $2\frac{1}{4}$ in eye. Scales with 114 to 128 radiating striae; circuli fine. Scales thin, smooth, rather well adherent; head and fins basally with small scales. Lateral line a little arched at first, falls median on side opposite origin of third dorsal; tubes slender, simple, well exposed. Height of first dorsal $1\frac{1}{2}$ to $1\frac{3}{4}$ in total head length; height of second dorsal $2\frac{1}{5}$ to $2\frac{1}{2}$; height of third dorsal $2\frac{1}{5}$ to $2\frac{2}{5}$; height of first anal $2\frac{1}{8}$ to $2\frac{1}{3}$; height of second anal $2\frac{1}{4}$ to $2\frac{2}{3}$; caudal truncate, $2\frac{1}{5}$ to $2\frac{1}{4}$; pectoral $1\frac{1}{2}$ to $1\frac{4}{5}$; ventral $1\frac{1}{2}$ to $1\frac{2}{3}$.

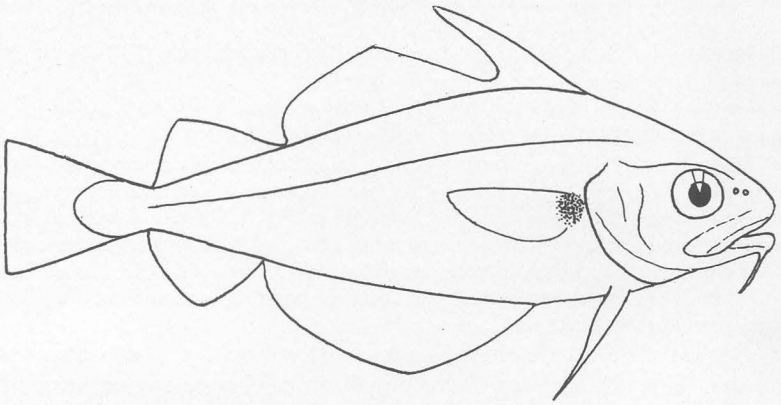


Fig. 228. *Trisopterus luscus*, from Day.

Back and upper surface pale brown, sides and below silvery white. Fins all pale brown. Dark spot at pectoral base. Ventrals and anal whitish. Caudal edged dusky behind. Length 96 to 218 mm.

Eastern Atlantic from Scandinavia to Morocco and the Mediterranean. Described above from a series from Italy. Reaches 433 mm., average 305 mm.

GADICULUS Guichenot

Gadiculus GUICHENOT, 1850, 'Explor. Algérie,' Poiss., p. 101. Type: *Gadiculus argenteus* Guichenot. Monotypic.

Body moderate, elongate. Snout short. Eye large. Mouth cleft oblique, lower jaw slightly protruding. Jaws with narrow band of small teeth. Vomer with very small teeth or none. Palatines toothless. No barbel. Branchiostegals 7. Scales moderate. Three dorsals and 2 anals. Caudal separated. Ventral of several rays.

Gadiculus argenteus Guichenot

Gadiculus argenteus GUICHENOT, 1850, 'Explor. Algérie,' Poiss., p. 102, Pl. VI, fig. 2. Algiers.—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 399 (off Morocco, 535 m.).

Merlangus argenteus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 302, Pl. XXV, fig. 7, Pl. XXVI, fig. 5 (tail) (off Morocco and Soudan in 410 m.).

Head 4; depth $7\frac{4}{5}$; dorsal 9–14 to 16; anal 15 to 18; scales 58 in lateral line, 9 above, 11 below; snout $4\frac{1}{8}$ in head measured from upper jaw tip; eye $4\frac{1}{8}$; maxillary $2\frac{1}{4}$.

Body long, slender, compressed, vent midway in its length. Caudal peduncle small, slender, least depth about $\frac{1}{4}$ its length or $2\frac{1}{4}$ in eye. Head equally as deep as body. Snout obtuse. Eye center about first third in head measured from upper jaw tip. Mouth large, oblique, mandible protruding. Maxillary reaches opposite middle of eye. Teeth in villiform bands in jaws; sometimes a small patch on vomer; palate and tongue otherwise smooth. No barbel. Nostrils together, close before eye, posterior larger. Interorbital scarcely elevated. Lateral line indicated by row of spaced black dots, parallel to line of back for upper fourth of body anteriorly. First dorsal inserted behind pectoral base; second dorsal begins opposite end of depressed pectoral; caudal rounded behind, small, long as eye; pectoral $2\frac{3}{4}$ in head; ventral very short.

Uniformly rosy, except jaws and belly, which silvery. Fins transparent grayish. Length 113 mm. (Vaillant.)

Mediterranean and adjacent Atlantic.

LAEMONEMA Günther

Laemonema GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 356. Type: *Phycis yarrellii* Lowe. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 3, p. 318.)

Body moderately long. Teeth villiform and in bands in jaws. Small patch of vomerine teeth. No palatine teeth. Chin with barbel. Branchiostegals 7. Scales small. Fins naked. Dorsals 2, first of 5 rays. One anal. Caudal separate from paired fins. Ventrals reduced to single long ray, bifid at end.

Bathypelagic.

KEY TO THE SPECIES

- a.*—Scales larger, 8 above lateral line; ventral fins not reaching vent. *yarrellii*.
aa.—Scales smaller, 13 above lateral line; ventral fins reaching eleventh anal ray.

robustum.

Laemonema yarrellii (Lowe)

Abrotea do alto (Madeira)

Figure 229

Phycis yarrellii LOWE, 1837 (1841), Trans. Zool. Soc. London, II, p. 190. Madeira; 1843, 'Fishes of Madeira,' p. 43, Pl. VII (Madeira).

Laemonema yarrellii GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 356 (type).

Head 5; depth 5; dorsal 5-60; anal 59; scales 110 in lateral line, 8 above to front dorsal fin; eye $3\frac{2}{3}$ in head.

Body much compressed, deepest above vent, tail tapering into a narrow band. Head rather depressed, not much deeper than wide. Snout obtuse, rounded, as long as eye. Mouth cleft partly horizontal, lower jaw included. Maxillary not reaching below hind eye edge. Teeth in narrow villiform bands in jaws, of equal size; only 3 or 4 teeth in middle at front edge of vomer. Barbel very slender, half as long as eye. Nostrils immediately before eye. Bony interorbital $\frac{2}{3}$ vertical diameter of eye. Opercle ends in small, acute, pungent spine. Nape slightly elevated. Head nearly entirely covered with very small scales, only lips and foremost part of snout naked; fins naked, not enveloped in loose membranes. First dorsal begins before pectoral base, very narrow, high, first ray as long as head. Second dorsal begins behind pectoral base, rays slightly longer posteriorly. Anal begins immediately behind

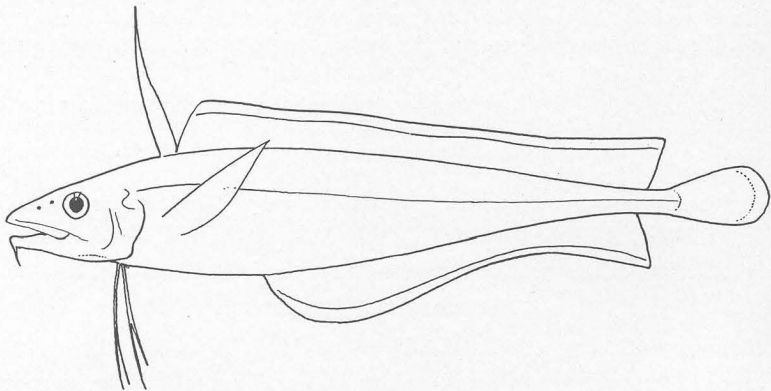


Fig. 229. *Laemonema yarrellii*, modified from Lowe.

second dorsal, lower than dorsal. Caudal very narrow, pointed, entirely free from dorsal and anal. Pectoral rather longer than ventral, equals space before front eye edge and end of opercle. Vent below sixth ray of second dorsal.

Immaculate brown, fins black. Length 190 mm. (Günther.)

Madeira.

***Laemonema robustum* Günther**

Laemonema robustum GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 357. Madeira.—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 286 (off Morocco and Cape Verde Islands, 460 to 760 m.).

Head $3\frac{3}{4}$; depth little less than length of head; dorsal 5-53; anal 47; scales 130 in lateral line, 13 above to front dorsal fin; eye little over 5 in head.

Body much compressed, deepest below second dorsal origin, tail tapering back into a narrow band. Head rather depressed, higher than broad. Snout depressed, obtuse, rounded, with upper jaw overlapping lower, lower than orbit. Mouth cleft

partly horizontal. Maxillary extends below hind edge of orbit. Teeth in villiform bands; small rounded patch on vomer. Barbel very slender, shorter than eye. Interorbital equals vertical eye diameter. Nape elevated. Opercle covered with skin, ending in obtuse point. Head, except snout, covered with small scales. First dorsal begins over pectoral base, narrow, high; first ray as long as head without snout. Second dorsal begins behind pectoral, rays slightly increase in length posteriorly. Anal lower than dorsal, ends some distance before end of dorsal. Caudal very narrow, rather elongate. Pectoral fin $4/5$ of head. Ventral extends opposite eleventh anal ray. Vent opposite fifth ray of second dorsal.

Brown, immaculate. Fins black. Length 356 mm. (Günther.)

Madeira.

PHYCIS Röse

Codlings

Phycis RÖSE, 1793, 'Pet. Arted. syn. nom. pisc.,' 2d Ed., p. 111. Type: *Gadus phycis* Linné. Tautotypic.

Urophycis GILL, 1863, Proc. Acad. Nat. Sci. Philadelphia, p. 240. Type: *Blennius regius* Walbaum. Monotypic.

Emphycus JORDAN AND EVERMANN, 1898, Bull. U. S. Nat. Mus., XLVII (3), p. 2552. Type: *Gadus tenuis* Mitchill. Monotypic.

Body rather elongate. Head subconic. Mouth rather large. Lower jaw included within upper. Jaws and vomer with broad bands of subequal pointed teeth. Palatines toothless. Chin with a small barbel. Gill membranes somewhat connected, narrowly joined to isthmus. Dorsals 2, first sometimes produced at tip, second fin long and slender to anal. Ventrals wide apart, filamentous, each of 3 slender rays, closely joined, appearing as one bifid filament.

KEY TO THE SPECIES

a.—Scales 6 or 7 above lateral line; ventral reaches far beyond anal origin

blennioides.

aa.—Scales 14 above lateral line; ventral reaches anal origin. *phycis*.

Phycis blennioides (Brünnich)

Gadus blennioides BRÜNNICH, 1768, 'Ichth. Massil.,' p. 24. Marseilles.

Phycis blennioides GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 351 (Madeira). —MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 400 (off Morocco, 535 m.).

Head $3\frac{4}{5}$ to 4; depth $4\frac{3}{4}$ to $4\frac{4}{5}$; dorsal 9 or 10—58 to 61; anal 53 to 56; scales 68 to 78 in lateral line; tubes about 45 to 50 in lateral line; scales 6 or 7 above lateral line, 14 to 16 below; predorsal scales 38 to 40; snout $3\frac{1}{2}$ to $3\frac{3}{4}$ in head; eye $3\frac{7}{8}$; maxillary 2 to $3\frac{1}{4}$; interorbital $6\frac{1}{2}$ to 7.

Body elongate, compressed, deepest at about the origin of second dorsal fin, tail tapering moderately behind. Caudal peduncle strongly compressed, least depth 6 to $6\frac{1}{3}$ in head. Head width 2 to 3 in its length. Snout conic, width $3/4$ to $4/5$ its length. Eye large, hind edge midway in head length, hind pupil edge about midway in young; diameter of eye equals snout length, greater than snout in young; interorbital $1\frac{4}{5}$ to $2\frac{2}{5}$ in eye. Mouth inferior, lower jaw shorter. Maxillary falls slightly short of hind eye edge, about $3/4$ in eye in young; expansion $2\frac{1}{2}$ to $2\frac{3}{4}$ in eye. Teeth in villiform bands in jaws and on vomer, none on palatines or tongue;

teeth above in about 8 irregular series, with several of the outer series a little larger; lower teeth in 4 or 5 irregular series, size mostly uniform. Mandibular barbel $1\frac{1}{5}$ to $1\frac{1}{4}$ in eye, slender. Front nostril about last $\frac{2}{5}$ in snout; hind nostril simple pore, midway between front one and eye. Interorbital level.

Gill rakers 3+8, lanceolate, equal gill filaments or 3 in eye. Scales with 24 to 28 parallel circuli each side of median vertical axis. Scales thin, loosely attached; cover head, small and crowded out over vertical fins basally. Lateral line arches high over pectoral and falls midway along side of tail; tubes slender, simple, but moderately exposed and well spaced. Height of first dorsal $2\frac{1}{3}$ to $2\frac{7}{8}$ in head; height of second dorsal $2\frac{1}{3}$ to $3\frac{1}{3}$; height of anal $3\frac{1}{4}$ to 4; caudal ends in median point behind, $1\frac{3}{4}$ to $1\frac{7}{8}$; pectoral $1\frac{1}{2}$ to $1\frac{3}{5}$; ventral $3\frac{1}{8}$ to $2\frac{1}{2}$ in combined head and trunk.

Brown, sides below and under surface whitish. Vertical fins edged blackish, especially conspicuous on edge of spinous dorsal. Pectoral pale brown. Ventral white. Iris silvery white. Length 125 to 292 mm.

Eastern north Atlantic and Mediterranean. Described above from a series of Italian examples. Reaches 750 mm.

Phycis phycis (Linné)

Abriote, Brota (Canaries), N'bonoh (Senegambia), Abrotea (Madeira)

Figure 230

Gadus phycis LINNÉ, 1766, 'Syst. Nat.', 12th Ed., p. 442. Mediterranean Sea.

Phycis furcatus BOWDICH, 1825, 'Excurs. Madeira,' p. 122, Fig. 28. Madeira.—LOWE, 1852, Ann. Mag. Nat. Hist., London, (2) X, p. 53 (Madeira).

Phycis mediterraneus LOWE, 1837 (1841), Trans. Zool. Soc. London, II, p. 189 (Madeira); 1843, 'Fishes of Madeira,' p. 44 (Madeira).—GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 354 (Madeira).—STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1), p. 709 (Santa Cruz, Teneriffe).—ROCHEBRUNE, 1883–1885, 'Faune Sénégalie,' Poiss., p. 114 (Cape Blanco, Portendik, Guet N'Dar, Argain).—VINCIGUERRA, 1890, Lo Spallanzani, Roma, (2) XIX, p. 482 (Las Palmas, Grand Canary); 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 327 (Grand Canary).

Urophycis mediterraneus JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 347 (Canary Islands).

Phycis limbatus VALENCIENNES, 1836–1844, 'Hist. Nat. Canaries,' II, part 2, p. 78, Pl. xiv, fig. 2 (Lanzarote, Grand Canary, Teneriffe).—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 403 (Santa Cruz, Teneriffe).

Head $3\frac{7}{8}$ to 4; depth $4\frac{1}{2}$ to $4\frac{3}{5}$; dorsal 9 or 10–64 to 65; anal 58; scales 98 in lateral line to caudal base; 14 scales above lateral line, 28 below; 55 predorsal scales; snout $3\frac{3}{4}$ to 4 in head; eye 4 to $4\frac{1}{5}$; maxillary 2 to $2\frac{1}{5}$; interorbital $4\frac{3}{4}$ to 5.

Body compressed, deepest at second dorsal origin. Caudal peduncle well compressed, lest depth $4\frac{2}{5}$ to 5 in head. Head width 2 in its length. Snout conic, length $\frac{2}{3}$ to $\frac{3}{4}$ its width. Eye large, high, hind edge slightly before middle in head length, about midway in head length in younger; diameter 1 to $1\frac{1}{5}$ in snout; interorbital $\frac{7}{8}$ to 1 in eye. Mouth large, lower jaw shorter. Maxillary reaches opposite hind pupil edge, expansion $1\frac{4}{5}$ to 2 in eye. Teeth in villiform bands in jaws and on vomer; palatines and tongue smooth. Mandibular barbel slender, a little longer than

snout. Front nostril at last third in snout; hind nostril a little nearer front nostril than eye. Interorbital broadly convex.

Gill rakers 3+9 or 10, lanceolate, $1\frac{3}{4}$ in gill filaments, which $1\frac{3}{4}$ in eye. Scales with 22 to 29+27 to 32 vertical parallel circuli. Scales rather weak, adherent, small on head and over vertical fins basally. Lateral line a little high at first, slopes until midway in body depth about midway in length of tail, then straight to caudal base. Height of first dorsal $2\frac{1}{4}$ to $2\frac{2}{5}$ in head; height of second dorsal $1\frac{7}{8}$ to $2\frac{4}{5}$; height of anal $2\frac{1}{4}$ to $2\frac{4}{5}$; caudal little convex behind, $2\frac{1}{4}$; pectoral $1\frac{2}{3}$ to $1\frac{7}{8}$; ventral $3\frac{1}{2}$ to $3\frac{7}{8}$ in combined head and body.

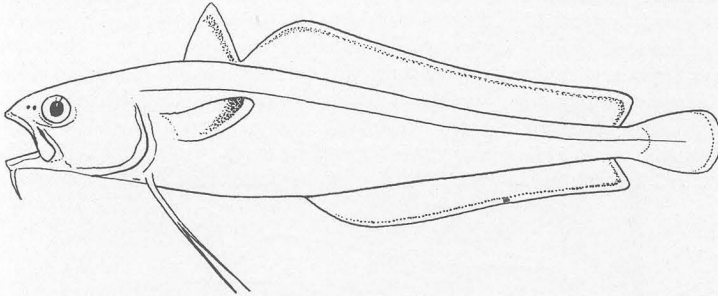


Fig. 230. *Phycis phycis*, from Valenciennes.

Brown, but little paler on under surface of head and belly. Vertical fins with a narrow white edge, submarginally with a dusky line. Pectoral and ventral brown. Length 160 to 260 mm.

Eastern Atlantic and Mediterranean. Described above from Italian examples. Reaches 610 mm.

MOLVA Fleming

Lings

Molva FLEMING, 1828, 'Hist. Brit. Animals,' p. 197. Type: *Gadus molva* Linné. Tautotypic.

Molva SMITT, 1893, 'Hist. Scand. Fishes,' I, p. 520. Type: *Gadus molva* Linné. (Emendation for *Molva* Fleming.)

Body elongate. Lower jaw included within upper. Bands of teeth in jaws, lower with large arrow-shaped movable canines. Vomer with curved series of canines mixed with small teeth, these being mostly fixed. Palatines toothless. Chin with barbel. Gill membranes broadly united. Scales very small. Dorsals 2, both well developed. One anal. Ventrals with several rays.

Fishes of northern seas, ranging into deep water.

Molva elongata (Otto)

Figure 231

Gadus elongatus OTTO, 1821, 'Conspectus animal. marit.,' (Inaug. Dissert.), Vra-tislaviae, p. 6. Nice.

Molva elongata MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 400, Fig. 278 (off Morocco, 535 m.).

Head $5 \frac{1}{5}$ to $5 \frac{2}{5}$; depth $12 \frac{3}{5}$ to $13 \frac{1}{2}$; dorsal 10 or 11—81; anal 79 or 80; scales about 28 counted along lateral line to caudal base; 18 scales above lateral line, about 30 below; snout $3 \frac{1}{4}$ to $3 \frac{1}{2}$ in head measured from upper jaw tip; eye $4 \frac{1}{4}$ to $4 \frac{2}{5}$; maxillary $2 \frac{1}{4}$ to $2 \frac{1}{2}$; interorbital 12 to 13.

Body very long, slender, slightly compressed, least depth 8 to $8 \frac{1}{5}$ in total head length. Head width $2 \frac{3}{5}$ to $3 \frac{1}{8}$ in total head length. Snout rather conic, width $1 \frac{2}{3}$ to $1 \frac{3}{4}$ in its length. Eye large, hind pupil edge midway in head length; diameter $1 \frac{1}{3}$ to $1 \frac{3}{5}$ in snout; interorbital $2 \frac{1}{2}$ to 3 in eye. Mouth large, lower jaw protruding. Maxillary reaches about opposite first third in eye. Teeth above in 5 or 6 irregular series forming villiform band; lower teeth with an outer row of short, small ones and an inner row of enlarged conic fixed ones, most of the posterior grouped in pairs; vomer with outer row of short crowded teeth and inner group of enlarged conic ones as on mandible; palate and tongue toothless. Nostril in a short tube, slightly behind last third in head. Interorbital narrow, level.

Gill rakers as 1+9 low asperous tubercles, much shorter than gill filaments; latter $2 \frac{1}{2}$ in eye. Scales with 15 to 31 circuli. Scales thin, loosely adherent; head

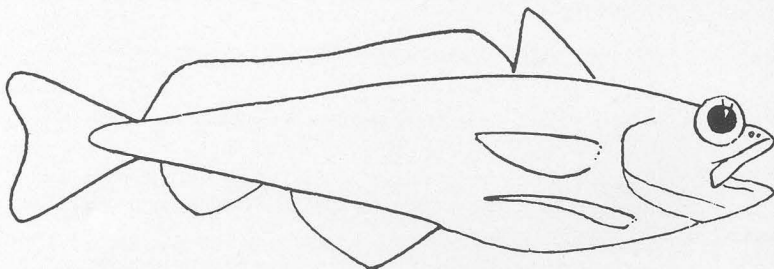


Fig. 231. *Molva elongata*, modified from Murray and Hjort.

largely naked, except occiput and top of cranium posteriorly, where the scales are very small. Lateral line complete, median along side. First dorsal begins a little before end of depressed pectoral, second ray $2 \frac{1}{2}$ to 3 in head; eleventh ray of second dorsal 4; fifth anal ray $4 \frac{1}{5}$ to $4 \frac{4}{5}$; caudal rounded convexly behind, $2 \frac{3}{4}$ to 3; pectoral 2 to $2 \frac{1}{8}$; ventral $1 \frac{1}{3}$ to $1 \frac{2}{5}$.

Olivaceous on back, sides and below pale or whitish, with a silvery white sheen. Dorsals pale, deep dusky brownish marginally and on caudal. Length 603 to 825 mm.

Northeast Atlantic and Mediterranean. Described above from two Mediterranean examples.

PHYSICULUS Kaup

Physiculus KAUP, 1858, Archiv Naturg., XXIV, part 1, p. 88. Type: *Physiculus dalwigkii* Kaup. Monotypic.

Pseudophysicis GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 350. Type: *Lota breviscula* Richardson. Monotypic.

Leptophysicis GARMAN, 1899, Mem. Mus. Comp. Zool., XXIV, p. 182. Type: *Leptophysicis filifer* Garman. Monotypic.

Body elongate. Snout broad, obtusely rounded, projects beyond mouth. Eye large. Mouth moderate. Jaws with bands of villiform teeth. Vomer and palatines toothless. Chin usually with barbel. Branchiostegals 7. Body covered with small scales and head entirely scaly. Dorsals 2. Anal single, not notched. Caudal rounded, slender, free. Ventral rays 5 and 2 outer filamentous rays. Vent well advanced.

***Physiculus dalwigkii* Kaup**

Figure 232

Physiculus dalwigkii KAUP, 1858, *Archiv Naturg.*, XXIV, part 1, p. 88. Madeira.

Physiculus dalwigkii GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.', IV, p. 348 (Madeira); 1868, *Proc. Zool. Soc. London*, p. 226 (St. Helena).—MELLISS, 1875, 'St. Helena,' p. 109, Pl. XXI, fig. 4.—GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 88 (Madeira).—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 290, Pl. XXV, fig. 3-c (Madeira and off Soudan, in 640 to 782 m.).

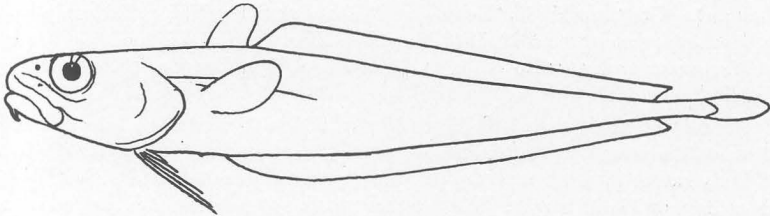


Fig. 232. *Physiculus dalwigkii*, from Vaillant.

Head 4; depth $5\frac{1}{3}$; dorsal 7-67; anal 69; ventral 5; 11 scales above lateral line.

Body rather low, tail tapering into a very narrow band. Head rather broad and depressed, as deep as wide. Snout rather broad, obtusely rounded, equals eye. Eye 4 times in head. Mouth cleft rather oblique, moderately wide, lower jaw a little shorter than upper. Maxillary reaches a little beyond eye center. Jaws with bands of villiform equal teeth. Chin with a small barbel half as long as eye. Interorbital flat, width a little less than vertical eye diameter. Nape broad, scarcely elevated, with a spine on each side pointing outward and covered by skin. Opercle ends in a short horizontal spine. Gill opening wide. Scales cover head, except the thin naked lips. First dorsal fin begins above pectoral base, nearly twice as high as long, longest ray 2 in head. Second dorsal begins immediately behind first dorsal, uniformly high, a little lower than first. Anal begins a little behind vent, lower than second dorsal. Caudal slender, rounded, not half the length of head. Pectoral $\frac{2}{3}$ of head. Ventral very narrow, slender outer ray produced filament not reaching anal. Vent below pectoral base.

Uniform brownish. Inside of mouth white. Pectoral and anal whitish. Axil, chin, and belly blackish. Length 216 mm. (Günther.)

Eastern Atlantic.

GADELLA Lowe

Gadella LOWE, 1843, Proc. Zool. Soc. London, XI, p. 91. Type: *Gadus gracilis* Lowe. Monotypic.

Uraleptus COSTA, 1858, Archiv Naturg., p. 87. Type: *Gadus maraldi* Risso. Monotypic.

Body elongate, compressed, tapers behind. Snout obtusely rounded. Eye small. Mouth large. Upper and lower jaw with outer series of strong curved teeth. No vomerine or palatine teeth. No barbel. Opercle with a small spine. Gill membranes united rather narrowly. Gills 4, slit behind fourth. Pseudobranchiae glandular. Branchiostegals 7. Two dorsals and one anal. Caudal distinct and separate. Ventral narrow, with flat base, of 6 rays.

Gadella maraldi (Risso)

Gadus maraldi RISSO, 1810, 'Ichth. Nice,' p. 123, Pl. VII, fig. 13. Nice.

Uraleptus maraldi GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 349 (Madeira; type of *Gadella gracilis* Lowe).—JOHNSON, 1863, Ann. Mag. Nat. Hist., X, p. 164 (Madeira).—GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 87 (compiled).

Merlucius ambiguus LOWE, 1840, Proc. Zool. Soc. London, VIII, p. 37. Madeira.

Merluccius ambiguus LOWE, 1839, Trans. Zool. Soc. London, III, (1849), p. 15 (Madeira).

Head 4; depth 6; dorsal 10-55 to 58; anal 56 to 62; ventral 6; lateral line with 120 scales, 8 above; eye 4 1/2 in head.

Body rather low, tail tapering into a very narrow band. Head rather thick, as wide as deep or 2 in its length. Snout rather broad, obtusely rounded, scarcely longer than eye. Mouth cleft oblique, wide, lower jaw received in upper. Maxillary reaches below hind eye edge. Teeth in a series rather large, curved, wide-set, also inner series of small teeth above. Interorbital a little wider than eye. Nape broad, scarcely elevated, with a spine on each side pointing outward and covered by skin. Opercle small, with a slender horizontal spine posteriorly. Gill opening wide. Head scaly, except naked chin and thin lips. First dorsal begins behind pectoral base, somewhat higher than long, not higher than second. Second dorsal begins immediately behind first, rays longer posteriorly where half length of head. Anal begins a little behind vent, like second dorsal. Caudal slender, slightly rounded, nearly half of head. Pectoral equals space from front eye edge to hind opercle edge. Ventral narrow, slender, outer ray filamentous, fin shorter than pectoral. Vent below origin of first dorsal.

Uniform brownish. Pectorals transparent, other fins blackish. Inside of mouth and gill opening white. Chin black. Length 230 mm. (Günther.)

Mediterranean and eastern Atlantic.

MORA Risso

Mora RISSO, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 224. Type: *Mora mediterranea* Risso. Monotypic.

Asellus (not Saint-Hilaire, 1764) VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II, part 2, p. 76. Type: *Asellus canariensis* Valenciennes. Monotypic.

Body moderately long. Mouth large, subinferior. Teeth cardiform, equal, in jaws, on vomer and palatines, and those of the upper jaw in band. Barbel present. Gill opening large. Branchiostegals 7. Scales moderate, cover head and trunk. Dor-

sals separate, prominent, short anterior fin and long posterior. Anals 2, widely separated. Caudal forked. Ventral with 6 rays.

Mora mora (Risso)

Ribaldo (Madeira), Pescada, Mariquita (Canaries), Ompojh (Senegambia)

Figure 233

Gadus mora RISSO, 1810, 'Ichth. Nice,' p. 116. Nice.

Mora mora MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 400, Fig. 278 (off Morocco, 1215 m.; off Canaries, 1365 m.).

Asellus canariensis VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II, part 2, p. 76, Pl. XIV, fig. 3. Canary Islands.—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 403 (Santa Cruz, Teneriffe).

Mora mediterranea LOWE, 1843, Proc. Zool. Soc. London, XI, p. 91 (off Magdalena, 15 leagues west of Funchal in 300 to 400 fathoms).—GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 341 (Madeira).—STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1), p. 707 (Canaries).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 114 (Cape Blanco, Portendik, Guet N'Dar, Argain).—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 298, Pl. XXV, fig. 6-a (off Canaries in 975 m.; off Morocco in 622 to 1180 m.).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 327 (Canaries).—RICHARD, 1905 (June 25), Bull. Inst. Océanogr. Monaco, XLI, p. 5 (Banc Gorringe in N. lat. 36°, W. long. 11°).

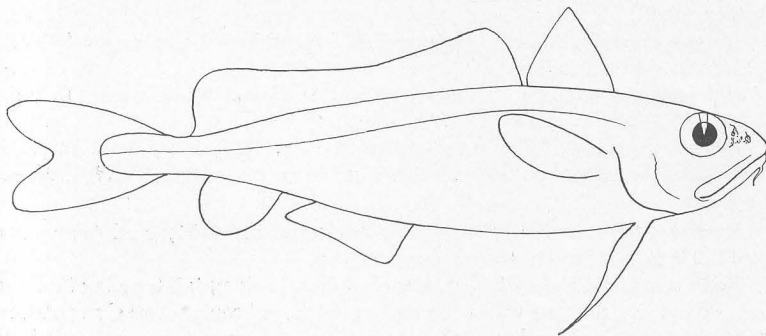


Fig. 233. *Mora mora*, from Bonaparte.

Head $4 \frac{2}{3}$; depth $4 \frac{3}{5}$; dorsal 7 or 8-42 to 45; anal 17 to 19-15 to 22; scales 95 in lateral line; snout $3 \frac{1}{4}$ in head; eye 3; maxillary $1 \frac{3}{4}$.

Body elongate, deepest at second dorsal origin, tail tapering moderately. Least depth of caudal peduncle 4 in head. Head rather small. Snout convex. Eye a little longer than snout, hind pupil edge midway in head length. Mouth oblique, lower jaw slightly shorter. Maxillary reaches opposite hind eye edge. Mandibular barbel shorter than eye. Interorbital but slightly elevated. First dorsal inserted opposite pectoral origin, first ray $1 \frac{3}{5}$ in head. Second dorsal begins opposite tip of depressed pectoral, hind rays little higher than anterior or $2 \frac{1}{3}$ in head. First anal begins a little nearer caudal base than snout tip, a little lower than second anal whose height is

a little less than 2 in head. Caudal forked, $1 \frac{1}{5}$ in head. Pectoral $1 \frac{3}{5}$. Ventral long as head.

Chestnut-brown upon back, dark ash color on belly. Blue spot upon opercle tip. Palate and tongue dark blue, latter with black spots. Dorsal and anal light blue basally, darker at tip. Pectorals light blue, with black spots. (Goode and Bean.)

Mediterranean and eastern Atlantic. Reaches 560 mm.

HALOPORPHYRUS Günther

Haloporphyrus GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 358. Type: *Gadus lepidion* Risso. Monotypic.

Lepidion (not *Lepidea* Savigny, 1817) SWAINSON, 1839, 'Nat. Hist. Animals,' II, p. 300. Type: *Lepidion rubescens* Swainson = *Gadus lepidion* Risso. Tautotypic.

Salilota GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 95. Type: *Haloporphyrus australis* Günther. Monotypic.

Body oblong, elongate. Head thick, rather compressed. Villiform teeth of equal size in jaws and vomer, none on palatines. Chin with barbel. Branchiostegals 7. Abdominal cavity extends far behind vent. Pyloric caeca very long, 17. Scales small. Two dorsals and 1 anal, first dorsal with 4 to 9 rays. Caudal separate. Ventral with narrow or wide base, rays 6 to 8.

Haloporphyrus güntheri Giglioli

Haloporphyrus güntheri GIGLIOLI, 1880 (January 1), Nature, XXI, p. 202 (on Günther, 1862).

Haloporphyrus guentheri GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 90, Pl. xviii, fig. A (Madeira).

Halopophyrus güntheri VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 134 (N. lat. $38^{\circ} 36'$, W. long. $26^{\circ} 30' 45''$, in 1165 m.).

Haloporphyrus lepidion (not Risso) GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 358 (Madeira).—JOHNSON, 1862, Ann. Mag. Nat. Hist., London, X, p. 166 (Madeira).

Head 4; depth little less than head length; dorsal 4-54; anal 49; ventral 6; scales 120 in lateral line, 15 above; eye 6 in head.

Body compressed, deepest before second dorsal origin, tail tapering into narrow band. Head deeper than wide. Snout depressed, subconic, obtusely round, much longer than orbit. Mouth cleft partly horizontal, upper jaw overlapping lower. Maxillary not reaching opposite hind eye edge. Teeth in villiform bands; above not covered by lips; small rounded patch at head of vomer. Barbel very slender, longer than eye. Interorbital width equals orbit. Opercle ends in obtuse point covered with skin. Nape elevated. Head, except lips, entirely covered with small scales; second dorsal and anal enveloped in loose scaly membranes. First dorsal very narrow, above pectoral base; first ray filamentous, much longer than head. Second dorsal moderately high, edge even. Anal begins immediately behind vent, median rays shortest. Caudal truncated. Pectoral little more than half of head. Outer ventral ray prolonged into 2 filaments, inner longer and equals head or extends to vent. Vent opposite twelfth ray of second dorsal.

Blackish brown. Fins black. Length 610 mm. (Günther.)

Eastern Atlantic and Mediterranean.

HALARGYREUS Günther

Halargyreus GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 342. Type: *Halargyreus johnsonii* Günther. Monotypic.

Body elongate. Jaws with bands of minute villiform teeth, of equal size. No vomerine or palatine teeth. No barbel. Gill rakers of outer arch long. Pseudo-brachiae glandular, rudimentary, covered by membrane. Branchiostegals 7. Scales small. Two dorsals and 2 anals, latter subcontinuous. Caudal separate. Ventral rays several.

Species few.

KEY TO THE SPECIES

- a.—Maxillary reaches beyond eye center; jaws equal in front; first dorsal rays half length of head. *johnsonii*.
 aa.—Maxillary reaches nearly opposite eye center; lower jaw projecting; first dorsal rays less than 1/4 of head. *brevipes*.

Halargyreus johnsonii Günther

Halargyreus johnsonii GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 342. Madeira. (From stomach of *Saccopharynx*.) [—GÜNTHER, 1880, 'Rept. Voy. "Challenger,"' I, p. 26 (New Zealand); 1887, *op. cit.*, XXII, p. 83 (copied).]

Dorsal 7-47 to 57; anal 17-41 to 47; ventral 5; 8 scales above lateral line; eye 4 in head.

Head rather elongate, compressed, equals space between vent and ventral bases, deeper than wide. Snout obtusely conical, little longer than eye. Mouth cleft wide, jaws equal in front. Maxillary extends little beyond middle in eye. Upper jaw without lip, lower very thin. Small bony symphyseal tubercle, points forward and downward. Jaws with narrow bands of minute villiform teeth. Interorbital flattish, width rather less than vertical eye diameter. Opercle and subopercle each end in a very small spine, both close together. Gill rakers longer than gill filaments. Scales extend forward on snout. First dorsal begins immediately behind pectoral base, of very slender simple articulated rays, half of head. Second dorsal begins immediately behind first, not much lower, base covered by a thin scaly membrane. Fourth to seventh anal rays longest, posterior decreasing to seventeenth after which 4 or 5 short rays follow, preceding stronger rays of second anal. Pectoral more than half of head. Ventral very narrow, outer ray produced into a fine filament of moderate length. Vent opposite ninth ray of second dorsal.

Delicate red on silvery ground. Pectoral and anal transparent. Mouth and gill cavity black. Length of head 63 mm. (Günther.)

Madeira and New Zealand. Described originally from an imperfect specimen taken from a *Saccopharynx*.

Halargyreus brevipes Vaillant

Figure 234

Halargyreus brevipes VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., XXII, p. 295, Pl. xxv, fig. 5. Off Morocco, in 1319 m.

Head 4; depth 8; dorsal 8-56; anal 26-22; ventral 5; scales 122 in lateral line, 7 above, 30 below. Body nearly cylindrical anteriorly. Head width a little less than

its height. Snout 3 in head, moderate. Eye 4 in head. Mouth rather large, lower jaw slightly produced. Maxillary not reaching beyond eye center. Jaws with bands of fine teeth; vomer and palatines toothless. No barbel. Nostrils together, oval, large, close before eye. Interorbital $5\frac{1}{2}$ in head. Preopercle rounded. Gill opening wide. Scales small and loose. Head scaly to snout tip. Lateral line near dorsal profile. First dorsal begins behind pectoral base, short. Second dorsal close to first, extends almost to caudal base. First anal begins below first fourth of second dorsal. Caudal

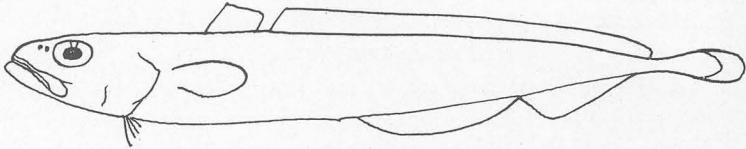


Fig. 234. *Halargyreus brevipes*, from Vaillant.

distinct, small. Pectoral 3 in head. Ventral very short, less than half of pectoral. Reddish brown, silvery on cheek and below. Pectorals dark. Mouth and branchial cavity intense black. Length 350 mm. (Vaillant.)

Off Morocco.

GAIIDROPSARUS Rafinesque

Rocklings

Gaidropsarus RAFINESQUE, 1810, 'Indice Ittiol. Sicil.', pp. 11, 51. Type: *Gaidropsarus mustellaris* Rafinesque = *Gadus mustela* Linné. Monotypic.

Enchelyopus (not Gronow, 1763) SCHNEIDER, 1801, 'Syst. Ichth. Bloch,' p. 50. Type: *Gadus cimbrius* Linné. (Designated by Jordan and Evermann, 1917, Stanford Publications, 'Genera of Fishes,' part 1, p. 57.)

Dropsarus RAFINESQUE, 1815, 'Analyse de la Nature,' p. 82. Type: *Gadus mustela* Linné. (*Dropsarus* Rafinesque proposed as an emendation of *Gaidropsarus* Rafinesque.)

Mustela (not Linné, 1758) OKEN, 1817, Isis, p. 1182. Type: *Gadus mustela* Linné. Tautotypic. (On *Les Mustèles* Cuvier, 1817, 'Règne Animal,' II, p. 215.)

Onos RISSO, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 214. Type: *Gadus mustela* Linné. (Designated by Jordan and Evermann, *op. cit.*, p. 119.)

Motella CUVIER, 1829, 'Règne Animal,' II, 2d Ed., p. 344. Type: *Gadus mustela* Linné. (*Motella* Cuvier proposed to replace *Mustela* Oken.)

Ciliata COUCH, 1832, Ann. Mag. Nat. Hist., London, V, p. 15. Type: *Ciliata glauca* Couch = *Gadus mustela* Linné. Monotypic.

Couchia THOMPSON, 1856, 'Nat. Hist. Ireland,' IV, p. 188. Type: *Couchia minor* Thompson = *Gadus mustela* Linné. Monotypic.

Molwella KAUP, 1858, Archiv Naturg., XXIV, part 1, p. 90. Type: *Molwella borealis* Kaup = *Gadus mustela* Linné. Monotypic.

Hypsiptera GÜNTHER, 1860, 'Cat. Fish. Brit. Mus.,' II, p. 386. Type: *Hypsiptera argentea* Günther. Monotypic.

Rhinonemus GILL, 1863, Proc. Acad. Nat. Sci. Philadelphia, p. 241. Type:

Gadus cimbrius Linné. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 3, p. 325.)

Body elongate, rounded in front, compressed behind. Caudal peduncle distinct. Head flattened above. Teeth in bands in each jaw and on vomer. Three or more barbels on snout, lips, and below mandibular symphysis. No pseudobranchiae. Branchiostegals 6 or 7. Vertebrae 47 to 49, of which 32 or 33 caudal. Pyloric caeca 8. Scales minute. Two dorsals, first of very slender, small rays, as fringe in depression, first ray prolonged; second fin elongated and almost reaches caudal base. Anal single. Caudal distinct. Ventral rays 3 to 8.

Species few, widely distributed in cool seas. The first dorsal is especially distinctive, being broken up into a number of free filamentous rays, united by the fin membrane only basally, the last ray hidden in a deep groove in dorsal margin.

Gadus pollachius is reported by Poggi¹ in a list of edible fish caught off the Canaries, as Abadejo, abad. Possibly it is an error for *Gadus maculatus*.

KEY TO THE SPECIES

- a.—Teeth of nearly equal size in upper jaw, lower inner series well spaced and enlarged; usually series of white dots along lateral line. *triccirratu*s.
 aa.—Outer row of stronger, enlarged, well-spaced teeth in both jaws; head, body, and dorsal fin sometimes with numerous, small rounded whitish spots, a row of brown spots along dorsal base with age. *maculatu*s.

*Gaidropsarus tricirratu*s (Brünnich)

Abrotea de Poca (Madeira)

*Gadus tricirratu*s BRÜNNICH, 1768, 'Ichth. Massil.,' p. 22. Marseilles.

Motella tricirrata LOWE, 1837 (1841), Trans. Zool. Soc. London, II, p. 189 (Madeira).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 133 (N. lat. 38° 52' 50", W. long. 27° 23', in 599 m., off Azores).

Head 4 1/3 to 4 3/4; depth 5 2/3 to 5 3/4; dorsal 55 to 72-57 or 58; anal 46 to 48; scales 150 in median lateral series to caudal base; tubes about 30 in lateral line; scales 18 above, 28 below; about 50 predorsal scales; snout 4 to 4 1/5 in head; eye 6 to 7 1/2; maxillary 2 to 2 1/6; interorbital 5 2/3 to 6 1/5.

Body well compressed, elongate, rather slender. Caudal peduncle strongly compressed, least depth 3 to 3 1/5 in head. Head width 1 4/5 to 2 1/8 in its length. Snout broad, depressed, convex over surface, length 4/5 to 1 in width at front of eyes. Eye center at first third in head; diameter 1 1/2 to 2 in snout, equals interorbital. Mouth large, lower jaw shorter. Maxillary extends a little less than eye diameter beyond eye, less than half of diameter of eye in young. Teeth in bands in jaws; fine outer series slightly enlarged above, and the lower inner series well spaced and moderately enlarged; bands of fine teeth across vomer; palatines and tongue toothless. Median mandibular barbel 3 3/4 in head. Front nostril about first 2/5 in snout, 4 3/4 in head; hind nostril simple pore at last 2/5 in snout. Interorbital broadly convex.

Gill rakers 1+9 low broad tubercles, much less than gill filaments, which are about equal 1 1/3 eye diameters. Scales with 15 to 35 circuli; a single radiating apical

¹(Article in 'Guidebook of Canary Islands'), 1881, 'Guia de Santa Cruz de Tenerife,' [p. d. 35].

groove and a single radiating basal groove. Scales all adherent, finely crowded over most of head above and vertical fins. Lateral line a little high at first, drops to median alongside of tail close before vent; tubes rather long, slender, well spaced. Height of first dorsal ray $3\frac{3}{4}$ to 4 in head; height of second dorsal fin $2\frac{7}{8}$ to 3; height of anal fin $3\frac{1}{8}$ to $3\frac{1}{5}$; caudal rounded convexly behind, $1\frac{3}{4}$ to 2; pectoral $1\frac{3}{4}$ to $1\frac{4}{5}$; ventral $1\frac{2}{5}$ to 2.

Brown above, paler below, under surface of head and belly whitish. Vertical fins all becoming dusky brown marginally. Length 83 to 215 mm.

Eastern Atlantic and Mediterranean. Described above from three Italian examples. Reaches 506 mm.

Gaidropsarus maculatus (Risso)

Onos maculatus RISSO, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 215. Nice.

Motella maculata GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 366 (Madeira).

Head 4 to $4\frac{2}{3}$; depth 6 to $7\frac{3}{4}$; dorsal 44 to 50-56 to 60; anal 47 to 50; scales 172 in median lateral series to caudal base; tubes about 34 in lateral line to caudal base; 18 scales above lateral line, 28 below; 55 predorsal scales; snout $3\frac{7}{8}$ to 4 in head; eye 5 to $6\frac{1}{5}$; maxillary $1\frac{4}{5}$ to 2; interorbital $4\frac{3}{4}$ to 6.

Body well compressed, long, slender. Caudal peduncle strongly compressed, least depth $3\frac{1}{3}$ to $3\frac{4}{5}$ in head. Head width $1\frac{4}{5}$ to 2 in its length. Snout depressed, convex over surface, length $\frac{7}{8}$ to 1 in width at front of eye. Eye center at first third in head; $1\frac{1}{2}$ to $1\frac{2}{3}$ in snout, $1\frac{1}{8}$ to $1\frac{1}{5}$ in interorbital. Mouth large, lower jaw shorter. Maxillary extends about an eye diameter beyond eye. Teeth in bands in jaws, each with an outer enlarged well-spaced series; a band of fine teeth across vomer; palatines and tongue smooth. Median mandibular barbel $3\frac{2}{3}$ in head. Front nostril at first $\frac{2}{5}$ of snout, with barbel $3\frac{2}{5}$ in head; hind nostril is a simple pore at last $\frac{2}{5}$ in snout. Interorbital broad and level.

Gill rakers 1+8, low broad tubercles, much less than gill filaments, which $1\frac{1}{3}$ in eye. Scales with 10 to 18 circuli; a single radiating apical groove. Scales all firmly adherent; finely crowded over most of head above and on vertical fins. Lateral line a little high at first, drops median alongside of tail close after vent; tubes rather long and slender, well spaced. Height of first dorsal ray $5\frac{1}{2}$ to $6\frac{1}{2}$ in head; height of second dorsal fin 3 to $3\frac{1}{4}$; height of anal fin $3\frac{1}{4}$ to $3\frac{3}{4}$; caudal rounded convexly behind, $1\frac{3}{4}$ to $1\frac{7}{8}$; pectoral $1\frac{1}{2}$ to $1\frac{2}{3}$; ventral $1\frac{1}{10}$ to $1\frac{1}{3}$.

Body brown above, paler to whitish below. Pectoral brown like back. Ventral whitish. Length 98 to 217 mm.

Eastern Atlantic and Mediterranean. Described above from a series of Italian examples. Reaches 458 mm.

BROSMICULUS Vaillant

Brosmiculus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 292. Type: *Brosmiculus imberbis* Vaillant. Monotypic.

Body elongate. Caudal peduncle small and slender. Head rather small. Teeth moderate, biserial in jaws, none on vomer or palatines. No barbel. No pseudo-branchiae. Branchiostegals 6, membrane free. One long dorsal and one long anal. Caudal distinctly free, rays 23. Pectorals high. Ventrals jugular, narrow, each with 5 rays.

***Brosmiculus imberbis* Vaillant**

Figure 235

Brosmiculus imberbis VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 293, Fig. 4. Off Cape Verde Islands, in 460 mm.

Head 4 1/2; depth 6; dorsal 58; anal 58; pectoral 21; ventral 5; scales 81 in lateral line, 7 above, 23 below. Body elongately fusiform, compressed. Snout obtuse, truncate, 4 in head. Eye 4 in head. Mouth moderate, lower jaw protrudes slightly. Maxillary reaches opposite eye center. Teeth in both jaws small, conic, in two rows. Vomer and palatines toothless. Front nostril small, rounded; hind nostril larger, elongated vertically, close before eye. Interorbital 3 1/3 in head. Suborbitals largely shield maxillary. Preopercle rounded. Opercular bones finely striated. Gill opening wide. Scales small, cycloid; extend forward entirely to snout tip. Lateral line incomplete, a little arched, extends about 3/5 of length. Dorsal origin begins behind pectoral base, ends shortly before caudal. Anal begins nearly opposite dorsal origin, similar to dorsal. Caudal rounded, 1/10 of body length. Pectoral shorter than head. Ventral shorter than pectoral, second ray more developed, passes anal origin. Vent at

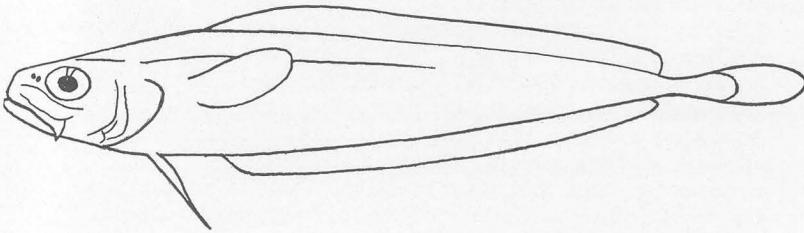


Fig. 235. *Brosmiculus imberbis*, from Vaillant.

last fourth of length. Dull gray. Light behind head, hind part of back, and on caudal peduncle. Cheeks silvery. Vertical fins sepia. Paired fins blackish. Length 159 mm. (Vaillant.)

Off the Canaries.

Merlucciidae**Hakes**

Body moderately elongate, terete. Caudal peduncle distinct. Head long, depressed, pikelike. Mouth terminal. Jaws and vomer furnished with strong teeth. No barbels at chin. Suborbitals moderate. Gill membranes not united. No pseudobranchiae. Branchiostegals 7. A single pyloric appendage. Scales small, deciduous. Dorsal fins 2, a short anterior and a long posterior. Anal single, long, like second dorsal. Second dorsal and anal more or less incised at margin behind middle, sometimes so deeply that the fins may appear divided. Caudal truncate

or forked, rays procurrent forward on caudal peduncle. Ventrals subjugular.

Fishes of the northern and southern hemispheres, ranging into deep water in the warmer areas of their distribution.

MERLUCCIUS Rafinesque

Hakes

Merluccius RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 26. Type: *Merluccius smiridus* Rafinesque = *Gadus merluccius* Linné. Monotypic.

Merlucius GILL, 1863, Proc. Acad. Nat. Sci. Philadelphia, p. 244. Type: *Gadus merluccius* Linné.

Onus RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' p. 12. Type: *Onus riali* Rafinesque = *Gadus merluccius* Linné. (*Onus* Rafinesque proposed to replace *Merluccius* Rafinesque.)

Merlangus RAFINESQUE, *op. cit.*, p. 67. Type: *Gadus merluccius* Linné. (*Merlangus* Rafinesque proposed to replace *Onus* Rafinesque.)

Stomodon MITCHILL, 1814, 'Rept. Fish. New York,' p. 7. Type: *Stomodon bilinearis* Mitchill. Monotypic.

Hydronus MINDING, 1832, 'Naturg. Fische.,' p. 83. Type: *Gadus merluccius* Linné. Monotypic.

Merlus GUICHENOT, 1847, 'Hist. fis. pol. Chile,' Gay, II, p. 328. Type: *Merlus gayi* Guichenot. Monotypic.

Homalopomus GIRARD, 1856, Proc. Acad. Nat. Sci. Philadelphia, p. 132. Type: *Homalopomus trowbridgii* Girard. Monotypic.

Epicopus GÜNTHER, 1860, 'Cat. Fish. Brit. Mus.,' II, p. 248. Type: *Merlus gayi* Guichenot. (*Epicopus* Günther proposed to replace *Merlus* Guichenot.)

Head slender, conic. Snout long, depressed. Eye rather large. Mouth large, oblique, lower jaw protruding. Maxillary extends to eye. Teeth slender, variable, in about 2 series, inner row longer and movable. Vomerine teeth similar. Palatines toothless. Preopercle with channel behind crest, crossed by short radiating ridges; preopercle edge free. Well-defined oblong, triangular excavation at forehead, bounded by ridges on separated frontals converging backward into a low occipital crest. Gill rakers long. Dorsals well separated, second with deep emargination, anal similar. Ventrals well developed, rays 7.

Large voracious fishes, with soft flesh, some ranging into deep water.

Merluccius merluccius (Linné)

Pescada, Morcego do mar (Madeira), Pescada (Canaries)

Figure 236

Gadus merluccius LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 254. Europe.

Merlucius merluccius PIETSCHMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 101 (Mogador, Agadir and Azamor, Morocco).

Merluccius vulgaris LOWE, 1840, Proc. Zool. Soc. London, VIII, p. 27 (Madeira); 1837 (1841), Trans. Zool. Soc. London, II, p. 189 (Madeira).—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 300 (off Soudan).—VINCI-GUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 327 (Grand Canary).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 399 (off Morocco, 141 to 535 m.;

Cape Blanco, 10 to 214 m.).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 261 (Cape Blanco).

Merluccius ambiguus LOWE, 1840, Proc. Zool. Soc. London, VIII, p. 37 (Madeira); 1839 (1849), Trans. Zool. Soc. London, III, p. 15.

Onos guttatus COLLETT, 1890, Bull. Soc. Zool. France, XV, p. 105. Fayal, Azores.—STEINDACHNER, 1891, Sitzs. Akad. Wiss. Wien, C (1), p. 360 (near Telde on coast of Grand Canary).

Head $3\frac{1}{8}$ to $1\frac{1}{3}$; depth $5\frac{2}{3}$ to 6; dorsal 10–36 to 39; anal 37 or 38; scales 125 in lateral line to caudal base and 5 or 6 more on latter; 10 scales above lateral line, 22 below; about 60 predorsal scales; snout $3\frac{1}{8}$ to $3\frac{1}{5}$ in head measured from upper jaw tip; eye $4\frac{1}{4}$ to $5\frac{1}{2}$; maxillary $1\frac{7}{8}$ to 2; interorbital $3\frac{3}{4}$ to 4.

Body elongate, compressed, deepest at first dorsal. Caudal peduncle strongly compressed, least depth 7 to 8 in total head length. Head width $2\frac{1}{2}$ to $2\frac{4}{5}$ in its length. Snout conic, depressed, width 1 to $1\frac{1}{8}$ in its length. Eye large, hind edge midway in total head length or hind pupil edge midway in young; diameter $1\frac{1}{4}$ to $1\frac{3}{4}$ in snout, 1 to $1\frac{1}{2}$ in interorbital. Mouth large, lower jaw protruding. Maxillary reaches nearly opposite hind eye edge, opposite hind pupil edge in young; ex-

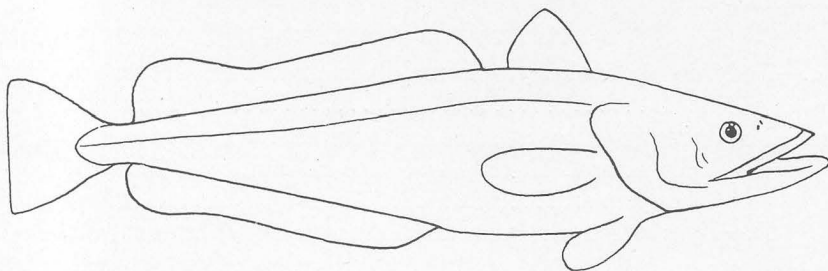


Fig. 236. *Merluccius merluccius*, from Smitt.

pansion $2\frac{1}{5}$ to 3 in eye. Teeth in jaws rather slender, compressed, inner upper series enlarged, well spaced and depressible inward; vomer with a biserial row of smaller teeth, inner enlarged and also depressible inward; palatine and tongue smooth. Nostrils together, within last third of snout; front nostril simple small pore; hind nostril 3 times as large, ovoid aperture. Interorbital but little elevated, nearly level.

Gill rakers 2+8, lanceolate, a little longer than gill filaments or 2 in eye. Scales with 40 to 42 complete circuli. Scales thin, cover most of body and head. Lateral line a little high at first, slopes until it is median at posterior part of tail; tubes rather large and simple. Height of first dorsal $2\frac{2}{3}$ to $2\frac{3}{4}$ in total head length; height of second dorsal $3\frac{2}{5}$ to $3\frac{2}{3}$; height of anal $3\frac{1}{2}$ to $3\frac{4}{5}$; caudal with hind edge obliquely truncated, lower rays a little shorter, $2\frac{1}{2}$ to $2\frac{7}{8}$; pectoral $1\frac{7}{8}$ to $2\frac{1}{8}$; ventral $1\frac{4}{5}$ to $1\frac{7}{8}$.

Back deep brown, sides and below silvery white. Iris silvery white. Upper fins dull brown, lower whitish. Length 102 to 300 mm.

Northeast Atlantic, south to the Azores and Cape Blanco, likely farther in deep water. Described above from five examples from Europe.

ORDER ALLOTRIIGNATHI

Head spineless or without serrations. Mouth typically protractile. Maxillary with outer blade and with inner hind process, which connected with its fellow below premaxillary spines; no supplemental maxillary. Teeth usually feeble or absent, never strong. Gills 4, pectinate. Pseudo-branchiae well developed. Branchiostegals 6. Air vessel without pneumatic duct. Supraoccipital well developed, separating parietals; no opisthotic; an orbitosphenoid, anteriorly in contact with mesethmoid, which is wholly or in part posterior to prefrontals. Vertebral column of solid centra which is coössified with arches. Scales, when present, thin, deciduous, or reduced to scattered tubercles. Vertical fins spineless, except sometimes one or two first dorsal rays. Pectorals with horizontal or subhorizontal base. Ventrals, when present, spineless, a little behind pectorals.

KEY TO THE SUBORDERS

- a.*—Body deeply oval; eyes normal; vertebrae normal; ventral rays 15 to 17.....SELENICHTHYES.
aa.—Body greatly elongated, slender; ventrals reduced or absent.
 b.—Eyes normal, lateral; vertebrae normal; ventrals with 1 to 9 rays.....TAENIOSOMI.
 bb.—Eyes telescopic; vertebrae of centra only; no ventrals.

ATELAXIA.

SUBORDER SELENICHTHYES

Body deep, compressed. Mouth terminal, toothless. Skeleton well ossified. Preopercle and symplectic distinct. Post-temporal forked, free. Pectoral fin rays inserted in scapula and on 3 pterygials, one of which is in contact with coracoid. Vertebrae 45 or 56; ribs strong and sessile. Fins without spines, dorsal and anal long. Pelvic bones connected with scapular arch.

Lamprididae

Opahs

Body high, oval, compressed. Caudal peduncle short, slender, without keel. Head moderate, rather deep. Eyes moderate. Mouth terminal. Jaws short and equal. No teeth in jaws; angle with grooves to permit of motion of jaws; pharyngeals with teeth in adult. Opercular bones entire, well developed. Gill opening large. Gills 4, pectinated,

branchial apparatus fully developed. Gill membranes free at isthmus. Vertebrae 45, of which 25 caudal. Esophagus without spinous teeth. Air vessel large, bifurcate behind. Pyloric appendages very numerous. Scales minute or small, thin, cycloid, deciduous, and somewhat larger in pectoral region. Lateral line present. Dorsal single, very long. No finlets. Anal long, uniformly low. Both dorsal and anal depressible in groove. Caudal moderately forked. Pectoral large, falcate. Ventrals thoracic, set back of pectoral base.

One genus.

LAMPRIS Retzius

Opahs

Lampris RETZIUS, 1799, *Svensk. Vet. Acad., Nya Handling*, Stockholm, XX, p. 91. Type: *Zeus guttatus* Brünnich. Monotypic.

Chrysotosus LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' IV, p. 586. Type: *Zeus luna* Gmelin. Monotypic.

Echemythes GISTEL, 1848, 'Naturg. Thierr.,' p. VIII. Type: *Zeus luna* Gmelin. (*Echemythes* Gistel proposed to replace *Chrysotosus* Lacépède.)

Body elevated, short, deep. Caudal peduncle with a pit above and one below, before caudal base. Snout short. Eye a little advanced from middle of head. Mouth small. Premaxillaries protractile. Jaws firm and trenchant. Tongue narrow, free, smooth. Branchiostegals 6 or 7. Lateral line greatly arched in front. Dorsal with an elevated falcate lobe in front, without distinct spines. Anal without anterior lobe. Caudal with 17 branched rays. Pectoral rays 23 to 25, base of fin horizontal. Ventral rays 14 to 17.

A single species, pelagic, widely distributed. Chiefly noted for its large size and brilliant colors, its rich flesh valued as food.

Lampris regius (Bonnaterre)

Peixe Cravo (Madeira)

Figure 237

Zeus regius BONNATERRE, 1788, 'Encycl. Ichth.,' p. 72, Pl. xxxix. Torbay, England.

Lampris lauta LOWE, 1837 (1841), *Trans. Zool. Soc. London*, II, p. 183 (Madeira); 1839 (1849), *op. cit.*, III, p. 6 (Madeira); 1839, *Proc. Zool. Soc. London*, p. 80 (Madeira); 1843, 'Fishes of Madeira,' p. 27, Pl. v (Madeira).

Lampris luna GÜNTHER, 1860, 'Cat. Fish. Brit. Mus.,' II, p. 416 (Devonshire).—STEINDACHNER, 1868, *Sitzs. Akad. Wiss. Wien*, LVII (1), p. 381 (Teneriffe).—VINCI-GUERRA, 1892, *Atti Soc. Ital. Sci. Nat.*, XXXIV, p. 318 (Canaries).

Head about 3; depth 1 7/8; dorsal 1, 52 to 54; anal 1, 39 to 41; snout 3 in head measured from upper jaw tip; eye 4 3/4; maxillary 3 1/5.

Body short, deep, deepest at dorsal origin. Least depth of caudal peduncle 4 1/3 in head. Head pointed, rather short. Snout conic. Eye with hind edge midway in head length; diameter 1 1/2 in snout. Mouth small, lower jaw protruding. Maxillary not reaching eye; expansion 2 1/2 in eye. Nostrils close together, about midway

in snout length. Scales small, soft, extremely deciduous; cover most of head, as cheeks and opercles, whereas muzzle, lips, and maxillary are naked. Lateral line arched high over pectoral base, then drops until midway alongside of tail. Dorsal origin opposite middle of pectoral base; second ray $2\frac{1}{2}$ in total head length. Anal begins opposite twenty-second or twenty-third dorsal rays. Caudal but slightly shorter than head. Pectoral $1\frac{1}{5}$; ventral $1\frac{1}{5}$.

Silvery, with rose or lilac tints, with golden tints on middle of side. Whole side,

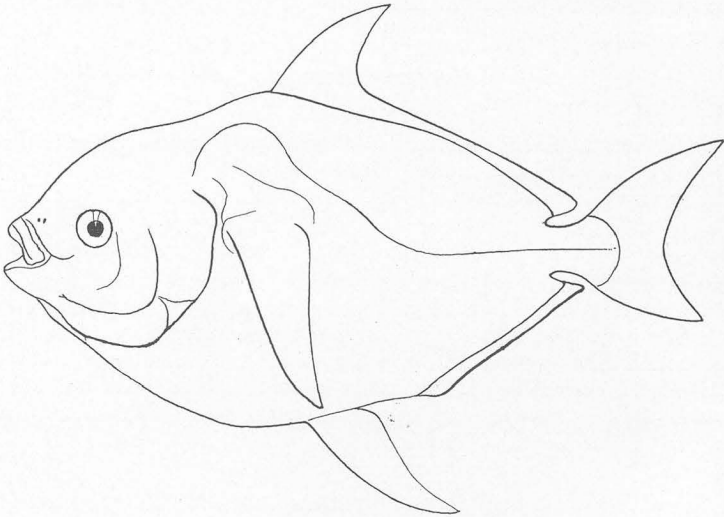


Fig. 237. *Lampris regius*, from Smitt.

cheeks, and opercles spotted with silvery white, round oval in form. Iris clouded gold and vermilion on silver ground. Fins bright vermilion. Length 728 to 1043 mm. (Lowe.)

Pelagic. Lowe says:

There is something about this fish which commands the admiration of the most incurious and unobservant. It is not usual to see great size, and richness without gaudiness of colour, in such combination. The very fishermen are eloquent in commendation of its splendour in the water; and by their name, intend to note it as "the pink" of beauty.

SUBORDER TAENIOSOMI

Body elongate, strongly compressed. Mouth parts normal. Skeleton feebly ossified, bones thin. No occipital crest. Post-temporal simple. Orbitosphenoid present. Lower pharyngeals rodlike, parallel with branchial arches, or absent. Pectoral fin rays inserted on scapula

and on 3 pterygials, 2 or all in contact with coracoid. Pelvic girdle present, not articulated to coracoid. Vertebrae 90 to 93; ribs feeble or absent. Fins of flexible nonarticulated rays, sometimes first dorsal ray spinous. Dorsal fin very long. Anal short or absent. Ventral, when present, with 1 to 9 rays.

Trachipteridae

King of the Herrings

Body moderately elongate, strongly compressed. Head short. Eye large, lateral. Mouth rather small, terminal. Premaxillaries protractile. Teeth feeble. Opercles unarmed. Gill membranes separate, free from isthmus. Gills 4, slit behind fourth. Pseudobranchiae well developed, in a pouch formed by a fold of mucous membrane. Pyloric appendages very numerous. Bones soft, muscles a little coherent. Vertebrae in large number. Body naked, skin smooth or prickly. Lateral line present. Dorsal single, extending from head to tail, rays all spinous as they are neither articulated nor branched, but very soft, fragile, flexible. No anal. Caudal rudimentary or divided in 2 parts, upper and larger fanlike, directed obliquely upward from slender tip of tail. Pectorals short. Ventrals thoracic, rays elongate, less than 6 usually atrophied with age. Vent median.

Bathypelagic. Fishes frequently of large size, found in most warm seas. Owing to their extreme fragility specimens are rare in collections.

TRACHIPTERUS Gouan

Trachipterus GOUAN, 1770, 'Hist. Pisc.,' p. 104. Type: *Trachipterus gouani* Gouan = *Cepola trachyptera* Gmelin. Tautotypic.

Trachypterus auct.

Gymnogaster BRÜNNICH, 1788, 'K. danske Selsk. Skrift.,' III, p. 408. Type: *Gymnogaster arcticus* Brünnich. Monotypic.

Bogmarus SCHNEIDER, 1801, 'Syst. Ichth. Bloch,' p. 518. Type: *Bogmarus islandicus* Schneider. Monotypic.

Vogmarus REID, 1849, Ann. Mag. Nat. Hist., London, III, p. 456. Type: *Bogmarus islandicus* Schneider.

Nemochirus RAFINESQUE, 1815, 'Specchio delle scienze,' II, pp. 100, 105. Type: *Nemochirus erythropterus* Rafinesque. Monotypic.

Nemotherus (Risso) COSTA, 1834, 'Cenni Zoologici,' Naples, Fig. 9. Type: *Nemotherus erythropterus* Risso. Monotypic.

Body ribbon-like. Mouth greatly protractile. Branchiostegals 6. No air vessel. Pyloric appendages numerous. Row of asperities along dorsal base and lateral line. Dorsal extends entire length of back, rays less than 200. Caudal mostly above longitudinal axis of body, erected fanlike. Ventrals sometimes absent, very long in young. Sometimes the young have fin rays several times as long as body and with lappet-like dilatations. Vent median. Silvery.

Trachipterus trachipterus (Gmelin)

Cepola trachiptera GMELIN, 1789, 'Syst. Nat. Linné,' p. 1187. Adriatic Sea.

Trachipterus gryphurus LOWE, 1850, Proc. Zool. Soc. London, p. 248. Madeira.—GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' III, p. 301 (copied).

Head $8\frac{1}{4}$ to $8\frac{3}{4}$; depth 9 to 10; dorsal 5, 150 to 167; pectoral 10; caudal 8; snout $2\frac{1}{2}$ to $2\frac{3}{5}$ in head, measured from upper jaw tip; eye $3\frac{1}{3}$ to 4; maxillary $3\frac{1}{2}$ to $4\frac{1}{5}$; interorbital $4\frac{3}{5}$ to 5.

Body extremely compressed, with greatest depth above opercle, long trunk and tail tapering back to very slender caudal peduncle. Head width about 4 in its total length. Snout obtuse, compressed, upper profile straight, width $1\frac{4}{5}$ to 2 in its length. Eye large, center about midway in head length, front pupil edge about midway in smaller example; diameter $1\frac{1}{4}$ to $1\frac{2}{3}$ in snout, much greater than eye. Mouth rather small, lower jaw projecting. Maxillary small, little inclined from vertical and not quite extended $\frac{2}{5}$ in snout, tapers below. Row of 10 transverse conic teeth across front of each jaw, well inside, the two innermost upper ones and each outermost lower one are a little enlarged; smaller example with upper teeth very small; palate and tongue toothless. Nostrils? Interorbital convex. Preorbital very broad, a little larger than eye, with fine rugose striae; preopercle, opercle, subopercle, and interopercle, all with fine radiating striae.

Gill rakers 4 or 0+9 or 10, lanceolate, $1\frac{1}{5}$ to $1\frac{1}{2}$ in gill filaments, which 2 to $2\frac{1}{2}$ in eye. Body scaleless, covered with very thin skin; along entire ventral edge of trunk are fine asperities; a few fine asperities on predorsal and along upper edge of gill opening; ventral edge of smaller example less asperous to more or less smooth. Lateral line complete, drops from above gill opening until at the lowest third in greatest body depth; armed its entire length with a row of very small well-spaced denticles. Anteriorly, the height of dorsal is 2 to $2\frac{1}{2}$ in total head length; caudal equals head, little larger in smaller example; pectoral $3\frac{1}{3}$ to 4 in head; ventrals only as slight knob little behind pectoral base.

Brilliant silvery or mercury white. Alongside of back 2 or 3 large dusky brown rounded blotches, at least as large as eye. Iris silvery white. Length 1020 to 1236 mm.

Eastern Atlantic and Mediterranean. Described above from 2 adults and 1 young from the Mediterranean.

Goode and Bean have given a provisional key to the Mediterranean species.¹ I believe that a number of the alleged distinctions given are untrustworthy. *Trachipterus gryphurus* Lowe was based on an example 635 mm. long, said to have the lateral line smooth and its depth $5\frac{1}{2}$ in the total length. My young example of the present species has the lateral line unarmed, though it is armed in both adults. The latter were identified as *Trachipterus liopterus*.

SUBORDER ATELAXIA

Branchiostegal rays at upper edge of ceratohyal and inclined upward. Opposing halves of hyoid unconnected and remote from each other.

¹1895, 'Oceanic Ichth.,' p. 477.

Lower pharyngeals concealed by skin and much reduced. Palatoquadrate bar atrophied. No orbitosphenoid. Vertebrae of centra only, without neural or haemal spines or other processes. Caudal divided and part of rays turned upward, the lower three enlarged and produced backward into long processes.

Giganturidae

Body elongate, slender, cylindrical. Snout small. Eye moderate, telescopic. Mouth cleft very broad. Under jaw not protruding in front, extending backward below basis of pectoral. Strong teeth in jaws and on palatines, none on vomer. Greater part of gill covers posteriorly ventral. Gill opening before and under pectoral. Pseudobranchiae present. No air vessel. No scales. Dorsal rays simple, fin at last third of body. Caudal with lower lobe greatly elongated. Pectoral fanlike, dorsad, high, behind and above gill opening. No ventral.

Deep-sea fishes of the eastern Atlantic.

GIGANTURA Brauer

Gigantura BRAUER, 1901, Sitzs. Gesell. Nat. Marburg, VIII, p. 128. Type: *Gigantura chuni* Brauer. Monotypic.

Characters expressed in the family.

Gigantura chuni Brauer

Figure 238

Gigantura chuni BRAUER, 1901, Sitzs. Gesell. Nat. Marburg, VIII, p. 128. Gulf of Guinea; 1906, 'Wiss. Ergebn. "Valdivia,"' XV (1), p. 310, Pl. I, figs. 1-3 (Gulf of Guinea in N. lat. 2° 36' 5", E. long. 3° 27' 5", in 3513 m.).



Fig. 238. *Gigantura chuni*, from Brauer.

Head $3\frac{7}{8}$; depth 8; dorsal 16; anal 11; pectoral 29; caudal 19; snout $11\frac{2}{3}$ in head; eye $3\frac{1}{5}$. Eyes telescopic, directed forward. Mouth cleft reaches gill opening. Lower jaw slightly shorter. Both jaws with a row of strong lateral fanglike teeth, upper with 12 larger teeth, smaller ones alternating, lower with 10 larger teeth and 3 small teeth externally alternating with each larger lower tooth. Palatine with 4 large teeth and 3 smaller. Front convex. Nostrils near snout tip. Gill opening extends ventrally nearly the length of lower jaw. Gill covers membranous, separate. Dorsal about its basal length from caudal base. Anal shorter, begins below eleventh dorsal ray. Caudal forked, greatly elongated lower lobe longer

than rest of body. Pectoral very broad and high. Body with metallic luster. Length 118 mm. (Brauer.)

Gulf of Guinea.

ORDER HETEROSOMATA

Flat Fishes

Body asymmetrical, strongly compressed, precaudal region short. Cranium normal behind, with twisted vertex in front to permit two eyes on same side, or one vertical and the other lateral. Mouth more or less protractile, formed above on edges by premaxillaries only. Interorbital bar mainly formed by frontal of eyed side. Parietals separated by supra-occipital. Vertebral column of solid centra joined with arches. Pectoral arch joined to skull by forked post-temporal. Upper pharyngeals 4, the third longest, much extended forward. Lower pharyngeals separate. Air vessel absent in adult. Dorsal and anal long. Caudal with 17 rays, 15 or fewer branched. Ventrals with 6 rays or less, thoracic or jugular.

A large group of fishes remarkable for the asymmetrical development of color on one side of body. In very young both sides of body are alike, one eye is placed on each side, the cranium normal and the fish swims erect. *Rhombus maximus* is listed by Baader from Mogador, Morocco (1873-1874, Ber. Senckenberg. Naturf. Gesell., p. 182).

KEY TO THE FAMILIES

- a.*—PSETTODOIDEA. Palatines toothed; dorsal fin begins on neck; front dorsal rays spinous; ventrals symmetrical with spine and 5 soft rays..... PSETTODIDAE.
- aa.*—PLEURONECTOIDEA. No palatine teeth; dorsal begins on head, at least above the eye; all fin rays articulated; ventral with 6 or fewer rays.
- b.*—Mouth usually terminal, with prominent lower jaw; preopercle edge free; nasal organ of blind side near edge of head; nerve of right eye always dorsal; sinistral, rarely reversed.
- BOTHIDAE.
- bb.*—Mouth small, terminal, partly terminal or inferior, lower jaw never prominent; preopercle edge not free; nasal organs symmetrical; right or left nerve dorsal without reference to dextrality or sinistrality; body dextral or sinistral.

SOLEIDAE.

Psettodidae

Mouth large, with strong, pointed teeth; jaws and dentition

equally developed on both sides. Maxillary with well-developed supplemental maxillary. Nasal organ of blind side scarcely higher than the other; olfactory laminae arranged transversely to or radiating from central rachis. Two postclavicles on each side. Vertebrae 24, of which 14 caudal; precaudal paraphophyses downwardly directed and united to form closed haemal arches. Dorsal fin not extending forward on head, anterior rays spinous. Pectoral radials well developed. Ventrals nearly symmetrical in form and position, posterior to clavicles; each of a spine and five soft rays. Sinistral and dextral individuals equally numerous and with dimorphic optic chiasma.

One genus.

PSETTODES Bennett

Psettodes BENNETT, 1831, Proc. Zool. Soc. London, part 1, p. 147. Type: *Psettodes belcheri* Bennett. Monotypic.

Shagomorus COPE, 1866 (1869), Trans. Am. Philos. Soc., XIII, p. 407. Type: *Pleuronectes erumei* Schneider. Monotypic.

Mouth very wide. Maxillary longer than half of head. Teeth biserial, slender, curved, distant, anterior inner lower ones longest and received in groove before vomer; teeth barbed or simple; vomer and palatines toothed. Gill rakers as groups of minute spines. Gill membranes scarcely united at throat. Scales rather small, ciliated. Dorsal begins on nape of neck. Most dorsal and anal rays branched.

Psettodes erumei (Schneider)

Boung (Senegambia), Lenguado de Altura (Cape Blanco)

Figure 239

Pleuronectes erumei SCHNEIDER, 1801, 'Syst. Ichth.,' p. 150. Tranquebar.

Hippoglossus erumei DUMÉRIL, 1859, Arch. Mus. Hist. Nat. Paris, X, p. 264 (West Africa).

Psettodes erumei CAPELLO, 1872, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, 1872, p. 86 (Bissau, West Africa).—ROCHEBRUNE, 1883–1885, 'Faune Sénégalie,' Poiss., p. 115 (Guet N'Dar, Barbarie, Dakar, Gorée).—OSORIO, 1894 (February), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) 3, p. 183 (Bissau).—BOULENGER, 1903 (1905), Mem. Soc. Españ. Hist. Nat., Madrid, I, p. 188 (Rio Benito, Spanish Guinea), p. 555 (Cape St. John).—PELLEGRIN, 1905, Act. Soc. Linn. Bordeaux, LX, p. 30, Fig. (Nouakchott, Guet N'Dar); 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanco, Cape Verde).—EHRENBAUM, 1913, Fischerbote, V, p. 361 (Cameroon).—PELLEGRIN, 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 173 (Mauritania, Nouakchott, Guet N'Dar).—REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 129 (Lagos).—FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 248 (Cape Palmas, Liberia).—METZELAAR, 1919, 'Rapp. Kolonie Curacao,' II, p. 275 (Cape Blanco).

Psettodes erumei OSORIO, 1898, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 199 (Bissau).

Psettodes belcheri BENNETT, 1831, Proc. Zool. Soc. London, 147. Atlantic coast of North Africa.—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LX (1), p. 976 (St.

Louis).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 280 (Port-Etienne).

Psettodes bennettii STEINDACHNER, *op. cit.*, p. 976. Senegal.—PETERS, 1876 (1877), Monatsb. Akad. Wiss. Berlin, p. 249 (Victoria, Cameroon).

Head $3\frac{3}{4}$; depth $2\frac{2}{3}$; dorsal 54; anal 40; scales 70 in lateral line to caudal base and 6 more on latter; 21 scales above lateral line, 27 below; snout $3\frac{1}{2}$ in head from upper jaw tip; eye $6\frac{3}{4}$; maxillary $1\frac{1}{2}$; interorbital $2\frac{1}{5}$ in snout.

Contour uniform ellipsoid. Caudal peduncle well compressed, length $\frac{3}{4}$ its least depth or latter $2\frac{5}{6}$ in total head length. Head width $2\frac{3}{5}$ in its length. Snout conic, as broad as long. Upper eye advanced for first third beyond lower. Mouth large, lower jaw well protruded. Maxillary long, extends well beyond eye or about $\frac{3}{5}$ of head; expansion $1\frac{1}{8}$ in eye. Teeth long, slenderly conic, in 2 rows with inner depressible inward, and all of larger ones barbed. Interorbital

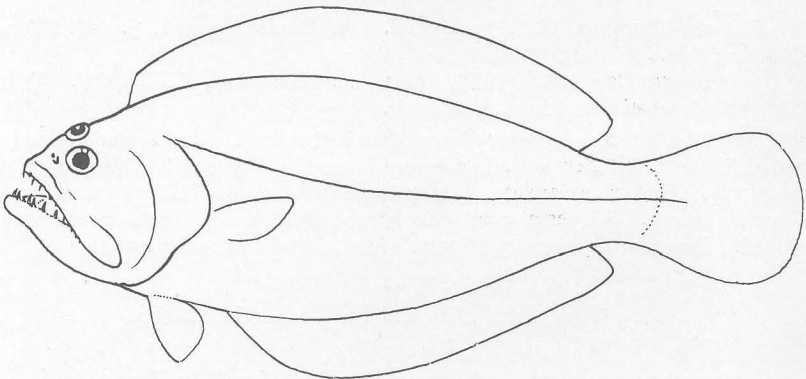


Fig. 239. *Psettodes erumei*.

level. Gill rakers $14 + 20$, short spinescent rudiments; gill filaments $1\frac{1}{3}$ in eye. Scales of left or colored side with 40 radiating basal striae; same number, but marginal, on the pale side and the very fine circuli incomplete. Scales large, mostly cycloid, some very weakly and sparsely ctenoid on left side. Smaller scales along body edges, and caudal very finely scaled. About 8 rows of scales on cheek; maxillary also scaly. Lateral line midway along side, inconspicuous. Dorsal origin an eye diameter behind the lower eye, twenty-third ray $2\frac{9}{10}$ in head; thirteenth anal ray $2\frac{4}{5}$. Caudal double convex behind; median rays longest or $1\frac{1}{4}$ in head; pectoral 2; left ventral $2\frac{3}{4}$.

Dull brownish on left side, with many well-scattered pale spots, none larger than scale exposure. Right side uniform white. Length 395 mm.

West coast of West Africa to the Indian Ocean. Described above from an example from Cape Palmas, Liberia. A small East Indian example is without any pale spots on the colored side.

Adult in the Museum of Comparative Zoölogy, from the Canaries.

Regan says of it:

It has no gill rakers, and the strongly toothed mouth is larger than in any other flat-fish; this is evidently a predaceous fish, which probably lies on the bottom, concealed from its prey, and then darts out, swimming rapidly for a short distance by lateral movements of the tail. Probably it has retained so many Percoid features because it has not adopted progression by undulating movements of the body and marginal fins to the same extent as other fishes of this order.

Bothidae

Mouth usually terminal and lower jaw prominent. No supplemental maxillary. No palatine teeth. Nasal organ of blind side near edge of head. Preopercle edge free. Nerve of right side always dorsal. Olfactory laminae arranged transversely to or radiating from, a central rachis. Vertebrae 33 to 43, of which 24 to 33 caudal; parapophyses united or separated below. Dorsal fin begins on head, at least above eye. All fin rays articulated. Ventral with 6 or fewer rays, base long or short. Body sinistral, except for reversed examples of certain species.

KEY TO THE SPECIES

- a.—Septum of gill cavity below gill arches; deep emargination near isthmus.
- b.—PARALICHTHINAE. Ventral fins without short bases, supported by pelvic bones, and situated behind clavicle, either symmetrical or with fin of eyed side nearly median in position.
- c.—Vomer toothed; lateral line strongly arched in front. CITHARUS.
- cc.—Vomer toothless; lateral line not arched. SYACIUM.
- bb.—PLATOPHRINAE. Ventral fin of blind side with short base, of ocular side elongate, extending forward to urohyal, supported by cartilaginous plate placed in advance of clavicle; vomer toothless; lateral line arched in front.
- d.—Interorbital narrow ridge sometimes with median groove; scales cycloid, usually ciliated, deciduous. ARNOGLOSSUS.
- dd.—Interorbital more or less broad, deeply concave; scales small, ctenoid, adherent. PLATOPHRYS.
- aa.—BOTHINAE. Septum of gill cavity between gill arches; emargination below shoulder girdle near isthmus not deep; vomer toothed; scales deciduous, ctenoid; lateral line with a strong arch in front; both ventrals elongate, extending forward to urohyal, supported by cartilaginous plates placed in advance of clavicle. LEPIDORHOMBUS.

CITHARUS Rose

Citharus ROSE, 1793, 'Pet. Artedi synonym. nom. pisc.', 2d Ed., p. 116. Type: *Citharus* Aristotle = *Pleuronectes linguatula* Linné.

Eucitharus GILL, 1888, Proc. U. S. Nat. Mus., XI, p. 600. Type: *Pleuronectes linguatula* Linné. (*Eucitharus* Gill proposed to replace *Citharus* Bleeker = *Citharus* Rose.)

Body elongate. Eyes sinistral. Mouth wide. Maxillary nearly half length of head. Teeth unequal, upper biserial, some canine-like; vomer toothed; palatines toothless. Septum of gill cavity below arches without foramen, deep emar-

gination near isthmus. Scales moderate, deciduous, weakly ctenoid. Lateral line strongly arched in front. Dorsal begins on snout. Both pectorals present. Ventral free from anal. Color sinistral.

One species in the Mediterranean region.

Citharus linguatula (Linné)

Pleuronectes linguatula LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 270. European Seas.

Citharus linguatula PIETSCHMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 114 (Atlantic coast of Morocco).

Head $3\frac{3}{5}$; depth $2\frac{2}{3}$; dorsal 65; anal 45; scales 37 in lateral line. Body elongate, flesh soft. Eyes large, close together. Mouth very large, oblique; lower jaw projects. Maxillary 2 in head. Some canine teeth, especially above in front; 2 or 3 rather large teeth on vomer. Gill-rakers $0 + 9$, slender, moderately long. Scales large, caducous. Fins all high and fragile. Dorsal begins before eye on right side. Caudal pointed. Left ventral on abdominal ridge, a little before right, its base scarcely lengthened. Color grayish, translucent. (Jordan and Goss.)

Mediterranean and adjacent Atlantic.

SYACIUM Ranzani

Syacium RANZANI, 1840, Nov. Comm. Acad. Sci. Inst. Bnon., IV, p. 20.

Type: *Syacium micrurum* Ranzani. Monotypic.

Hemirhombus BLEEKER, 1862, Versl. Akad. Wetensch. Amsterdam, XIII, p. 425. Type: *Hemirhombus guineensis* Bleeker. Monotypic.

Citharichthys BLEEKER, *op. cit.*, p. 427. Type: *Citharichthys cayennensis* Bleeker. Monotypic.

Orthopsetta GILL, 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 330. Type: *Psettichthys sordidus* Girard. Monotypic.

Metoponops GILL, 1864, *op. cit.*, pp. 146, 198. Type: *Metoponops cooperi* Gill. Monotypic.

Etropus JORDAN AND GILBERT, 1881, Proc. U. S. Nat. Mus., IV, p. 364. Type: *Etropus crossotus* Jordan and Gilbert. Monotypic.

Aramaca (Jordan and Goss) JORDAN, 1885 (1887), Rept. U. S. Fish Comm., p. 133. Type: *Citharichthys paetulus* Jordan and Gilbert. Monotypic.

Cyclopsetta GILL, 1888, Proc. U. S. Nat. Mus., XI, p. 601. Type: *Hemirhombus fimbriatus* Goode and Bean. Orthotypic.

Azevia (Jordan) JORDAN AND GOSS, 1886 (1888), Rept. U. S. Fish Comm., p. 271. Type: *Citharichthys panamensis* Steindachner. Monotypic.

Body ovate-elliptic, much compressed. Mouth moderate, gape curved. Upper teeth biserial, lower uniserial; front upper teeth enlarged. Vomer toothless. Interorbital space broad in males, more or less concave, narrowed in females. Gill rakers short and thick. Scales rather large, ciliate. Lateral line not arched in front. Dorsal low, front rays not elevated. No anal spine. Caudal partly free. Both pectorals present, colored one produced in male. Ventrals short, colored one on abdominal ridge.

Small flounders, mostly of the tropical Atlantic.

KEY TO THE SPECIES

- a.—Upper teeth biserial, lower uniserial.
 b.—Scales 50 to 57 in lateral line; interorbital broader.....*papillosum*.
 bb.—Scales 60 to 70 in lateral line; interorbital narrower.....*micrurum*.
 aa.—Teeth biserial in both jaws.
 c.—Eyes nearly or quite superimposed.....*spilopterum*.
 cc.—Eyes well separated, interorbital is one-half diameter of lower eye.
guineensis.

***Syacium papillosum* (Linné)**

Figure 240

Plauronectes papillosus LINNÉ, 1758, 'Syst. Nat.', 10th Ed., p. 271. Brazil (on Aramaca Maregrave, 1648, 'Hist. Nat. Brasil,' p. 181. Brazil).

Hemirhombus soleaeformis CLARK, 1913, Proc. Roy. Phys. Soc. Edinburgh, XIX, p. 385 (Ascension Island).

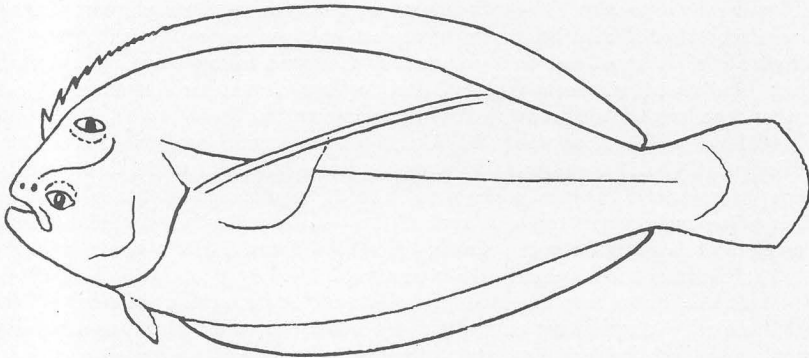


Fig. 240. *Syacium papillosum*, from Jordan and Evermann.

Head $3 \frac{2}{3}$; depth $2 \frac{2}{5}$; dorsal 81 to 88; anal 63 to 70; scales 50 to 57 in lateral line; eye large, $4 \frac{2}{3}$ in head; maxillary $2 \frac{1}{2}$. Anterior teeth canine-like. Interorbital space very broad, greater than long diameter of eye in males, about equal to vertical diameter in females. Gill rakers short, strong, not $\frac{1}{3}$ length of eye. Accessory scales very numerous. Maxillary tip scaly. First dorsal rays nearly on median line, their tips much exerted. Pectoral of male $1 \frac{1}{4}$ in head. Nearly plain brown, with darker dots or mottlings, no ring-like spots or ocelli. Blind side sometimes wholly or partly dusky. Fins mottled, left pectoral barred. Reaches over 305 mm. (Jordan and Goss.)

Tropical Atlantic.

***Syacium micrurum* Ranzani**

Linguado (St. Thomas Island)

Syacium micrurum RANZANI, 1840, Nov. Comm. Acad. Sci. Inst. Bonon., IV, p. 20, Pl. v. Brazil.

Hemirhombus aramaca (not Cuvier) OSORIO, 1894 (February), *Jorn. Sci. Math. Phys. Nat., Acad., Lisboa*, (2) III, p. 178 (Morro Peixe, St. Thomas Island; Principe Island; Rolas Island, West Africa); 1898, *op. cit.*, (2) V, p. 199 (Principe Island; St. Thomas, Rolas).—LAMPE, 1914, 'Deutsche Südpolar Exped.,' XV (7), p. 247 (Porto Grande, São Vicente, Azores).

Head $3 \frac{2}{5}$ to $3 \frac{3}{5}$; depth $2 \frac{1}{4}$ to $2 \frac{1}{2}$; dorsal 85 to 87; anal 67 or 68; scales 52 to 62 in lateral line to caudal base and 4 to 6 more in latter; 21 scales above lateral line, 21 below; snout $3 \frac{2}{5}$ to $4 \frac{1}{3}$ in head, measured from upper jaw tip to lower front eye edge; lower eye $3 \frac{4}{5}$ to $4 \frac{1}{3}$; maxillary $2 \frac{1}{3}$ to $2 \frac{2}{5}$; interorbital 3 to $3 \frac{3}{4}$ in eye.

Body elongately ovoid, deepest about first third in total length. Caudal peduncle with least depth $2 \frac{1}{5}$ to $2 \frac{1}{2}$ in total head length. Head width $3 \frac{1}{6}$ to $3 \frac{7}{8}$ in its length. Snout compressed, width $1 \frac{1}{8}$ to $1 \frac{2}{5}$ in its length. Lower eye with about $\frac{1}{4}$ its diameter advanced from upper, center about first third in head; diameter slightly longer than snout in young, a little less with age. Mouth small, curved, nearly vertical, jaws about even. Maxillary reaches opposite middle of lower eye; expansion $1 \frac{3}{4}$ to 2 in lower eye. Teeth small, simple, conic, rather irregularly biserial and inner row somewhat enlarged, especially on right side. Front nostril at about last third in snout as measured to lower eye, with a short flap; hind nostril simple pore close before lower eye. Interorbital narrow, with rather deep longitudinal groove. Preopercle edge entire.

Gill rakers 2 + 8, lanceolate, $1 \frac{1}{3}$ in gill filaments, which are 2 in eye. Sinistral scales with 14 to 17 basal radiating striae; apical denticles 31 to 44, in 2 irregular series transversely. Dextral scales with 18 to 21 basal radiating striae; circuli all fine. Fine scales cover bases of vertical fins. Lateral line not arched in front, complete; tubes small, slender, simple. Height of dorsal $2 \frac{4}{5}$ in head; height of anal 3; caudal rounded behind, $1 \frac{1}{3}$; pectoral $1 \frac{2}{5}$.

Left side brown, marked with numerous variable rays, spots or blotches of light gray to blackish; some light rings, each with a dark spot and dark rings with a pale spot. Usually 2 dark ocelli on lateral line just before caudal peduncle and another at end of depressed pectoral. Vertical fins pale, with a row of rather regularly scattered dark spots along both dorsal and anal and several across caudal. These fins are all more or less speckled with paler color. Right side pale or whitish. Length 63 to 134 mm.

Tropical Atlantic. Described above from American (Jamaica and Puerto Rico) examples.

***Syacium spilopterus* (Günther)**

Figure 241

Citharichthys spilopterus GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 421. Bahia; New Orleans; San Domingo; Jamaica; Niger Expedition.—STEINDACHNER, 1870, *Sitzs. Akad. Wiss. Wien*, LX (1), p. 975 (St. Louis).—BOULENGER, 1916, 'Cat. Fresh-water Fishes Africa,' IV, p. 4, Fig. 2 (type: Lagos, Lower Niger, Spanish Guinea, Angola).—FOWLER, 1919, *Proc. U. S. Nat. Mus.*, LVI, p. 260 (Elimina, Ashantee).

Hemirhombus stampfii STEINDACHNER, 1895, *Notes Leyden Mus.*, XVI, p. 52, Pl. III, fig. 3. Grand Cape Mount, Liberia.—PELLEGRIN, 1913, *Bull. Soc. Zool.*

France, XXXVIII, p. 152 (Konakry, Guinea), p. 152 (Ivory Coast), p. 153 (Lagune de Kotonou, Dahomey); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 73 (Konakry, Ivory Coast, Dahomey).

Head $3 \frac{1}{3}$ to $3 \frac{2}{5}$; depth $2 \frac{1}{8}$ to $2 \frac{2}{5}$; dorsal 75 to 88; anal 60 to 64; scales 44 or 45 in lateral line to caudal base and 6 more on latter; 18 or 19 scales above lateral line, 18 to 20 below; snout $4 \frac{1}{8}$ to $5 \frac{1}{2}$ in head measured to upper eye; upper eye 5 to $6 \frac{1}{8}$; maxillary $2 \frac{2}{5}$ to $2 \frac{3}{5}$.

Body elongately ellipsoid, deepest midway in its length. Caudal peduncle compressed, least depth $2 \frac{1}{5}$ to $2 \frac{2}{3}$ in total head length. Head greatly depressed, width $3 \frac{1}{4}$ to 4 in its length. Snout short, depressed, profile convex, width a little less than length to lower eye. Eyes about opposite, hind edges a little before middle in head length. Mouth cleft vertically inclined, jaws about even. Maxillary extends below middle of eyes; expansion $1 \frac{2}{3}$ to 2 in eye. Teeth conic, moderate, uniserial, equally developed in both sides of jaws, well spaced, depressible inward. Front nostril about last third in snout; hind nostril smaller, lower, opposite the edges

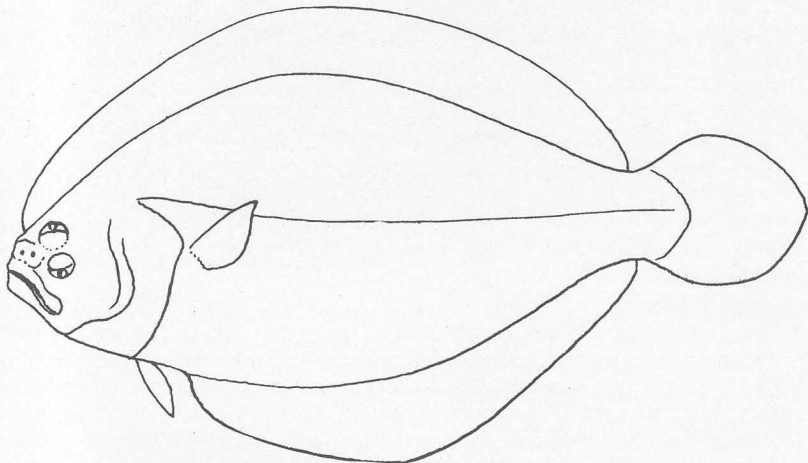


Fig. 241. *Syacium spilopterum*, from Boulenger.

of front of eyes. Interorbital is a narrow bony ridge, with a slight median groove. Preopercle entire.

Gill rakers $5 + 14$, lanceolate, $1 \frac{3}{4}$ in eye. Sinistral scales with 25 or 26 basal radiating striae; apical denticles 38 to 60, biserial; circuli very fine. Dextral scales with 25 or 26 basal radiating striae. Scales smaller along body edges; 8 rows across cheek from eye to preopercle ridge. Lateral line complete, median along side of body, nearly straight; tubes simple, well exposed. Dorsal begins about opposite front nostril; height of fin 2 to $2 \frac{1}{8}$ in head; height of anal 2 to $2 \frac{1}{8}$; caudal convexly rounded behind, $1 \frac{1}{6}$ to $1 \frac{2}{5}$; pectoral $1 \frac{4}{5}$ to $1 \frac{7}{8}$, left pectoral slightly longer than right.

Eyes and color on left side, largely dull uniform brown. Right side whitish. Length 106 to 168 mm.

Tropical Atlantic. Described above from an example obtained at the mouth of the Congo by the American Museum Congo Expedition. Others examined in this connection from Chiloangotown in Angola and Gaboon in the French Congo, also a series from America (Tobasco, Puerto Rico, Santo Domingo, and Trinidad). Reaches 177 mm.

***Syacium guineensis* (Bleeker)**

Papayo (Gorée), Linguado (Mossamedes)

Hemirhombus guineensis BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, XVIII, No. 2, p. 24, Pl. III. Asenfoe, Ashantee.—GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.', IV, p. 423 (Coast of Guinea).—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLV (1), p. 13 (Gorée).—BUETIKOFER, 1890, 'Reis. Liberia,' II, p. 480.—OSORIO, 1894 (February), Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 179 (St. Thomas Island).—STEINDACHNER, 1895, Notes Leyden Mus., XVI, p. 51 (Grand Cape Mount, Liberia).—OSORIO, 1898, *op. cit.*, (2) V, p. 199 (St. Thomas).—PELLEGRIN, 1905, Act. Soc. Linn. Bordeaux, LX, p. 31, Fig. (Guet N'Dar, Dakar); 1907, *op. cit.*, LXII, p. 83 (Gorée); 1912, Bull. Soc. Zool. France, XXXVII, p. 291 (Mossamedes); 1913, *op. cit.*, XXXVIII, p. 116 (Baie du Lévrier); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 73 (Baie du Lévrier, Guet N'Dar, Dakar, Gorée, Mossamedes).—REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 129 (Lagos).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 90 (Bay of Tarrofaí, São Antão, Cape Verde Islands).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 277 (Gorrei; Rio de Oro).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 280 (Baie du Lévrier; Rio de Oro).

Syacium guineensis FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 268 (Gaboon).

Head $3\frac{1}{4}$ to $3\frac{7}{8}$; depth $2\frac{1}{6}$ to $2\frac{2}{5}$; dorsal 79 to 94; anal 60 to 74; scales 43 to 51 in lateral line to caudal base and 4 more on latter; 13 scales above lateral line, 18 below; snout $4\frac{3}{4}$ in head measured from its tip to lower eye; lower eye $4\frac{2}{3}$; maxillary $2\frac{1}{3}$; interorbital 8.

Body elongately ovoid, deepest about first $\frac{2}{3}$ in total length. Caudal peduncle with least depth $2\frac{1}{8}$ to $2\frac{1}{2}$ in total head length. Head width $3\frac{1}{3}$ to $3\frac{1}{2}$ in its total length. Snout compressed, as long as wide. Lower eye advanced about half its diameter to upper and its center to about first third in head, as long as snout and greater than interorbital. Mouth vertically inclined, jaws about even. Maxillary reaches opposite middle of lower eye; expansion $1\frac{3}{4}$ in latter. Teeth irregularly biserial, all of inner row in each jaw little enlarged; several anterior upper teeth a little enlarged and canine-like; apparently teeth in jaws in young uniserial. Nostrils separated; front one with a short flap midway in snout; hind one simple pore midway between anterior and lower front eye edge. Interorbital level, with a slight bony ridge on each side. Preopercle entire.

Gill rakers 1 to 5 + 8 to 15, lanceolate, $\frac{1}{2}$ of gill filaments, which are $1\frac{2}{3}$ in eye. Sinistral scales with 19 to 22 basal radiating striae; circuli fine. Dextral scales with 24 to 26 basal radiating striae. Very small scales in interorbital, post-ocular and infraorbital of lower eye; vertical fins with small scales basally. Lateral line nearly straight, without a distinct arch anteriorly; tubes simple, slender. Height

of dorsal 2 1/2 in head; height of anal 2 1/2; caudal rounded convexly behind, 1 3/5; pectoral 1 1/4.

Left side dull uniform brown. Right side whitish. Length 45 to 163 mm.

Tropical Atlantic. Described above from two young examples from the Gaboon, French Congo, and one adult from Brazil (Rio de Janeiro).

ARNOGLOSSUS Bleeker

Arnoglossus BLEEKER, 1862, Versl. Akad. Wet. Amsterdam, XIII, p. 427. Type: *Pleuronectes arnoglossus* Schneider. Tautotypic.

Eyes sinistral. Mouth wide, or rather wide. Maxillary more or not much less than 1/3 of head. Teeth small, equal, uniserial or imperfectly biserial; vomer and palate toothless. Interorbital is a narrow ridge, sometimes with median groove. Gill membranes broadly united below throat. Gill rakers slender, styliform. Vertebrae 38, of which 28 caudal. Scales moderate, deciduous, cycloid or weakly ctenoid. Lateral line distinctly arched in front. Dorsal begins on snout. Dorsal and anal rays simple. Both pectorals present. Ventral free from anal.

Eastern Atlantic, Mediterranean, and East Indies. Species few.

KEY TO THE SPECIES

a.—Scales 55 to 60 in lateral line.

b.—Some of front dorsal rays produced.

c.—Dorsal with first 4 rays produced; anal rays 76 to 79. *imperialis*.

cc.—Only second dorsal ray produced, nearly long as head; anal rays 60 to 67. *thori*.

bb.—Front dorsal rays not produced, not longer than others; anal rays 72.

capensis.

aa.—Scales 45 in lateral line; front dorsal rays not produced; anal rays 61 to 63.

aspilos.

Arnoglossus imperialis (Rafinesque)

Bothus imperialis RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 23. Sicily.

Arnoglossus lophotes GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 417. Europe (British ?).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 407 (off Cape Blanco, 39 to 77 m.).

Head 2 1/2 to 4 3/4; depth 2 2/3 to 2 4/5; dorsal 95; anal 77; scales 60 in lateral line; eye 5 in head. Snout with lower jaw slightly prominent, long as eye. Eyes separated by a very narrow elevated ridge, lower in advance of upper. Maxillary little less than 1/3 in head. Scales deciduous; front curve of lateral line subsemicircular. Four anterior dorsal rays elongate, nearly long as head; dorsal begins in front of upper eye and ends close by caudal. Caudal somewhat shorter than head, rounded. Pectoral 2/3 of head. Color uniform. Length 203 to 254 mm. (Günther.)

North East Atlantic.

Rhombus cristatus Lowe¹ is imperfectly described. It may be synonymous. The chief characters set forth by Lowe are as follows:

¹1839, Proc. Zool. Soc. London, p. 88. (Madeira); 1839 (1849), Trans. Zool. Soc. London, III, p. 15 (Madeira).

Dorsal 98; anal 75. Body elongate, ellipsoid. Eyes together. Teeth slender, pointed, uniserial above. Scales large, deciduous, edges rough. Second to fourth dorsal rays elongate, produced. Left side brown, immaculate.

Arnoglossus thori Kyle

Arnoglossus thori KYLE, 1913 (June 25), 'Rept. Danish Oceanogr. Exped. Medit.,' No. 2, p. (14) 55, Fig. 8. Santander, Bay of Biscay; N. lat. 23° 35', W. long. 17° 14', near Canary Islands; N. lat. 23° 46', W. long. 11° 5'; Mediterranean; Sea of Marmora.—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 280 (Cape Blanco).

Pleuronectes grohmanni (not Bonaparte) VAILLANT, 1888, 'Expéd. Sci. "Travailleuse" et du "Talisman,"' Poiss., p. 188 (off Morocco in 112 to 120 m.; off Soudan in 102 to 175 m.; off Cape Verde in 75 to 90 m.).

Arnoglossus grohmanni MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 407 (off Cape Blanco, 77 m.).

Head $3\frac{1}{2}$ to $3\frac{3}{4}$; depth $2\frac{1}{2}$; dorsal 89; anal 66; scales 51 in lateral line to caudal base and 14 more on caudal basally; 12 scales above lateral line, 12 or 13 below; snout 4 in head, measured from upper jaw tip to lower eye; lower eye $3\frac{1}{4}$ to $5\frac{1}{4}$; maxillary $2\frac{3}{5}$ to $2\frac{3}{4}$; interorbital $2\frac{1}{2}$ to 5 in eye.

Body elongately ovoid, deepest about first $\frac{2}{5}$ in total length. Caudal peduncle with least depth $2\frac{1}{6}$ to $2\frac{1}{4}$ in total head length. Head width $3\frac{3}{4}$ to 4 in total head length. Snout compressed, width $1\frac{1}{3}$ to $1\frac{2}{5}$ in its length. Lower eye slightly advanced, center about at first third in head measured from upper jaw tip; about at first $\frac{2}{5}$ in total head length in young; $1\frac{1}{2}$ in snout; snout $\frac{3}{4}$ of lower eye in young. Mouth large, lower jaw protruded. Maxillary reaches opposite front edge of lower eye; expansion $1\frac{4}{5}$ to 3 in lower eye. Teeth rather slender, conic, uniserial, better developed on right side above and some of anterior slightly enlarged in both jaws; palate toothless. Interorbital long, narrow frenum, with median longitudinal groove. Preopercle edge entire.

Gill rakers 9, lanceolate, as long as gill filaments or $1\frac{4}{5}$ in eye. Sinistral scales with 50 to 55 basal radiating striae; apical denticles 33 to 43, uniserial; circuli fine. Dextral scales with 48 to 50 basal radiating striae; no denticles. Scales thin, caducous, well exposed, cover head and trunk; small scales on bases of vertical fins. Lateral line complete, arched anteriorly or arch $\frac{1}{3}$ of straight section; tubes all simple, well exposed. Height of dorsal 2 to $2\frac{1}{5}$ in total head length; height of anal $2\frac{1}{8}$ to $2\frac{2}{5}$; caudal ends in median point behind, $1\frac{1}{4}$ to $1\frac{1}{2}$; pectoral $1\frac{1}{2}$ to $1\frac{3}{5}$.

Pale brown on left side, right side whitish. Length 40 to 108 mm.

Eastern Atlantic and Mediterranean. Described above from a series of Mediterranean examples.

Arnoglossus capensis Boulenger

Arnoglossus capensis BOULENGER, 1902, 'Marine Invest. South Africa,' I, p. 1. False Bay, Cape Colony.—CLARK, 1913, Proc. Roy. Phys. Soc. Edinburgh, XIX, p. 385 (Ascension Island).

Head $4\frac{1}{2}$; depth $2\frac{1}{4}$; dorsal 81; anal 72; scales 60 in lateral line. Snout $\frac{2}{3}$ diameter of eyes, which $3\frac{1}{2}$ times in head and 4 times in interocular width.

Mouth symmetrical, 3 1/2 in head; lower jaw projects little beyond upper. A single series of small teeth. Maxillary extends to below front edge of lower eye. Gill openings moderately wide. Scales moderate, smooth, very thin, deciduous. Lateral line single, with a semicircular curve above pectoral. Dorsal begins on snout, rays about half of head. Caudal distinct from dorsal and anal, rounded nearly long as head. Left pectoral 2/3 of head, right pectoral 1/2. Colorless. Length 160 mm. (Boulenger.)

South Africa and Ascension Island.

Arnoglossus aspilos (Bleeker)

Rhombus aspilos BLEEKER, 1850, 'Nat. Tyds. Ned. India,' I, p. 408. Batavia.

Arnoglossus aspilus CAPELLO, 1872, *Jorn. Sci. Math. Phys. Nat., Acad., Lisboa*, p. 85 (Angola).—OSORIO, 1898, *Jorn. Sci. Math. Phys. Nat., Acad., Lisboa*, (2) V, p. 199 (Angola).

Head nearly 4; depth 2 1/3; dorsal 80 to 82; anal 61 to 73; scales 45 in lateral line. Snout with lower jaw prominent. Lower eye in advance of upper. Maxillary 2/5 of head. Interorbital width less than 1/2 of eye, which is 4 in head. Portion of humeral arch projects beyond ventral. Dorsal and anal continued on to caudal root. Uniform brownish gray. Length 77 mm. (Günther.)

East Indies. Reported from Angola by Capello.

PLATOPHRYS Swainson

Platophrys SWAINSON, 1839, 'Nat. Hist. Animals,' II, p. 302. Type: *Rhombus ocellatus* Agassiz. Monotypic.

Solea CATESBY, 1771, 'Hist. Nat. Carolina,' II, 2d Ed., p. 27. Type: *Pleuronectes lineatus* Linné. (Designated by Jordan and Evermann, 1917, Stanford Publications, 'Genera of Fishes,' Part 1, p. 31.) (Inadmissible.)

Peloria (not *Pelorus* Montfort, 1808) COCCO, 1844, 'Intorno ad alcuni nuovi pesci del mare di Messina' (letter from Prof. Anastasio Cocco to Signor Augusto Krohn), p. 21. Type: *Peloria podas* Cocco.

Coccolus (Bonaparte) COCCO, *loc. cit.*, p. 21. Type: *Coccolus annectens* Cocco.

Rhomboidichthys BLEEKER, 1856, *Act. Soc. Ind. Néerl. (Menado-Maccas.)*, I, p. 67. Type: *Rhombus myriaster* Schlegel. Monotypic.

Charybdia FACCIOLA, 1885, 'Nat. Sicil.,' IV, p. 265. Type: *Peloria ruppelii* Cocco.

Trichopsetta GILL, 1888, *Proc. U. S. Nat. Mus.*, p. 603. Type: *Citharichthys ventralis* Goode and Bean. Monotypic.

Perissias JORDAN AND EVERMANN, 1898, *Bull. U. S. Nat. Mus.*, No. 47, part 3, p. 2667. Type: *Platophrys taeniopterus* Gilbert. Monotypic.

Body ovate, strongly compressed. Mouth comparatively small. Maxillary third or less of head. Teeth small, subequal, in 1 or 2 series, none on vomer or palatines. Interorbital broad, concave, widest in adult males. Gill rakers moderate. Scales adherent, very small, ctenoid. Lateral line with a strong arch in front. Dorsal begins before eye, rays simple. Caudal convex behind. Left pectoral usually with one or more filamentous rays, longest in male. Left ventral on abdominal ridge. Coloration usually variegated, sinistral.

Small flounders, widely diffused in most warm seas. Sexual differences great, males with broad interorbital and long pectoral.

KEY TO THE SPECIES

- a.—Dorsal and anal rays anteriorly each with a basal spinule, also each is largely covered by little rough scales; scales 84 to 89 in lateral line. *podas*.
 aa.—Dorsal and anal rays without spinules; scales 88 to 96 in lateral line. *lunatus*.

Platophrys podas (De la Roche)

Tapaculo (Canaries)

Figure 242

Pleuronectes podas DE LA ROCHE, 1809, Ann. Mus. Paris, XIII, pp. 318, 354, Pl. xxiv, fig. 14. Ivica.

Bothus podas STEINDACHNER, 1867, Sitzs. Akad. Wiss. Wien, p. 51 (Santa Cruz, Teneriffe); 1868, *op. cit.*, LVII (1), p. 717 (Teneriffe).—OSORIO, 1895, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) II, p. 129 (St. Thomas).—EHRENBAUM, 1913, Fischerbote, V, p. 362 (Cameroon).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 134 (Rosario in 16 m.; Povoção, Azores, 10 m.).

Rhomboidichthys podas GÜNTHER, 1880, 'Rept. Voy. "Challenger,"' I, p. 3 (St. Vincent).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 328 (Canaries).—OSORIO, 1898, *op. cit.*, (2) V, p. 199 (St. Thomas).—CLARK, 1913, Proc. Roy. Phys. Soc. Edinburgh, XIX, p. 385 (Ascension Island).

Platophrys podas JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 347 (Canary Islands).—CUNNINGHAM, 1910, Proc. Zool. Soc. London, p. 113 (St. Helena).—FOWLER, 1923, Proc. Acad. Nat. Sci. Philadelphia, p. 35 (Praia Formosa, Madeira).

Rhombus heterophthalmus BENNETT, 1831, Proc. Zool. Soc. London, p. 147. Atlantic coast of North Africa.

Rhombus madeirensis LOWE, 1833, Proc. Zool. Soc. London, I, p. 143. Funchal Bay, Madeira; 1838, Trans. Cambridge Philos. Soc., VI, p. 201, Pl. vi, fig. 1 (Porto Santo Island, Madeira).

Rhombus serratus VALENCIENNES, 1836–1844, 'Hist. Nat. Canaries,' II (2), p. 82. Canary Islands.

Rhombus serratus VALENCIENNES, *op. cit.*, Pl. xviii, fig. 1.—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 403 (Santa Cruz, Teneriffe).

Rhomboidichthys mancus (not Broussonet) GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 432 (Madeira, Lanzarote).—PELLEGRIN, 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanco, Cape Verde); 1905, Act. Soc. Linn. Bordeaux, LX, p. 32 (Nouakchott); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 24 (Nouakchott).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 280 (Nouakchott).

Platophrys mancus LAMPE, 1914, 'Deutsche Südpolar Exped.,' Fisch., XV, p. 247 (Ascension Island; Ponta Delgada, Azores).

Bothus mancus VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 134 (Rosario, Corvo in 16 m.; Povoção in 10 m.; Porto Santo, N. lat. 33° 2', W. long. 16° 20', in 100 m.).

?*Pleuronectes linguala* POGGI, 1881, (article in 'Guidebook of Canary Islands') 'Guia de Santa Cruz de Teneriffe,' [p. d. 35].

Head $3\frac{1}{3}$ to $4\frac{1}{6}$; depth $1\frac{2}{3}$ to $1\frac{4}{5}$; dorsal 87 to 90; anal 66 to 71; scales 79 to 81 in lateral line to caudal base and 5 more on latter; 21 or 22 scales above lateral line, 38 to 41 below; snout 4 to 5 in head measured from its tip to lower eye; lower eye 3 to $4\frac{3}{4}$; maxillary 3 to $3\frac{7}{8}$; interorbital $2\frac{2}{3}$ to $4\frac{3}{5}$.

Body rather deeply ovoid, deepest about first $\frac{2}{5}$ in total length. Caudal peduncle with least depth $2\frac{1}{4}$ to $2\frac{1}{3}$ in total head length. Head width $3\frac{1}{3}$ to $3\frac{4}{5}$ in its length. Snout compressed, width 1 to $1\frac{1}{4}$ in its length. Eyes well separated, lower nearly entirely in advance of upper; in young only $\frac{3}{5}$ of lower eye in advance and a little greater than snout or interorbital; in adult lower eye is slightly less than snout or interorbital. Mouth inclined, mandible well protruded. Maxillary well inclined, reaches opposite front edge of lower eye, slightly beyond in young;

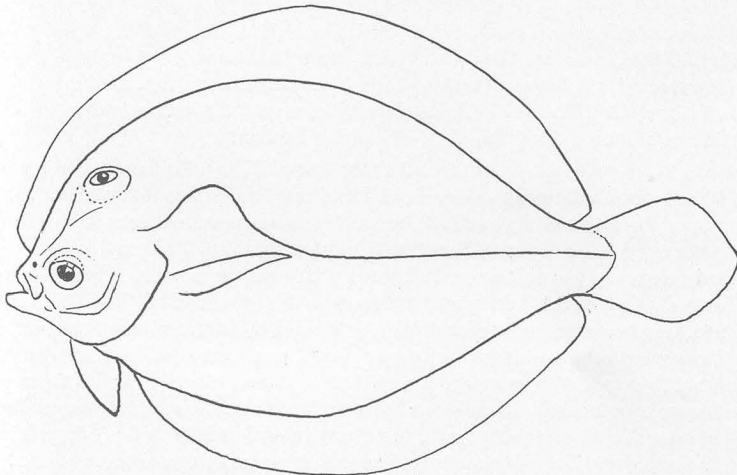


Fig. 242. *Platophrys podas*, from Valenciennes.

expansion 2 to $2\frac{1}{3}$ in eye. Teeth conic, simple, mostly rather irregularly biserial, triserial at front of upper jaw and inner series slightly enlarged; palate toothless. Nostrils small, together, close before lower eye, with a slight fringed flap. Interorbital rather deeply concave.

Gill rakers 5+9, lanceolate, $\frac{1}{3}$ of gill filaments, which $1\frac{1}{3}$ in eye. Sinistral scales caducous, with 35 to 40 radiating basal striae; rather large apical denticles 3 to 13, transversely rows 2 or 3; circuli fine. Dextral scales with 33 or 34 basal radiating striae. Scales all small on vertical fins, small denticle at base of each anterior dorsal and anal ray each side. Lateral line with a strong arch anteriorly, which 4 in straight section; tubes small, well exposed, each with a small terminal branch above or below. Height of dorsal medianly $2\frac{1}{3}$ to $2\frac{2}{5}$ in total head length; height of anal medianly $2\frac{1}{8}$ to $2\frac{1}{2}$; caudal rounded convexly behind, $1\frac{1}{8}$ to $1\frac{1}{5}$; pectoral $1\frac{1}{2}$ to 2.

Left side blackish brown, also fins. Right side whitish, including right ventral and fin edges inclining from grayish to dusky, especially on caudal terminally. Iris largely slaty. Length 62 to 170 mm.

Eastern Atlantic and Mediterranean. Described above from a series of examples from the Mediterranean and Praia Formosa, west of Funchal, Madeira.

Two in the U. S. National Museum received from Captain William Stimpson, labelled from West Africa.

Three from Fayal, Azores, and one from Madeira, largest 140 mm. in the Museum of Comparative Zoölogy.

Possibly *Rhombus senegalensis* Kaup as credited by Duméril¹ may have been intended for the present species?

Platophrys lunatus (Linné)

Pleuronectes lunatus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 269 (on *Solea lunata* Catesby, 1732, 'Nat. Hist. Carolina,' II, Pl. xxvii [Bahamas]).

Rhomboidichthys lunatus OSORIO, 1894 (February), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 179 (Rolas Canal, between St. Thomas and Rolas Island, West Africa); 1898, *op. cit.*, (2) V, p. 199 (Rolas Island).

Head $3\frac{1}{3}$ to $3\frac{1}{2}$; depth 2 to $2\frac{1}{10}$; dorsal 93 to 100; anal 73 or 74; scales 84 to 90 in lateral line to caudal base and 4 to 6 more on latter; 44 or 45 scales above lateral line, 42 to 45 below; snout $3\frac{7}{8}$ to 4 in head measured from its tip to lower eye; lower eye $5\frac{4}{5}$ to 6; maxillary 3 to $3\frac{1}{8}$; interorbital $2\frac{2}{3}$ to $3\frac{1}{5}$.

Body elongately ovoid, deepest about first $\frac{2}{5}$ in total length. Caudal peduncle with least depth 3 to $3\frac{1}{8}$ in total head length. Head width $3\frac{1}{5}$ to $3\frac{2}{3}$ in total head length. Snout compressed, width $1\frac{2}{5}$ to $1\frac{1}{2}$ in its length. Eyes well separated, lower entirely in advance of upper, front pupil edge at first third in head, diameter $1\frac{3}{4}$ to $1\frac{4}{5}$ in snout, 2 to $2\frac{1}{2}$ in interorbital. Mouth rather small, mandible well protruded. Maxillary a little inclined from the vertical; expansion 1 to $1\frac{1}{4}$ in eye. Teeth biserial in jaws, inner row in each a little enlarged; palate and tongue edentulous. Nostrils close together, each in a small tube, within the last fourth of snout below lower eye. Interorbital deeply concave. Preopercle edge entire.

Gill rakers 9, lanceolate, about half length of gill filaments which are as long as eye. Sinistral scales with 78 to 86 basal radiating striae; 5 to 10 feeble apical denticles, 3 or 4 series transversely; circuli fine. Dextral scales with 50 to 88 radiating basal striae. Scales firmly adherent, all smaller and crowded about body edges and largely over vertical fins; on blind side no scales at bases of anterior dorsal and anal rays. Lateral line complete, with a small strong arch anteriorly, $4\frac{1}{2}$ to $4\frac{3}{5}$ in straight section; tubes all simple, each with but few or no short weak branches. Height of dorsal medianly $2\frac{4}{5}$ in total head length; height of anal medianly $2\frac{4}{5}$; caudal rounded convexly behind, $1\frac{2}{5}$ to $1\frac{3}{5}$; pectoral $1\frac{4}{5}$ to $3\frac{1}{5}$ in combined head and trunk.

Left side pale warm brown, with pale blue rings, variable, though the largest is on middle of side; on head and about body edges rings even smaller than pupil, largest even little larger than eye; also each blue ring or spot with very dark brown outer bordering line. On lateral line 3 deep dusky brown blotches, larger than eye; first one at end of arch, second one a little before middle of straight section and last close before caudal base. Right side of body, inclusive of vertical fins, whitish.

¹ 1859, Nouv. Mus. Hist. Nat. Paris, X, p. 264 (Senegal.)

Male with large conic spine on left side in front of maxillary and left pectoral greatly produced. Reaches 266 to 285 mm.

Tropical Atlantic. Described from a series of American (Bahamas and West Indies) examples. Reaches 458 mm.

LEPIDORHOMBUS Günther

Lepidorhombus GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, pp. 407, 411. Type: *Pleuronectes megastoma* DONOVAN. Monotypic.

Body oblong, much compressed. Eyes on left side. Mouth wide. Maxillary more than 1/3 of head. Each jaw with narrow band of villiform teeth, without canines. Vomer with teeth, none on palatines. Gill membranes scarcely united on throat. Gill rakers lanceolate, well developed. Branchiostegals 7. Vertebrae 41, of which 30 caudal. Scales small, ctenoid, deciduous. Dorsal begins on snout. Both pectorals present. Ventrals free from anal.

Lepidorhombus whiff-iagonis (Walbaum)

Pleuronectes whiff-iagonis WALBAUM, 1792, 'Arted. Pisc.,' III, p. 120 (on *Whiff Pennant*, 1776, 'Brit. Zool.,' III, p. 238. Cornwall).

Pleuronectes megastoma VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 188 (off Morocco and Azores, 550 to 560 m.); 1919, Rés. Camp. Sci. Monaco, LII, p. 134 (Banc Princesse Alice, N. lat. 37° 57', W. long. 29° 15', in 200 m.).

Head 3; depth 2 1/3; dorsal 85 to 91; anal 61 to 75; scales 104 to 110 in lateral line; snout measured to lower eye 3 1/8 in head as measured from snout tip; eye 5 1/2; maxillary 1 7/8.

Body ovoid. Least depth of caudal peduncle 3 1/2 in total head length. Lower eye nearly half in advance from upper. Mouth cleft oblique, lower jaw protruding. Maxillary reaches opposite hind pupil edge of lower eye. Teeth rather small, biserial; some on vomer; none on palatines. Interorbital narrow ridge. Gill rakers close set, about half of eye. Scales strongly ctenoid, covering head and body, also a row along each fin ray. Lateral line arched above pectoral, 2 1/5 in horizontal section to caudal base. Dorsal fin begins before upper eye. Caudal cuneate, a little less than head. Pectoral slightly less than half of head. Left side brownish yellow, with obscure spots. Right side white, sometimes tinged red. Length 253 mm. (Day.)

Northeast Atlantic. Reaches 598 mm.

Soleidae

Soles

Body oblong or elongate. Eyes small, close together, with or without a bony ridge between. Mouth very small, much twisted toward eyed side. Teeth in villiform bands, very small or obsolete. Preopercle edge adnate, concealed by skin and scales. Gill membranes adnate to shoulder girdle above. Gill openings narrow. Body usually scaly. Pectorals small or absent. Ventrals small, one or both sometimes wanting.

Small fishes of sandy bottoms, those of sufficient size valued as food. *Solea aurantiaca* reported from Mogador, Morocco, by Baader (1873-1874, Ber. Senckenberg, Naturf. Gesell., p. 182).

KEY TO THE GENERA

- a.—SOLEINAE. Eyes and color dextral, former separated by a bony ridge.
 b.—Vertical fins well separated; body elliptical or elongate, depth 1/3 to 2/5 of length.
 c.—Body elongate; pectorals subequal, present on both sides. . . . SOLEA.
 cc.—Body oblong; pectoral usually small, sometimes absent from blind side. . . . MONOCHIRUS.
 bb.—Vertical fins fully confluent around short tail; body oblong. . . SYMPHURUS.
 aa.—SYNAPTURINAE. Eyes and color dextral; ventrals distinct; vertical fins confluent; eyes not separated by bony ridge.
 d.—Pectorals present. . . . SYNAPTURA.
 dd.—Pectorals absent. . . . MONODICHTHYS.
 aaa.—CYNOGLOSSINAE. Eyes and color sinistral; no pectorals; ventrals, if present, free from anal; eyes not separated by bony ridge. . . . CYNOGLOSSUS.

SOLEA Quensel

Solea QUENSEL, 1806, Svensk. Vet. Akad., Nya Handling, Stockholm, XXVII, pp. 44, 203. Type: *Pleuronectes solea* Linné. Tautotypic.

Pegusa GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, pp. 462, 467. Type: *Solea pegusa* (not Lacépède) Yarrell = *Solea aurantiaca* Günther. Tautotypic.

Bathysolea ROULE, 1916 (May 20), Bull. Inst. Océanogr. Monaco, No. 320, p. 28. Type: *Bathysolea albida* Roule. Monotypic.

Eusolea ROULE, *loc. cit.* Type: *Pleuronectes solea* Linné. (*Eusolea* Roule evidently intended for *Solea* Quensel.)

Dicologlossa CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 14. Type: *Solea cuneata* Moreau. Orthotypic.

Body elongate, depth 1/3 to 2/5 of its length. Gill openings moderate, confluent below. Vertebrae 47 to 50. Lateral line single on both sides. Vertical fins well separated. Pectorals subequal, present on blind side. Right ventral with short base, free from anal.

Eastern Atlantic and neighboring seas. The key below is largely from the excellent revision by Chabanaud.

KEY TO THE SPECIES

- a.—Pectoral robust, usually long, left always present, rays 7 to 10, upper ray simple and others branched.
 b.—First dorsal ray inserted on upper edge of head; front nasal tube of blind side cylindrical or base weakly swollen; urohyal angle obtuse, straight or feebly arched.
 c.—DICOLOGLOSSA. Supratemporal prolongation of lateral line forms S with curves angular, ascending branch oblique and upper curve behind vertical of lower; scale striae short, scroll-like; right pectoral obliquely truncate terminally.
 d.—Caudal free from dorsal and anal.

- e.*—Dorsal 61 to 71; anal 52 to 56; scales 90 to 92; a row of ocellated spots along dorsal base and a symmetrical series along anal base. *hexophthalma*.
- ee.*—Dorsal 78 to 83; anal 61 to 67; scales 112 to 130; ocellated spots symmetrical, rather small, present only in young of less than 100 mm. *theophila*.
- dd.*—Caudal joined by membranes with dorsal and anal.
- f.*—Dorsal 81 to 89; anal 65 to 77; scales 105 to 130; depth 4 or more. *cuneata*.
- ff.*—Dorsal 69 to 77; anal 56 to 60; scales 70; depth about 3. *chirophthalmus*.
- cc.*—SOLEA. Supratemporal prolongation of lateral line forms S with curves rounded, ascending branch vertical; scale striae long, form undulate transverse lines; right pectoral rounded.
- g.*—Space between front nasal tube and edge of head on blind side 1 1/2 to 1 3/4 in space between front nasal tube and mouth cleft; round black spot on right half of pectoral terminally. *solea*.
- gg.*—Space between front nasal tube and edge of head on blind side 2 1/2 in space between front nasal tube and mouth cleft; pectoral membrane entirely black. *senegalensis*.
- bb.*—PEGUSA. First dorsal ray inserted on front edge of head; front nasal tube of blind side dilated terminally; supratemporal prolongation of blind side 1/2 circumference; jaw angle arched.
- h.*—Front nasal tube on blind side cylindrical, external edge without or with very short cilia, aperture contracting by crescentic membrane; hind nostril separated from front one and opening at level of body far more elevated than base of tube, orifice directed posteriorly; scale striae long, form undulate transverse lines; pectoral less than 1/3 of head. *kleinii*.
- hh.*—Front nostril like rosette, outer edge with long cilia, aperture obstructed by numerous cartilaginous partitions, radiating from edge to center; hind nostril close to front one, opening clearly at level of base of tube, orifice directed ventrally; pectoral more than 1/3 of head.
- i.*—No ocellated spots on lateral line; scale striae undulate, transverse lines. *lascaris*.
- ii.*—Three ocellated spots in lateral line; scale striae short, scroll-like. *triophthalmus*.
- aa.*—BATHYSOLEA. Pectoral short, slender, rays all simple, mostly setiform, right

with 5 at most and left mostly rudimentary or absent; prolongation of supra-temporal part of lateral line not at all or only slightly distinct, forms S, ascending branch oblique, upper arch somewhat behind vertical of lower; nasal tube of blind side cylindrical or weakly swollen at base.

j.—Dorsal 75 to 89; anal 61 to 71; scales 112 to 125. *profundicola.*

jj.—Dorsal 91; anal 73; scales 128.

lactea.

***Solea hexophthalma* Bennett**

Solea hexophthalma BENNETT, 1831, Proc. Zool. Soc. London, p. 147. Atlantic coast of North Africa.—GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 465 (type).—PELLEGRIN, 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanc, Cape Verde); 1905, Act. Soc. Linn. Bordeaux, LX, p. 132 (Nouakchott, Marsa, Côte mauritanienne; 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 74 (Baie du Lévrier; Côtes mauritaniennes).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 281 (Nouakchott).

Dicologlossa hexophthalma CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 16 (Mauretania coast).

Head 4 1/3; depth 2 1/2; dorsal 66; anal 49; scales 88 in lateral line. Inter-orbital very narrow, its width equals vertical diameter of eye. Nostrils on blind side hidden. Pectoral of colored side more developed than on blind side, length 1/2 of head. Brownish olive, with darker and lighter crossbands. Along dorsal base 3 black ocelli, edged with white, and 3 others along that of anal; ocelli alternate with smaller round whitish spots. Very indistinct brown band across caudal base. Length 77 mm. (Günther.)

Mauritania. Reaches 184 mm. according to Chabanaud.

***Solea theophila* (Risso)**

Figure 243

Pleuronectes theophilus RISSO, 1810, 'Ichth. Nice,' p. 313. Gulf of Nice.

Solea impar BENNETT, 1831, Proc. Zool. Soc. London, p. 147. Atlantic coast of North Africa.—GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 468 (type of *Solea impar* Bennett).

Solea azevia (Capello) STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII, p. 720 (name in synonymy), Pl. v. Lisbon, Cadiz, Gibraltar, Santa Cruz de Teneriffe, Bilbao, Barcelona.

Dicologlossa azevia CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 18 (Morocco; Mauretania).

Solea stephanica CHABANAUD, 1926, Bull. Soc. Zool. France, p. 12. Cape Blanco.—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 281 (types; Cape Blanco).

Head 4; depth 2 3/5; dorsal 67 to 76; anal 53 to 59; scales 115 in lateral line. Upper jaw produced into longish lobe, overhanging lower. One of nostrils on blind side very wide, circular, surrounded by a broad wreath of fringes. Width of inter-orbital space rather less than vertical diameter of orbit. Pectorals of both sides equal

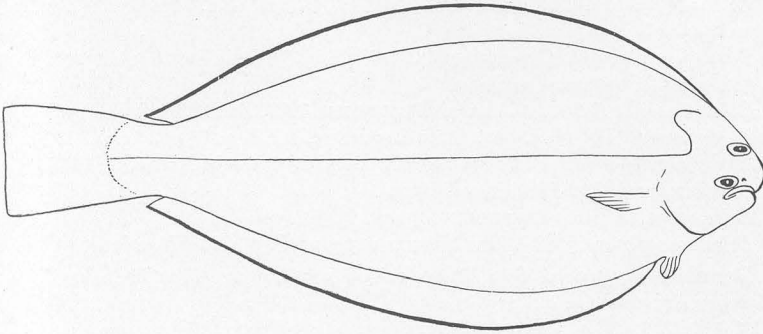


Fig. 243. *Solea theophila*, from Steindachner.

in length, $\frac{2}{5}$ of head. Grayish brown, marbled and dotted with black. Pectoral with black ocellus on middle of its hinder half. Length 153 mm. (Günther.)

Mediterranean and Mauritania. Chabanaud gives its maximum size at 360 mm.

***Solea cuneata* Moreau**

Figure 244

Solea cuneata MOREAU, 1881, 'Hist. Nat. Poiss. France,' III, p. 312. Trouve dans l'Océan; Loire; Poitou, Sables-d'Olonne, Rochelle; Golfe de Gascogne, Arcachon, Bayonne, Saint-Jean-de-Luz.—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 135 (off Morocco in 11 m.).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 280 (note).

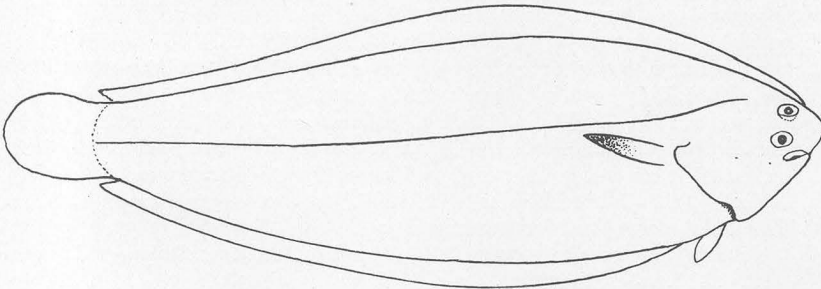


Fig. 244. *Solea cuneata*, from Pellegrin.

Soleata cuneata DE LA PYLAIE, 1834 [1835], Congrès Sci. France, Poitiers, p. 534 (*nomen nudum*).

Dicologlossa cuneata CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 23 (Morocco; Senegal).

Solea senegalensis var. *m'baoensis* PELLEGRIN, 1907, Bull. Soc. Zool. France, p. 87. M'bao, Senegal; 1907, Act. Soc. Linn. Bordeaux, LXII, p. 83 (M'bao); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 75, Pl. I, fig. 1 (type).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 278 (Cape Blanco).

Solea vulgaris (part) PELLEGRIN, *op. cit.*, p. 74.

Solea senegalensis (not Kaup) METZELAAR, *op. cit.*, p. 228 (Casada Bay).

Dorsal 81 to 89; anal 65 to 77; scales 105 to 132, above 25 to 29, below 29 to 35. Body very elongate. Snout profile obtuse. Eye $4\frac{1}{2}$ to $7\frac{1}{8}$ in head. Right pectoral $1\frac{1}{2}$ to 2. Gray-brown. Sometimes deeper brown spots along dorsal base, size of eye or smaller. Similar spots also along anal base. Right pectoral with terminal black blotch. Reaches 260 mm. (Chabanaud.)

Eastern Atlantic, France, Mediterranean to Senegal.

Solea chirophthalmus Regan

Solea chirophthalmus REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 129. Lagos.

Dicologlossa chirophthalmus CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 28 (no locality).

Head $4\frac{1}{2}$; depth $2\frac{2}{3}$ to $2\frac{4}{5}$; dorsal 69 to 77; anal 56 to 60; scales 65 to 72 in longitudinal series. Upper eye somewhat in advance of lower; diameter is equal to or a little less than snout, 5 or 6 in head and about twice interorbital; maxillary extends below posterior $\frac{1}{4}$ of eye. No dilated nostril on blind side. Caudal rounded, contiguous to dorsal and anal. Right pectoral with 9 rays, $\frac{1}{3}$ of head; left pectoral with 7 or 8 rays, not more than $\frac{1}{4}$ of head. Grayish, with traces of dark spots on body, series of 5 or 6 near bases of dorsal and anal apparently alternating with series of lateral line. Pectoral with blackish ocellus. Length 170 to 200 mm. (Regan.)

Lagos.

Solea solea (Linné)

Pleuronectes solea LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 270. European Seas.

Solea vulgaris STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1), p. 720 (Teneriffe).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 328 (Grand Canary).—PELLEGRIN, 1905, Act. Soc. Linn. Bordeaux, LX, p. 32 (Nouakchott, Cape Blanco); 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanco, Cape Verde).—PRIETSMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 113 (Mogador, Agadir, and Azamor, Morocco).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 407 (off Morocco, 141 m.; Cape Blanco, 77 m.).—PELLEGRIN, 1913, *op. cit.*, XXXVIII, p. 116 (Baie du Lévrier); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 74 (Baie du Lévrier, Côtes Mauritanienes).

Solea vulgaris typica CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 32 (Agadir, Morocco).

Head 5 to $5\frac{1}{2}$; depth $3\frac{1}{6}$ to $3\frac{1}{4}$; dorsal 83 or 84; anal 71 or 72; scales 120 to 139 in lateral line to caudal base; 31 to 36 scales above lateral line, 34 to 40

below; snout measured to upper eye $4 \frac{1}{8}$ to $4 \frac{1}{3}$ in head; upper eye 6 to $7 \frac{1}{3}$; mouth curve 4.

Body elongately ovoid, with greatest depth at about first fourth in total length. Head greatly depressed, width $3 \frac{1}{4}$ to $3 \frac{1}{3}$ in its length. Upper eye about $\frac{1}{2}$ its diameter in advance of lower, hind edge of latter at first $\frac{2}{5}$ in head, or about first $\frac{3}{7}$ in young. Mouth cleft well curved. Teeth firm, in a broad band inside blind side only. Lips rather thin on right side; thick, fleshy, with longitudinal plicae on left side and no cirri. Front nostril in fleshy papilla at last third in snout length to lower eye; hind nostril a simple pore, rather close behind front one. Interorbital little depressed concavely, width slightly greater than eye.

Gill rakers as 3+6 obsolete feeble papillae; gill filaments a little greater than lower eye. Scales with 14 or 15 apical denticles, 3 series transversely; basal radiating striae 16 or 17; circuli fine. Cirri or fringes on blind portion of predorsal, snout and lower sides moderately developed. Dorsal and anal have basal halves finely scaled dextrally, also greater basal portion of caudal. Height of dorsal $2 \frac{1}{4}$ to $2 \frac{1}{2}$ in head; height of anal $2 \frac{1}{4}$ to $2 \frac{1}{2}$; caudal rounded convexly behind, $1 \frac{1}{5}$ to $2 \frac{2}{5}$; pectoral $2 \frac{1}{2}$ to 3, little less developed on blind side.

Right side brown, left side whitish. Vertical fins on right side finely specked with brown. In young, the outer $\frac{2}{5}$ of pectoral are blackish. Left pectoral whitish. Length 152 to 350 mm.

Eastern Atlantic and Mediterranean. Described above from a series of Italian examples. Chabanaud gives 405 mm. as the maximum size.

***Solea senegalensis* Kaup**

Derer (Senegambia)

Solea senegalensis KAUP, 1858, Archiv Naturg., p. 94. Senegal.—DUMÉRIL, 1859, Arch. Mus. Hist. Nat. Paris, X, p. 264 (Senegal).—GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.', IV, p. 464 (copied).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalaise,' Poiss., p. 115 (Dakar, Gorée, Argain Bay, Guet N'Dar).—PELLEGRIN, 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 74 (St. Louis, Senegal).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 282 (note).—CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 36 (Morocco; Senegal).

Solea vulgaris var. *melanochir* PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 116 (Baie du Lévrier); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 74 (Baie du Lévrier).

Solea melanochir CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 281 (Baie du Lévrier).

Head $4 \frac{1}{2}$ to $5 \frac{1}{2}$; depth $3 \frac{1}{5}$ to $3 \frac{1}{2}$; dorsal 82 to 84; anal 67 to 70; pectoral 8 to 10; scales 115 to 120 in lateral line, 27 above, 32 below; eye $4 \frac{1}{2}$ in head. Profile of snout rounded or angular. Upper eye largely in advance of lower. Teeth small, distinct on blind side. Nostril of blind side tubular, not dilated. Interorbital concave, a little less than eye. Scales rough, ctenoid, cover fins. Lateral line slopes a little on head, becomes median over greater body axis. Dorsal begins above upper eye. Caudal convexly rounded behind. Pectoral of right or colored side $1 \frac{2}{3}$ to 2 times in head. Ventrals free. Chocolate, with small gray dots. Blind side uniformly brownish. End of pectoral black. Length 136 to 262 mm. (Pellegriin.)

Senegal. Chabanaud reports examples up to 500 mm.

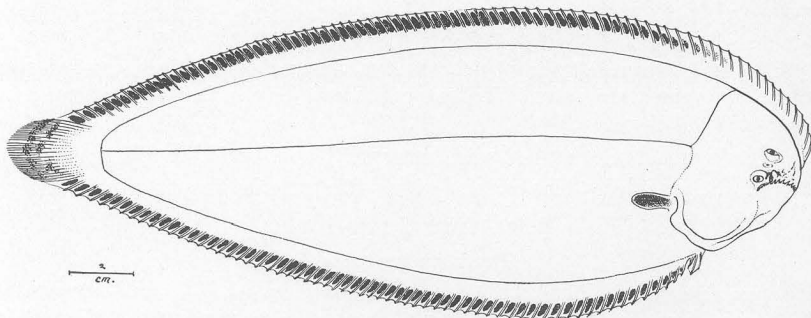
***Solea kleinii* (Risso)**

Figure 245

Rhombus kleinii RISSO, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 255. Nice.*Solea capellonis* STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII, p. 722, Pl. IV, fig. 2. Gibraltar and Lesina in Dalmatia.—PIETSCHMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 114 (Atlantic coast of Morocco).

Head 5; depth $2\frac{7}{8}$; dorsal 78; anal 61; caudal 18; scales 112 in lateral line, counted from opposite gill opening to caudal base; 32 scales above lateral line at greatest body depth to dorsal base, 44 below to anal base; snout, from tip to upper eye 4 in head; mouth curve 4.

Body elongately ovoid, with greatest depth about first third in length of trunk. Head greatly depressed, width 3 in its length. Upper eye about $\frac{2}{3}$ its diameter in advance of lower, hind edge of latter about first $\frac{2}{5}$ in head length. Mouth cleft

Fig. 245. *Solea kleinii*.

well curved. Teeth fine, in a rather broad band inside blind side only. Lips rather fleshy, right lower with a fringe of 13 short conic tentacles. Front nostril in fleshy papilla, a little larger than those in the mandibular fringe, on upper lip close before front edge of upper eye; hind nostril is a simple pore midway between anterior and front of lower eye; a single small fleshy tentacle, like those of the mandibular edge, close below on edge of upper lip. Interorbital slightly concave, about equals eye. Hind nostril of sinistral side is in dilated papilla with a wreath of basal tentacles or a fringe.

Gill rakers 4+20, obsolete short papillae, much shorter than gill filaments, which are about equal to pectoral. Dextral scales ctenoid, apical denticles 12 to 14, in transverse basal series 3 to 5; basal radiating striae 5 or 6; circuli rather coarse. Sinistral scales cycloid; basal radiating striae 9 to 14; circuli coarse. Sinistral side of head with many of lower scales fringed, especially close above mouth; edge of gill opening on sinistral side also well fringed. Dorsal and anal dextrally have basal halves finely scaled; caudal base finely scaled over its basal half. Height of dorsal $2\frac{4}{5}$ in head; height of anal $2\frac{2}{3}$; caudal $1\frac{4}{5}$; pectoral 4; equally developed on both sides of body.

Right side muddy brown. Each membrane of outer $\frac{2}{5}$ of dorsal with neutral

dusky blotch; anal similarly marked. Dextral pectoral neutral dusky. Inside of gill opening is dusky brown. Left side of body whitish, inclusive of fins. Length 248 mm.

Previously known only from the Mediterranean region. The above-described example was obtained at the mouth of the Congo by the Congo Expedition. The distribution of the species is thus considerably extended.

***Solea lascaris* (Risso)**

Lenguado (Canaries)

Figure 246

Pleuronectes lascaris RISSO, 1810, 'Ichth. Nice,' p. 311, Pl. VII, fig. 32. Nice.

Solea lascaris GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' p. 467 (Madeira).—STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1), p. 725 (Teneriffe).—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 189 (Porto Praya).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 329 (Grand Canary).—JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 347 (Canary Islands).—PELLEGRIN, 1905, Act. Soc. Linn. Bordeaux, LX, p. 32 (Nouakchott à Guet N'Dar), p. 85 (M'Bao); 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanc, Cap Vert); 1912, *op. cit.*, XXXVII, p. 291 (Mossamedes); 1913, *op. cit.*, XXXVIII, p. 116 (Baie du Lévrier); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 76 (Baie du Lévrier; Nouakchott et Guet N'Dar; Mossamedes).—FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 268 (Gaboon).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 278 (Cape Blanco).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 282 (Cape Blanco, Nouakchott).

Pegusa lascaris CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 44 (African coast, Canaries).

Solea scriba VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II (2), p. 84, Pl. XVIII, fig. 3. Canary Islands.—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 403 (Santa Cruz, Teneriffe).

Solea vermeuleni METZELAAR, *op. cit.*, p. 279, Fig. 60. Cape Blanco.

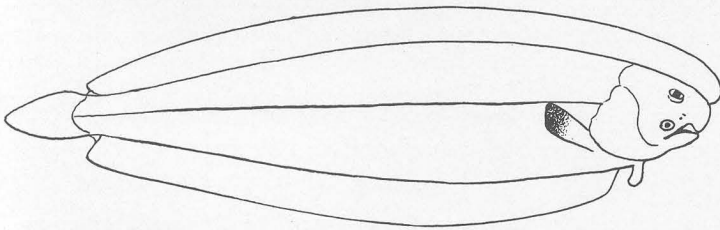


Fig. 246. *Solea lascaris*, from Valenciennes.

Head $4\frac{2}{5}$ to $5\frac{1}{8}$; depth 3 to $3\frac{1}{3}$; dorsal 79 to 81; anal 62 to 65; scales 118 to 145 in lateral line to caudal base; 22 to 34 scales above lateral line, 35 to 47 below; snout to upper eye $4\frac{1}{6}$ to $4\frac{1}{4}$ in head; upper eye $6\frac{2}{3}$ to 8; mouth curve $3\frac{1}{2}$ to 4.

Body elongately ovoid, with greatest depth at about first third in total length. Head greatly depressed, width $3\frac{1}{8}$ to $3\frac{1}{3}$ in its length. Upper eye about $\frac{2}{3}$ its diameter in advance of lower, hind edge of lower eye at about first $\frac{3}{7}$ of head length. Mouth cleft well curved. Teeth firm, in a broad band inside blind side only. Lips thin on right side; thick, and fleshy, with longitudinal plicae on left side, and no cirri. Front nostril in fleshy papilla, on upper lip a little nearer lower eye than snout end; hind nostril simple pore midway between front edges of eyes. Interorbital level, greater than either eye.

Gill rakers as a narrow band or row of feeble papillae, of which $3+8$ are slightly enlarged; gill filaments equal lower eye. Scales with 18 to 20 basal radiating striae; apical denticles 14 to 16, rather long, in 4 transverse series; circuli fine. Upper front portion of head, predorsal, and gill flap of blind side with many of scales finely fringed. Dorsal and anal with basal halves finely scaled dextrally, also greater basal portion of caudal. Height of dorsal $2\frac{1}{4}$ to $2\frac{1}{3}$ in head; height of anal $2\frac{1}{3}$ to $2\frac{1}{2}$; caudal rounded convexly behind, $1\frac{1}{5}$ to $1\frac{1}{4}$; pectoral $2\frac{2}{5}$ to $2\frac{2}{3}$, nearly equally developed on both sides of body.

Right side dull brown, left side whitish. Vertical fins marginally dusky all around. Outer $\frac{2}{5}$ of right pectoral with blackish blotch; left pectoral uniform white. Length 106 to 319 mm.

Eastern Atlantic and Mediterranean. Described above from a series of Italian examples. Chabanaud gives 336 mm. as maximum size.

***Solea triophthalmus* Bleeker**

Solea triophthalmus BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, XVIII, No. 2, p. 27, Pl. IV, fig. 1. Abraoun, Guinea.—PELLEGRIN, 1907, Act. Soc. Linn. Bordeaux, LXII, p. 85 (Dakar and Rufisque).

Solea triophthalma PELLEGRIN, 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 76 (between Dakar and Rufisque).

Pegusa triophthalmus CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 48 (copied).

Head $4\frac{3}{4}$; depth 3; dorsal 76; anal 61; scales 95 in lateral line; eye 5 in head. Snout prominent before eye, not fringed. Eyes half diameter distant, upper eye well advanced from lower. Lips without papillae or fringes. A narrow row of fringe along lower edge of head. Scales ctenoid. Dorsal begins on snout tip. Caudal convexly rounded behind. Pectoral 2 in head. Violaceous greenish, variegated with streaks and spots. Along lateral line are 3 large blackish ocelli, each with a white border and a pale central dot. Blind side whitish. Length 88 mm. (Bleeker.)

Senegal, Guinea. Chabanaud gives 205 mm.

***Solea profundicola* Vaillant**

Solea profundicola VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 190. Coasts of Portugal, Cadiz, Soudan, in 250 to 1290 m.

Bathysolea profundicola CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 49 (type = Banc d'Arguin examples).

Solea vulgaris (not Linné) VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 189 (Banc d'Arguin, 235 m.).

Head 5; depth 3; dorsal 84; anal 69; caudal 16; ventral 4; scales 127 in lateral

line, 31 above, 49 below. Snout somewhat prominently rounded, obtuse. Upper eye more advanced than lower, well covered by lid, $2\frac{1}{2}$ in head. Mouth small, reaches barely to middle of lower eye; feebly armed with teeth on blind side only. Nostrils as in common sole. Interorbital slightly less than $\frac{1}{3}$ of head. Scales small, ctenoid, on both sides of body. Lateral line nearly straight. Dorsal begins opposite middle of upper eye. Caudal rounded and free. Pectoral filiform, indistinct, of 1 to 3 rays. Ventral equally little developed. Eyed side gray-brown. Dorsal and anal black, excepting rays, dark tint also visible on blind side, tips of rays whitish. Length 147 mm. (Vaillant.)

Eastern Atlantic. According to Roule *Solea greenii* Günther¹ is synonym.

***Solea lactea* Roule**

Solea lactea ROULE, 1916, Bull. Mus. Hist. Nat. Paris, p. 8. Porto Praya de São Iago, Cape Verde, N. Lat. $15^{\circ} 15'$, W. long. $23^{\circ} 04' 05''$, in 660 m.

Bathysolea lactea CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 53 (type).

Bathysolea albida ROULE, 1916 (May 20), Bull. Inst. Océanogr. Monaco, No. 320, p. 28. Cape Verde Islands, in 660 m.; 1919, Rés. Camp. Sci. Monaco, LII, p. 91, Pl. v, fig. 4a (3 miles northeast of Maio, Cape Verde Islands, in 1616 m.).

Head 6; depth 3; dorsal 92; anal 74; caudal 21; pectoral 1; ventral 5; scales 144 in lateral line, 31 to 34 above, 41 to 45 below. Snout short, thick, truncate, keeled, not overhanging mouth; shorter than eye diameter. Eyes large, close, largely covered by scaly lids; upper advanced $\frac{1}{2}$ its length. Mouth small, reaches opposite middle of lower eye. Teeth cardiform, very fine, somewhat stronger on blind side. Gular region separated from trunk by a deep notch. Papillae on head short, slightly serrate, formed in narrow bands on borders of head and around snout. Scales finely ctenoid on both sides of body. Caudal 10 in total length. Pale yellowish white or yellowish brown, uniform on both sides. Fins like body, with some brownish spots on blind side. Length 166 mm. (Roule.)

Eastern Atlantic, off Cape Verde Islands.

MONOCHIRUS Rafinesque

Monochirus RAFINESQUE, 1814, 'Préc. découv. somiologiques,' p. 7. Type: *Monochirus hispidus* Rafinesque. Monotypic.

Leptosoma (not Leach, 1819) NARDO, 1827, Giorn. Fisica Nat. Pavia, I, pp. 15, 22. Type: *Leptosoma atrum* Nardo.

Microchirus BONAPARTE, 1833, 'Fauna Ital.,' Pesci, I, fasc. v. Type: *Pleuronectes microchirus* De la Roche. Orthotypic.

Spanius GISTEL, 1848, 'Naturg. Thierr.,' p. ix. Type: *Leptosoma atrum* Nardo. (*Spanius* Gistel proposed to replace *Leptosoma* Nardo.)

Buglossus GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, pp. 462, 469. Type: *Pleuronectes variegatus* Donovan. (Designated by Jordan, 1918, Stanford Publications, 'Genera of Fishes,' part 3, p. 319.)

Quenselia (Jordan) JORDAN AND GOSS, 1886 (1889), Rept. U. S. Fish Comm., XIV, p. 306. Type: *Pleuronectes ocellatus* Linné. Monotypic.

¹ 1889, Ann. Mag. Nat. Hist., London, (6) IV, p. 419. Southwest coast of Ireland in 150 fathoms.

Echinoseola CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 10. Type: *Pleuronectes ocellatus* Linné. Monotypic.

Body oblong, depth $1/3$ to $2/5$ of length. Gill openings moderate, confluent below. Vertebrae 34 to 40. Lateral line single on both sides. Vertical fins well separated. Pectoral usually small, sometimes absent on blind side. Right ventral with short base, free from anal.

KEY TO THE SPECIES

- a.—*QUENSELIA*. Pectoral of both sides well developed, that of eyed side not quite half of head; scales 70 to 75 in lateral line; 4 ocelli in quadrangle postmedian. *ocellatus*.
- aa.—*MICROCHIRUS*. Pectoral fin of blind side minute, that of eyed side small, not twice as long as eye.
- b.—A ciliate membrane at upper lobe of opercle interrupting 3 or 4 rows of scales immediately above pectoral base; first dorsal inserted level with upper edge of upper eye; last dorsal ray without posterior membrane. *boscanion*.
- bb.—No membranous process at upper lobe of opercle; first dorsal ray inserted level with lower edge of upper eye or below its level; last dorsal ray with posterior membrane. *luteus*.

***Monochirus ocellatus* (Linné)**

Soldado, Lenguado doble (Canaries)

Figure 247

Pleuronectes ocellatus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 269. Surinam [locality erroneous].

Solea ocellata GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 465 (Madeira).—STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1) p. 724 (Teneriffe).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 328 (Canaries).

Quenselia ocellata JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, 347 (Canary Islands).

Solea oculata VALENCIENNES, 1836–1844, 'Hist. Nat. Canaries,' II (2), p. 84, Pl. XVIII, fig. 2. Canary Islands.—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 403 (Santa Cruz, Teneriffe).

Echinoseola oculata CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 10 (Teneriffe).

Head 4 to $4\frac{2}{5}$; depth $2\frac{1}{2}$ to $2\frac{2}{3}$; dorsal 67 to 74; anal 47 to 56; scales 48 to 57 in lateral line to caudal base and 4 or 5 more on latter; 14 or 15 scales above lateral line, 17 or 18 below; snout $4\frac{2}{5}$ to 5 in head, measured from its own tip to front edge of upper eye; upper eye $5\frac{1}{4}$ to $5\frac{2}{3}$; mouth curve $3\frac{2}{3}$ to $3\frac{7}{8}$.

Body oblong-ovoid, deepest about first third in its total length. Head greatly depressed, width 3 to $3\frac{1}{3}$ in its length. Upper eye about half its diameter in advance of lower, hind edge of latter at first $2/5$ in head, or but slightly advanced from middle in head length in young. Mouth cleft well curved. Teeth fine, in a broad band inside blind side only. Lips thin, smooth, without cirri. Front nostril in a fleshy papilla, on upper lip at about last third in snout as measured to lower eye; hind nostril a simple pore close above and before front edge of lower eye. Interorbital slightly concave.

Gill rakers absent or only few minute rudimentary papillae; gill filaments $1\frac{1}{5}$ in upper eye. Scales with 10 basal radiating striae; apical denticles 20 to 29, rather long, transversely 6 series; circuli fine. Upper front portion of head, under surface of mandible or gill membranes below on blind side with fine fringes on most scales. Height of dorsal $1\frac{7}{8}$ to $2\frac{1}{5}$ in head; height of anal 2 to $2\frac{1}{5}$; caudal rounded convexly behind, $1\frac{1}{6}$ to $1\frac{1}{3}$; pectoral 3 to $4\frac{1}{6}$; left pectoral but slightly shorter, narrower.

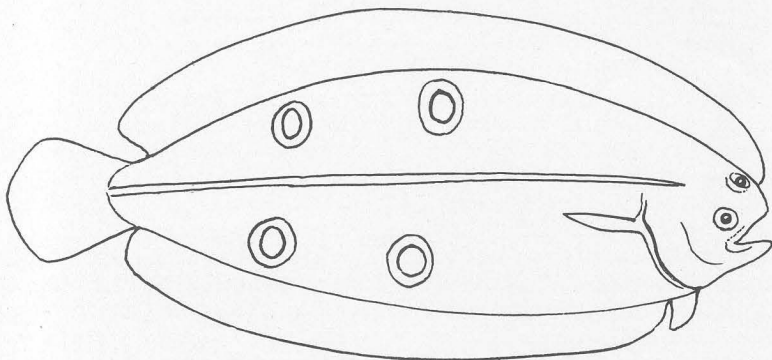


Fig. 247. *Monochirus ocellatus*, from Valenciennes.

Right side brown, left side paler to whitish. Along dorsal and anal marginally rather regular wide-spaced dark spots on membranes. Pectoral of right side dusky medianly, left pectoral whitish. Length 60 to 123 mm.

Eastern Atlantic and Mediterranean. Described above from a series of Mediterranean examples. According to Chabanaud the maximum example he observed was 159 mm.

Two in the U. S. National Museum from the Canaries, of which one was received from the Vienna Museum.

***Monochirus boscanion* (Chabanaud)**

Solea (Microchirus) boscanion CHABANAUD, 1926, Bull. Mus. Hist. Nat. Paris, p. 127. Spain; Soudan; Baie du Lévrier.

Microchirus boscanion CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 58 (Baie du Lévrier, Senegal).

Solea variegata (not Donovan) VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman," Poiss., p. 109 (Coast of Soudan in 130 m.).

Solea lutea (not Risso) PELLEGRIN, 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 76 (Baie de Hann).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 282 (Cape Blanco).

Dorsal 71 to 81; anal 55 to 63; scales 70, 17 or 18 above, 20 to 22 below. Body very elongate. Front profile rounded. Snout not prominent, scarcely protrudes. Jugular angle 85° . Interocular space about $\frac{1}{4}$ to $\frac{1}{3}$ of head. Reddish brown or yellowish, uniform or marbled darker. Along dorsal and anal bases there is a row of

five poorly defined deeper brown spots the size of the eye. Blackish, ill-defined vertical streaks on body not extending on dorsal or anal. Black band on caudal base, fin otherwise whitish with brown marks as transverse network. Right pectoral black. Reaches 70 mm. (Chabanaud.)

Eastern Atlantic, from Spain to Senegal.

Monochirus luteus (Risso)

Pleuronectes luteus RISSO, 1810, 'Ichth. Nice,' p. 312. Nice.

Microchirus minutus CHABANAUD, 1927 (March 5), Bull. Inst. Océanogr. Monaco, No. 488, p. 64 (Agadir).

Head $4\frac{1}{3}$ to $4\frac{4}{5}$; depth $2\frac{4}{5}$ to 3; dorsal 65 to 73; anal 52 to 54; scales 65 to 78 in lateral line and 5 to 7 more on latter; 18 or 19 scales above lateral line, 21 to 23 below; snout 5 to $6\frac{1}{4}$ in head, measured from its tip to the front edge of upper eye; upper eye $5\frac{1}{5}$ to 6; mouth curve $2\frac{4}{5}$ to $3\frac{1}{3}$.

Body oblong-ovoid, with greatest depth at about the first third in its total length. Head greatly depressed, width $2\frac{7}{8}$ to 3 in its length. Upper eye with about half its diameter in advance of lower; hind edge of lower eye midway in head length. Mouth cleft moderately curved. Teeth fine, in broad band inside blind side only. Lips thin, left more fleshy and with long plicae. Front nostril in a fleshy tube a little behind middle in snout length as measured to lower eye; hind nostril a simple pore, rather close behind front one and before lower eye. Interorbital level, usually with a slight median depression.

Gill rakers absent or only as rudimentary papillae; gill filaments a little longer than lower eye. Scales with 9 or 10 basal radiating striae; apical denticles usually rather long, 15 or 16, transversely 3 to 5 series; circuli fine. Upper front portion of head, muzzle, and gill membrane of blind side with fine fringes. Height of dorsal $1\frac{5}{6}$ to 2 in head; height of anal $1\frac{4}{5}$ to 2; caudal rounded convexly behind, 1 to $1\frac{1}{8}$; pectoral $2\frac{4}{5}$ to $3\frac{1}{8}$; left pectoral much shorter and smaller.

Right side brown, with darker crossbands; deepest forming about 6 dark blotches on dorsal and anal and these fins pale to whitish submarginally. Length 76 to 165 mm.

Eastern Atlantic and Mediterranean. Described above from a series of Mediterranean examples.

SYMPHURUS Rafinesque

Tongue Fishes

Symphurus RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' p. 52. Type: *Symphurus nigrescens* Rafinesque. Monotypic.

Plagusia BROWNE, 1789, 'Nat. Hist. Jamaica,' p. 445. Type: *Pleuronectes plagusia* Schneider. Tautotypic. (Inadmissible.)

Odontolepis FISCHER, 1813, 'Zoognosia Tab. Synopt. Illustr.,' 3d Ed., pp. 71, 78. Atypic. Type: *Symphurus nigrescens* Rafinesque. (Designated by Jordan and Evermann, 1917, Stanford Publications, 'Genera of Fishes,' part 1, p. 85.)

Plagusia RAFINESQUE, 1815, 'Analyse de la Nature,' p. 83. Type: *Pleuronectes plagusia* Linné. Tautotypic.

Bibronia COCCO, 1844, 'Intorno ad alcuni nuovi pesci del mare di Messina,' (letter from Prof. A. Cocco to Sig. Krohn), p. 15. Type: *Bibronia ligulata* Cocco. Monotypic.

Euporista GISTEL, 1848, 'Naturg. Thierr.,' p. x. Type: *Pleuronectes plagiusa* Linné. (*Euporista* Gistel proposed to replace *Symphurus* Rafinesque.)

Eupnoea GISTEL, *op. cit.*, p. 105. Type: *Plagusia lactea* Bonaparte = *Symphurus nigrescens* Rafinesque. Monotypic.

Aphorista KAUP, 1858, *Archiv Naturg.*, XXIV, part 1, p. 106. Type: *Achirus ornatus* Lacépède. Monotypic.

Glossichthys GILL, 1861, *Proc. Acad. Nat. Sci. Philadelphia* ('Cat. Fish. E. Coast'), p. 51. Type: *Pleuronectes plagusia* Schneider. Monotypic.

Ammopleurops GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 490. Type: *Plagusia lactea* Bonaparte. Monotypic.

Bascanius (not *Bascanion* Baird and Girard, 1853) SCHIÖDTE, 1867, *Naturh. Tidsskr.*, (3) V, pp. 269, 275. Type: *Bascanius taedifer* Schiödte. Monotypic.

Acedia JORDAN AND GOSS, 1886 (1889), *Rept. U. S. Fish Comm.*, XIV, p. 321. Type: *Aphoristia nebulosa* Goode and Bean. Monotypic.

Body elongate, more or less lanceolate in contour. Eyes small, very close together, without a distinct interorbital ridge between. Mouth small, twisted toward blind side. Teeth little developed, in villiform bands. Gill openings narrow, gill membranes adnate to shoulder girdle above, joined together and free from isthmus below. Scales ctenoid. Head without fringes. Edge of preopercle covered by scales. No lateral line. Vertical fins more or less confluent. Pectorals wanting in adult. Ventral of left side only present, free from anal. Coloration sinistral.

***Symphurus nigrescens* Rafinesque**

Symphurus nigrescens RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' p. 52. Palermo.

Ammopleurops lacteus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 192 (off Soudan in 250 m.; Banc d'Arguin in 140 to 235 m.).

Head 4 1/2; depth 3 3/5; dorsal 90; anal 73 to 75; scales 80 in longitudinal series. Body moderately elongate. Scales small, not very rough. Rather pale, plain or more or less mottled with darker, but without crossbars. Dorsal and anal chiefly black anteriorly and posteriorly, with paler edgings. (Jordan and Goss.)

Mediterranean and eastern Atlantic. Length of example noted by Vaillant 88 mm.

SYNAPTURA Cantor

Synaptura CANTOR, 1849, *Jour. Asiatic Soc. Bengal* ('Cat. Malay. Fish. '), XVIII, part 1, p. 1204. Type: *Pleuronectes orientalis* Schneider. (*Synaptura* Cantor proposed to replace *Brachirus* Swainson.)

Brachirus (not Swainson, not *Brachyrus* Swainson, not *Brachyurus* Fischer, 1814) SWAINSON, 1839, 'Nat. Hist. Animals,' II, p. 303. Type: *Pleuronectes orientalis* Schneider. (Designated by Swain, 1882, *Proc. Acad. Nat. Sci. Philadelphia*, p. 281.)

Solenoides (Bleeker) KAUP, 1858, *Archiv Naturg.*, p. 96. Atypic. (Name in synonymy.) Type: *Pleuronectes commersonianus* Lacépède.

Euryglossa KAUP, *op. cit.*, p. 99. Type: *Pleuronectes orientalis* Schneider. Monotypic.

Anisochirus GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, pp. 480, 486. Type: *Synaptura panoides* Bleeker. (Designated by Jordan, 1919, *Stanford Publications*, 'Genera of Fishes,' part 3, p. 319.)

Body oblong. Gill openings moderate, confluent below. Scales very small, ctenoid. Vertebrae 49, of which about 40 caudal. Vertical fins fully confluent around short tail. Pectorals present.

***Synaptura punctatissima* Peters**

Boularéréyé (Konakry), Ogoouéré (Libreville)

Figure 248

Synaptura punctatissima PETERS, 1876 (1877), Monatsb. Akad. Wiss. Berlin, p. 249, Pl. , fig. 2. Victoria, Cameroon.—PELLEGRIN, 1905, Act. Soc. Linn. Bordeaux, LX, p. 33 (between Nouakchott and Guet N'Dar); 1905, Bull. Soc. Zool. France, XXX, p. (137) 140 (Cape Blanco, Cape Verde); 1913, *op. cit.*, XXXVIII, p. 152 (Konakry, Guinea), p. 154 (Libreville, Gaboon); 1914, Ann. Inst. Océanogr. Monaco, VI (4), 1914, p. 77 (between Nouakchott and Guet N'Dar; Konakry; Libreville).—EHRENBAUM, 1913, Fischerbote, p. 506, Fig. (Cameroon).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 282 (Port-Étienne).

Synaptura punctatissima var. *nigromaculata* PELLEGRIN, 1905, Bull. Soc. Zool. France, XXX, p. (137) 141. Between Nouakchott and Guet N'Dar; 1905, Act. Soc. Linn. Bordeaux, LX, pp. 33, 34, Pl. III, fig. 2 (Nouakchott and Guet N'Dar); 1913, Bull. Soc. Zool. France, XXXVIII, p. 116 (Baie du Lévrier); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 77, Fig. 13 (between Nouakchott and Guet N'Dar; Baie du Libreville).

Synaptura punctatissima nigromaculata METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 280 (West Africa).—CHABANAUD AND MONOD, 1926, *loc. cit.* (Baie du Lévrier; West Africa).

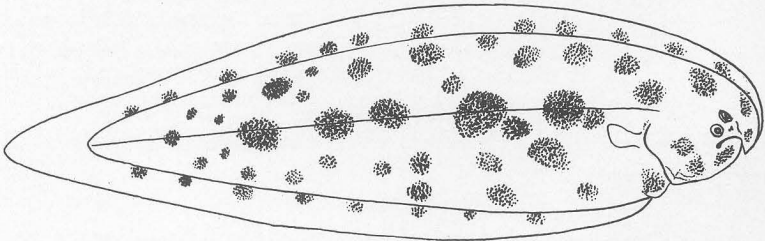


Fig. 248. *Synaptura punctatissima*, from Pellegrin.

Head $5\frac{3}{4}$ to $6\frac{1}{2}$; depth 3 to 4; dorsal 73 to 82; anal 57 to 65; scales 100 to 120 in lateral line. Grayish or rosy, with small black points on each scale. Sometimes large dusky blotches, irregularly rounded. Blind side rosy white or yellowish. Pectoral pale or blackish terminally. Length 195 to 310 mm. (Pellegrin.)

West Africa, from Cape Blanco to the French Congo.

MONODICHTHYS Chabanaud

Monodichthys CHABANAUD, 1925, Bull. Mus. Hist. Nat. Paris, p. 356. Type: *Monodichthys proboscideus* Chabanaud. Monotypic.

Elongately ovoid. Snout large, prominent, recurved below in a long uniform appendage. Eyes small, close together, upper advanced. Nostrils two on each side of head. No pseudobranchiae. Scales moderate, ctenoid. Vertebrae 43, of which 35 caudal. Fins scaleless, all rays simple. Vertical fins confluent around short tail. Ventral asymmetrical, contiguous with anal.

One species.

Monodichthys proboscideus Chabanaud

Monodichthys proboscideus CHABANAUD, 1925, Bull. Mus. Hist. Nat. Paris, p. 356. Cape Blanco, Mauritania; 1926, *op. cit.*, p. 52 (Kwéle-Kwéle, Malimba Bay, Cameroon).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 282, Figs. 31-32 (type: Cameroon).

Head $4\frac{3}{5}$; depth $3\frac{1}{4}$; dorsal 113; anal 72; scales 90 (of which 5 are before gill opening), 19 above lateral line, 24 below; snout from front eye $2\frac{1}{4}$; front eye 9.

Body very thick, attenuated posteriorly. Front profile well rounded. Eyes median in head, upper about 3 in snout. Right front nostril is a simple tube, reaches front eye, and hind nostril pore close below lower edge of lower eye medially; left front nostril close to mouth cleft slightly behind end of mandible, large, moderately dilated in a fringed rosette and simple aperture with a small valve; left hind nostril higher, about opposite first third of mouth cleft. Scales with 8 basal radiating striae; apical denticles 10, transversely 5 and the median denticle longest, slender. A few fleshy points along lower edge of head on blind side. Lateral line not prominent, single, median, straight.

Yellowish green, mottled gray. Along dorsal base there are 6 brown spots bordered darker and 4 along anal base. Also a row of obsolete brown spots along lateral line. Blind side white. Eyelids gray, iris orange. Length 71 mm. (Chabanaud.)

Mauritania to Cameroon.

CYNOGLOSSUS Buchanan-Hamilton

Cynoglossus BUCHANAN-HAMILTON, 1822, 'Fishes of Ganges,' pp. 32, 365. Type: *Cynoglossus lingua* Buchanan-Hamilton. Monotypic.

Icania KAUP, 1858, Archiv Naturg., XXIV, part 1, p. 109. Type: *Achirus cynoglossus* Buchanan-Hamilton. Monotypic.

Arelia KAUP, *loc. cit.* Type: *Pleuronectes arel* Schneider. Tautotypic.

Eyes sinistral. Mouth small, asymmetrical, snout protruding beyond it and hooked. Teeth minute, on right side only; none on palate. Gill openings narrow. Vertebrae 46 to 60. Scales small, ctenoid on colored side. Lateral lines 2 or 3. Dorsal begins on snout. Vertical fins confluent. Pectoral absent. Ventral small, with 4 rays.

Indo-Pacific and eastern Atlantic; few in fresh water.

KEY TO THE SPECIES

a.—Two lateral lines on left side.

b.—Mouth cleft reaches opposite middle or slightly beyond middle of lower eye; scales 102 to 103 in lateral line.....*canariensis*.

bb.—Mouth cleft extends beyond lower eye; scales 126 to 130 in lateral line.
lagoensis.

aa.—Three lateral lines on right side; mouth cleft extends beyond lower eye.

- c.—Scales 94 to 100 in lateral line.....*gorensis*.
 cc.—Scales 110 to 140 in lateral line.....*senegalensis*.

Cynoglossus canariensis Steindachner

Figure 249

Cynoglossus canariensis STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLV, (1), p. 13, Pl. II, fig. 2. Banc d'Arguin, Canary Islands.—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 280 (Senegal coast.)—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 284 (note).

Head 5; depth 4 1/2; dorsal 130; anal 100; scales 102 to 103 in lateral line; snout 3 1/2 in head. Upper eye slightly advanced before lower. Mouth cleft reaches slightly beyond middle in diameter of lower eye. Upper nostril midway between front eye edges, lower above mouth edge before lower eye. Interorbital a little less than

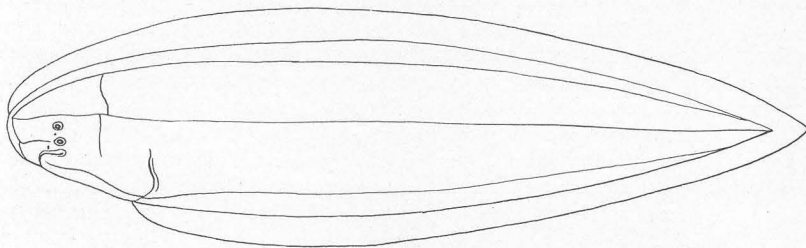


Fig. 249. *Cynoglossus canariensis*, from Steindachner.

lower eye. Some scales on eyed side clearly ctenoid. Left side with 3 lateral lines. Reddish gray-brown upon eyed side, tinged with greenish yellow next to bases of dorsal and anal. Length 280 mm. (Steindachner.)

Canary Islands.

Cynoglossus lagoensis Regan

Cynoglossus lagoensis REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 129. Lagos.

Head 4 1/5 to 4 4/5; depth 4; dorsal 120 to 126; anal 95 to 98; scales 80 to 85 from above gill opening to base of caudal; 12 scales between upper and middle lateral lines at their widest distance apart; upper eye 3 to 4 in snout, 10 to 12 in head. Cleft of mouth extends beyond lower eye. Interocular width 2/3 to 3/4 diameter of upper eye. Two nostrils, posterior midway between anterior margins of eyes. Three lateral lines on left side, one on right. Brownish gray. Length 380 mm. (Regan.)

Metzelaar places this as a synonym of *Cynoglossus canariensis*.

Cynoglossus gorensis Steindachner

Méyiéré (Konakry)

Figure 250

Cynoglossus gorensis STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLV,

(1), p. 12, Pl. I, fig. 2. Gorée.—OSORIO, 1893 (August), *Jorn. Sci. Math. Phys. Nat., Acad., Lisboa*, (2) III, p. 134 (Benguella, Angola); 1898, *op. cit.*, (2) V, p. 199 (Angola).—PELLEGRIN, 1905, *Act. Soc. Linn. Bordeaux*, LX, p. 35 (Guet N'Dar à Dakar); 1913, *Bull. Soc. Zool. France*, XXXVIII, p. 152 (Konakry, Guinea); 1914, *Ann. Inst. Océanogr. Monaco*, VI (4), p. 79 (Guet N'Dar à Dakar; Konakry).—REGAN, 1915, *Ann. Mag. Nat. Hist., London*, (8) XV, p. 129 (Lagos).—FOWLER, 1918, *Proc. U. S. Nat. Mus.*, LVI, p. 249 (Cape Palmas, Liberia), p. 268 (Gaboon).—CHABANAUD AND MONOD, 1926, *Bull. Étud.-Hist. Sci. Af.-Occ. française*, p. 284 (Cape Blanco).

Head 5 to $5\frac{2}{3}$; depth $3\frac{3}{4}$ to $4\frac{1}{4}$; dorsal 123 to 126; anal 89 to 94; scales 94 to 100 in median lateral line to caudal base; 15 to 17 scales above median lateral line and deepest part of body to upper lateral line, 24 to 28 below at same point; snout $3\frac{1}{4}$ in head measured to upper eye; mouth curve $3\frac{2}{3}$ to 4.

Body evenly elongate, ovoid, deepest at about first $\frac{2}{5}$ in total body length. Head width $4\frac{3}{4}$ in its length. Snout broadly depressed; profile is a nearly complete semicircle. Upper eye small, about half of interorbital and its front half in advance of

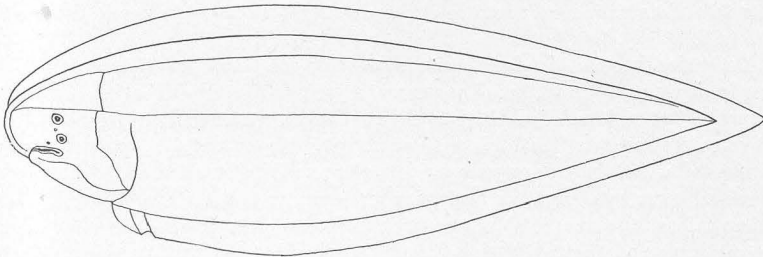


Fig. 250. *Cynoglossus goreensis*, from Steindachner.

lower eye. Mouth cleft on blind side more curved than on colored side. Lips thin, entire. Lower nostril in a short fleshy tube, close before eye, though a little before upper nostril, which is slightly above middle of interorbital. Interorbital level.

Gill rakers minute, rudimentary papillae; gill filaments as long as mouth curve. Scales with 37 to 44 basal radiating striae; apical denticles 28 to 33, with 8 series transversely; circuli fine. Scales largest over median portion of trunk, become small and crowded about borders, strongly ctenoid on left or colored side and cycloid on right or blind side. Two lateral lines, upper 8 scales from dorsal body edge. Height of dorsal $3\frac{1}{8}$ in head; height of anal 3; caudal pointed, $1\frac{5}{6}$ in head.

Left side pale uniform brown, right side whitish. Length 130 to 327 mm.

West Africa, from the Senegal to Benguela. Described above from an example from Liberia and another from the Gaboon.

***Cynoglossus senegalensis* (Kaup)**

Plar (Senegambia), Koua-Koua (Dahomey)

Arelia senegalensis KAUP, 1858, *Archiv Naturg.*, XXIV, part 1, p. 108. West Africa.

Plagusia (Arelia) senegalensis DUMÉRIL, 1859, *Arch. Mus. Hist. Nat. Paris*, X, p. 264 (Senegal).

Cynoglossus senegalensis GÜNTHER, 1862, 'Cat. Fish. Brit. Mus.,' IV, p. 502 (no data).—CAPELLO, 1872, *Jorn. Sci. Math. Phys. Nat., Acad., Lisboa*, p. 86 (Bissau, West Africa).—PETERS, 1876 (1877), *Monatsb. Acad. Wiss. Berlin*, p. 249 (Victoria, Cameroon).—ROCHEBRUNE, 1883–1885, 'Faune Sénégalie,' Poiss., p. 116 (Gorée, Dakar, Guet N'Dar, Barbarie).—BUETTIKOFER, 1894, 'Reis. Liberia,' II, p. 480.—STEINDACHNER, 1895, *Notes Leyden Mus.*, XVI, p. 50 (Messurad River mouth, Liberia).—PELLEGRIN, 1913, *Bull. Soc. Zool. France*, XXXVIII, p. 153 (Lagune de Porto-Novo; Dahomey); 1914, *Ann. Inst. Océanogr. Monaco*, VI (4), p. 78 (Lagune de Porto-Novo).

Cynoglossus (Arelia) senegalensis STEINDACHNER, 1870, *Sitzs. Akad. Wiss. Wien*, LX (1), p. 977 (St. Louis).

Plagusia bitineata (?not Cuvier) DUMÉRIL, *loc. cit.*, (Isle of Prince, Portuguese West Africa).

Head 5 to 5 3/4; depth 3 5/6 to 4 1/2; dorsal 123 to 136; anal 96 to 101; caudal 11 or 12; scales 96 to 120 counted in lateral line from opposite gill opening to caudal base, and 20 to 22 more on latter; 16 to 19 scales above to upper lateral line, 29 to 34 below to abdominal edge; snout to upper eye 2 4/5 to 2 7/8 in head; mouth cleft 4 4/5 to 5.

Body elongate and slenderly ovate in profile, widest at first 2/5 its length. Head strongly depressed. Snout broadly convex in profile. Upper eye half its diameter in advance of lower, hind edge of latter slightly before center in head length. Mouth cleft curved strongly. Teeth obsolete or absent. Upper nostril a moderate pore in interorbital, a little nearer upper eye; lower in papilla, advanced and close to upper lip before lower eye. Interorbital narrowly concave, equals eye. No gill rakers. Median lateral line complete; upper lateral line complete, follows close along dorsal edge of trunk and through each as chain of tubes not perforating scales. Dextral scales finely ctenoid; apical denticles 28 to 36; basal elements in 4 series; basal radiating striae 27 to 42; circuli fine. Sinistral scales cycloid; basal radiating striae 33 to 36; circuli fine. Along bases of dorsal and anal sinistrally broad basal scaly sheath of fine close-set scales. Dorsal origin begins slightly above upper eye, not quite at end of snout and like anal continuous with pointed caudal. Height of dorsal 3 1/5 to 3 3/5 in head; height of anal 3 to 3 3/5; caudal 2 to 3.

Dull drab on left side, scarcely variegated. Right side whitish. Length 376 to 570 mm.

Coasts of West Africa, from the Senegal to the Congo. The above description from three examples obtained at the mouth of the Congo by the Congo Expedition.

ORDER ZEOIDEI

John Dories

Mouth very protractile. No supramaxillary. Anterior trunk muscles not reaching or just reaching posterior ends of frontals, which formed of ridged, tuberculated, or pitted lateral portions bordering a median depression for reception of long posterior processes of premaxillaries. Occipital crest thin. Suspensorium inclined obliquely forward and metapterygoid reduced. Vertebrae 31 to 46; first firmly attached

to cranium. Caudal with 13 principal rays, of which 11 branched. Each ventral fin with 1 spine and 5 to 9 branched rays.

Two families.

Zeidae

John Dories

Body short, deep, much compressed, elevated. Eye lateral, high. Mouth large, terminal. Upper jaw protractile. Teeth small, in narrow bands or single series on jaws, vomer, and sometimes palatines. Opercle much reduced. Some of the bones of head usually with spines. Preopercle not serrate. Gill openings wide, membranes little united, free from isthmus. Gills 4, slit behind fourth. Gill rakers usually short. Pseudobranchiae large. Branchiostegals 7 or 8. Vertebrae 31 to 40. Pyloric appendages exceedingly numerous. Air vessel large. Body naked or covered with minute smooth scales, or with bony protuberances. Ventral edge often serrate, with strong bony plates. Lateral line concurrent with back. Dorsal emarginate or divided, front part with spines, often strong. Second dorsal longer, highest rays behind middle. Soft anal like soft dorsal, usually preceded by 1 to 4 spines, not graduated, often forming separate fin. Caudal rounded, on moderate peduncle. Pectoral small. Ventral thoracic, well developed, with a spine and 6 to 8 rays.

Fishes of warm seas, variable with age, some living at considerable depths. About eleven genera.

KEY TO THE GENERA

- a.*—Branchiostegals 7; anal spines 3 or 4; a series of bony plates along dorsal and anal bases. ZEUS.
aa.—Branchiostegals 8; anal spines 2; no bony plates along dorsal and anal bases. CYTTUS.

ZEUS Linné

Zeus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 266. Type: *Zeus faber* Linné. (Designated by Gill, 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 126.)

Zenopsis GILL, 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 126. Type: *Zeus nebulosus* Schlegel. Monotypic.

Body much compressed and elevated. Mouth cleft wide. Minute teeth in jaws, on vomer, none on palatines. Branchiostegals 7. Air vessel large. Pyloric caeca very numerous. Scales exceedingly small or absent. A series of bony plates or soft dorsal and soft anal, also sometimes on spinous dorsal and anal (*Zenopsis*); another series on abdomen. Dorsals 2, contiguous, spines 9 or 10, not much shorter than soft fin. Anal with 3 or 4 spines.

Species few.

Zeus faber Linné

Gallo San Pedro, Pez gallo, Gallo cristo (Canaries), Peixe Gallo (Madeira)

Figure 251

Zeus faber LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 267. In Pelago.—LOWE, 1837 (1841), Trans. Zool. Soc. London, II, p. 183 (Madeira).—VALENCIENNES, 1836–1844, 'Hist. Nat. Canaries,' II (2), p. 59 (Canaries).—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 402 (Santa Cruz, Teneriffe); 1868, *op. cit.*, LVII (1), p. 364 (Santa Cruz, Teneriffe).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 317 (Grand Canary).—PIETSCHMANN, 1906, Ann. k. k. Naturhist. Hofmuseums, Wien, XXI, p. 113 (Mogador, Agadir, and Azamor, Morocco).—PELLEGRIN, 1907, Act. Soc. Linn. Bordeaux, LXII, p. 90, Fig. 17 (Rufisque, Dakar).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 407, Fig. 293 (off Morocco, 141 m.), p. 614 (off Morocco).—PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 117 (Baie du Lévrier); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 72 (Baie du Lévrier, Rufisque, Dakar).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 275 (Gorrei; Rio de Oro; Cape Blanco).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 280 (Rio de Oro).

Head $2\frac{1}{8}$ to $2\frac{2}{5}$; depth $1\frac{3}{5}$ to $2\frac{1}{8}$; dorsal IX or X, 21 to 24; anal IV,

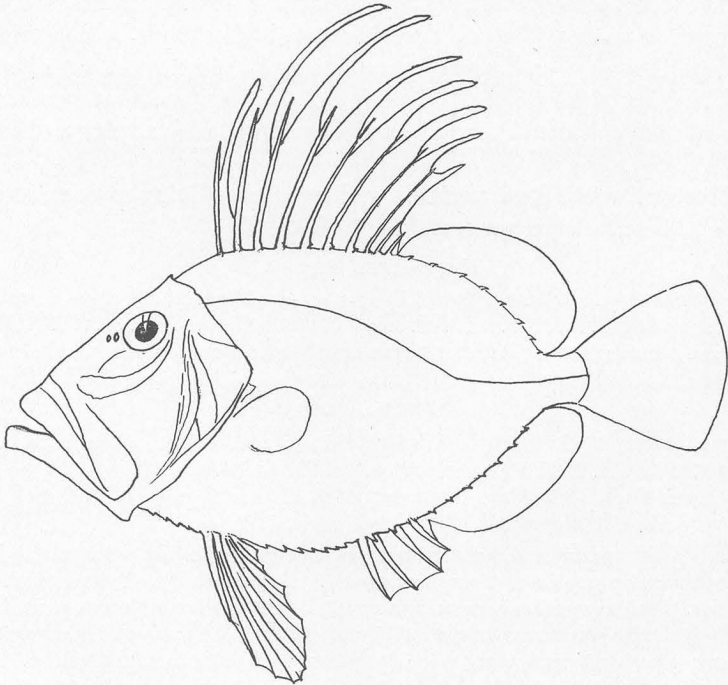


Fig. 251. *Zeus faber*, from Smitt.

20 to 22, 1; scales 93 counted along and close above lateral line to caudal base and 3 more on latter; 10 scales above lateral line to spinous dorsal origin, 20 above to soft dorsal origin, 55 below; tubes about 65 in lateral line to caudal base; snout $1\frac{4}{5}$ to $1\frac{5}{6}$ in head measured from tip of upper jaw; eye $3\frac{1}{2}$ to $6\frac{7}{8}$; maxillary $1\frac{7}{8}$ to 2; interorbital $4\frac{7}{8}$ to $6\frac{2}{5}$.

Body strongly compressed, deeply ovoid, much shorter in young. Caudal peduncle well compressed, length $1\frac{1}{5}$ in its least depth, which is 5 to $5\frac{2}{5}$ in total head length. Head deep, strongly compressed, width $3\frac{2}{3}$ to 4 in its total length. Snout strongly compressed, width 2 to $3\frac{1}{4}$ in its length. Eye high, its front edge midway in head length as measured from upper jaw tip; eye center midway in young; diameter $1\frac{2}{3}$ to 4 in snout; $1\frac{1}{10}$ in interorbital in adult, much greater than interorbital in young. Mouth large, very oblique, mandible protruding. Maxillary large, nearly vertical, reaches front of eye in young, about opposite front nostril in adult; expansion $1\frac{2}{5}$ in eye in young, much greater than eye in adult or 3 in snout. Bands of simple, conic teeth in each jaw, 4 or 5 irregular series above and 3 or 4 below; small patch of similar small teeth each side of vomer; tongue edentulous. Nostrils together, close before eye, posterior large, about equals pupil. Interorbital convexly elevated. Adult with very strong suprascapular spine, $1\frac{2}{3}$ in snout, preceded by 2 smaller spines; small spine each side of occiput; slender preorbital spine $1\frac{3}{4}$ in eye; spine below and another behind at lower end of mandible; humeral spine long and well developed in young.

Gill rakers 4+9, tubercular, $2\frac{3}{4}$ in gill filaments, which $1\frac{1}{4}$ in eye. Scales simple, cycloid, circuli complete, about 40. Head naked, except about 20 series transversely adherent. Bucklers along bases of dorsals 4 to 7, along anals 5 to 8, any or all sometimes asymmetrical; abdominal spines 6 to 8+6 to 9. Lateral line arched a little at first, drops until midway on side of tail. Second dorsal spine $1\frac{3}{4}$ to $1\frac{2}{3}$ in head; seventh dorsal ray $2\frac{3}{4}$ to $4\frac{2}{3}$; seventh anal ray $3\frac{1}{5}$ to $4\frac{1}{4}$; second anal spine $2\frac{1}{3}$ to 3; caudal rounded behind, $1\frac{2}{5}$ to 2; pectoral $2\frac{1}{2}$ to $3\frac{1}{4}$; ventral 1 to $1\frac{1}{3}$. Dorsal spines acquire long filaments with age and the longest is half total length.

Brownish, paler below with a silvery sheen. There is a round black spot as large as the eye, smaller in young, with a pale narrow border on the middle of the side. Fins mostly pale. Ventral dusky. Length 67 to 383 mm.

Eastern Atlantic, Mediterranean, and probably the Indian Ocean. Described above from a series of Mediterranean examples.

Zeus conchifer Lowe

Zeus conchifer LOWE, 1850, Proc. Zool. Soc. London, p. 247. Madeira; 1852, Ann. Mag. Nat. Hist., London, (2) X, p. 49 (Madeira).—GÜNTHER, 1860, 'Cat. Fish. Brit. Mus.,' II, p. 395 (type).

Zenopsis conchifer GOODE AND BEAN, 1895, 'Ocean. Ichth.,' p. 225 (copied).

According to Günther the type of *Zeus conchifer* is 685 mm. long and differs only in the possession of three anal spines. The other items he sets forth are easily covered by the variation in my material.

CYTTUS Günther

Cyttus GÜNTHER, 1860, 'Cat. Fish. Brit. Mus.,' III, p. 396. Type: *Capros*

australis Richardson. (Designated by Gill, 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 126.)

Cyttopsis GILL, 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 126. Type: *Zeus roseus* Lowe. Monotypic.

Body well compressed, elevated. Mouth protractile. Minute teeth in jaws and on vomer, none on palatines. Branchiostegals 8. Body covered with very small scales. No bony plates at bases of vertical fins, though sometimes bony plates on median line between ventral and anal (*Cyttopsis*). Dorsals 2, contiguous, spines 8 or 9. Anal spines 2. Ventral with spine and 6 or 8 soft rays.

Atlantic and Australasian seas. Species few.

***Cyttus roseus* (Lowe)**

Zeus roseus LOWE, 1843, Proc. Zool. Soc. London, II, p. 85. Madeira.

Cyttus roseus GÜNTHER, 1860, 'Cat. Fish. Brit. Mus.,' II, p. 396 (type?).—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 349 (Morocco, in 410 m.).

Cyttopsis roseus GILL, 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 126 (name).

Dorsal VIII, 28; anal II, 29; ventral I, 8. Upper and lower profiles of snout straight. Scales very small. Between ventral fins and vent 3, each having a longitudinal ridge. Spines of dorsal and ventral fins stout and striated; those of anal short, first being very stout and immovable. Length 280 mm. (Günther.)

Madeira and off Morocco.

ORDER BERYCOIDEI

Berycoid Fishes

Head with more or less conspicuous mucous cavities. Air vessel without persistent duct. Vertebrae 24 to 30. No suborbital stay. Pharyngeals and shoulder girdle normal. Scales absent, or cycloid in the bathypelagic forms, with a more or less spinescent armature in the shore forms. Anterior rays of vertical fins usually spinous, rarely absent. Caudal usually with 19 principal rays, 17 or 18 branched. Ventrals thoracic or subabdominal, spine present or absent and rays 3 to 13. Families 14.

KEY TO THE FAMILIES

- a.*—XENOBERYCES. Palate toothless; no subocular shelf; a single supplemental maxillary; dorsal and anal with few slender graduated spines; ventrals thoracic, consisting of a slender spine and 6 to 9 soft rays. MELAMPHAIDAE.
- aa.*—BERYCOIDEI. Palate usually toothed; subocular shelf; 1 or 2 supplemental maxillaries; dorsal and anal with well-developed spines; ventrals thoracic or subabdominal, with or without a spine, 3 to 13 soft rays.
- b.*—Chin with 2 long mental barbels; scales moderate, ctenoid;

- dorsal continuous, spines 5; anal spines 3 or 4; caudal with 16 branched rays; ventrals subabdominal, without spines, rays 7 to 8. POLYMIXIIDAE.
- bb.—Chin without barbels; caudal with 17 branched rays.
- c.—Dorsal single, with 2 to 8 spines; anal spines 1 to 4.
- d.—Suborbitals narrow; scales firm.
- e.—Dorsal and anal bases equal; dorsal and anal rays all articulated; ventral with oblong ovate obliquely striated plate and 5 rays.
- DIRETMIDAE.
- ee.—Anal base much longer than dorsal base; dorsal spines 4; ventral with spine and 10 rays.
- BERYCIDAE.
- dd.—Suborbitals broad; scales various; anal shorter than dorsal, spines 1 or 2; ventral with a spine and 6 rays. TRACHICHTHYIDAE.
- cc.—Dorsal deeply notched, with 10 to 13 strong spines; anal spines 4; scales firm, very rough. HOLOCENTRIDAE.

Melamphaidae

Mouth protractile. Gills 4, Nasal bones separate. No orbito-sphenoid. Dorsal and anal fins with few slender graduated spines. Caudal fin with 19 principal rays, 17 of which branched, procurrent rays spinous. Ventrals thoracic, of a slender spine and 6 to 9 soft rays.

About five genera.

KEY TO THE GENERA

- a.—Scales moderate or large, 20 to 35 in lateral series; dorsal spines 2 to 12, rays 15 to 16, fin median. MELAMPHAES.
- aa.—Scales small, 40 in lateral series; dorsal fin rays all simple, 28, fin beginning over orbit. PLATYBERYX.

MELAMPHAES Günther

Melamphaes GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 433. Type: *Metopias typhlops* Lowe. Monotypic.

Metopias (not Gory, 1832) LOWE, 1843, Proc. Zool. Soc. London, p. 90. Type: *Metopias typhlops* Lowe.

Plectromus GILL, 1883, Proc. U. S. Nat. Mus., p. 257. Type: *Plectromus sub-orbitalis* Gill. Monotypic.

Scopelogadus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 140. Type: *Scopelogadus coeles* Vaillant. Monotypic.

Poromitrella ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 7. Type: *Poromitrella nigriceps* Zugmayer. Monotypic.

Scopeloberyx ZUGMAYER, *op. cit.*, p. 8. Type: *Scopeloberyx opercularis* Zugmayer. Monotypic.

Body moderately elongate. Head large and thick, with wide muciferous channels, bones often with foliaceous expansions. Mouth moderate, oblique, jaws subequal. Teeth villiform, in both jaws. Palate toothless. Opercles unarmed. Pseudo-branchiae present. Branchiostegals 8. Scales moderate or large, cycloid, rather irregularly arranged. Dorsal with 2 to 12 spines and 15 or 16 soft rays. Anal usually inserted below last dorsal rays, with 1 or more spines and 8 or 9 rays. Caudal forked. Pectorals long. Ventrals thoracic, rays 7.

Bathypelagic.

KEY TO THE SPECIES

- a.—MELAMPHAES. Anal origin entirely behind dorsal base *typhlops*.
 aa.—Anal inserted below dorsal base, at least below its posterior portion.
 b.—PLECTROMUS. Dorsal with 3 to 5 low spines.
 c.—Ventrals short, not reaching anal.
 d.—Maxillary less than half of head *cocles*.
 dd.—Maxillary half, or more than half, of head *robustus*.
 cc.—Ventrals longer, reach hind edge of anal base *megalops*.
 bb.—POROMITRELLA. Dorsal with 12 spines and 5 rays *nigriceps*.

Melamphaes typhlops (Lowe)

Metopias typhlops LOWE, 1843, Proc. Zool. Soc. London, p. 90. Madeira; 1850. *op. cit.*, p. 251 (Madeira).

Melamphaes typhlops GÜNTHER, 1864, 'Cat. Fish. Brit. Mus.,' V, p. 433 (Magdalena, Madeira); 1887, 'Rept. Voy. "Challenger,"' XX, p. 27, Pl. v, fig. K (Madeira).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 98 (off Azores, N. lat. 36° 46', W. long. 26° 41', 3250 m.).—ROULE, 1914 (May 31), Bull. Inst. Océanogr. Monaco, No. 292, p. 14 (southeast of Portugal, surface).

Head 3; depth rather more than 4; dorsal VI, 14; anal II, 6; pectoral 15; ventral I, 7; scales 25 in lateral series, 7 transversely. Head a little compressed, higher than broad and longer than thick. Snout very obtuse. Eye small, 6 in head, 2 1/2 in snout. Lower jaw scarcely projecting. Maxillary reaches opposite hind eye edge. Crown of head very convex, divided by ridges (which are angularly bent) into a central rhomboid, and a pair of lateral portions; skin extending from ridge to ridge, covering muciferous channels, finely and longitudinally plaited and pierced at regular intervals by very small pores. Opercle with a membranaceous edge. Gill membranes free from isthmus, not united. Gills 4. Pseudobranchiae small. Head scaleless. Scales large, especially on trunk, edges irregularly notched; become smaller on tail; thoracic region covered with very large ones, especially one between ventrals not much smaller than opercle. Anal base covered with rather large scales; caudal base scaly. No lateral line. Dorsal origin nearly midway between snout tip and caudal base; spines very feeble, becoming gradually longer to the last; second soft ray longest, much shorter than fin base. Anal small, spines very feeble. Caudal small and forked. Pectoral falciform, not quite so long as head and not reaching vent. Ventral much shorter, spine very feeble. Black. Length about 87 mm. (Günther.)

Eastern Atlantic.

Melamphaes cocles (Vaillant)

Scopelogadus cocles VAILLANT, 1888, 'Expéd. "Travailleur" et du Talisman,' Poiss., p. 143, Pl. XXVI. Banc d'Arguin, 1090 to 1250 m.; off Cape Verde Islands, 3655 m.

Head 3; depth 3 1/5; dorsal 12; anal 8; pectoral 13; ventral 10; scales 21 in lateral series, 6 transversely. Body very compressed. Snout short and curved. Eye rudimentary. Mouth moderate, inclined. Mandible deep. Maxillary reaches orbit, moderately expanded behind. Numerous uniserial fine teeth in jaws; none on vomer, palatines, or tongue. Scales smooth. No lateral line. Dorsal inserted nearer mandible tip than caudal base by about half length of head; base about 3/4 of length of head. Anal shorter, origin little behind middle of dorsal base. Caudal emarginate. Pectoral long, passes beyond end of dorsal. Ventral short, inserted below pectoral base. Vent midway between snout tip and caudal base. Length 80 mm. (Vaillant.)

Eastern Atlantic, in 1090 to 3655 m.

Melamphaes robustus Günther

Figure 252

Melamphaes robustus GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 29. Mid-Atlantic, southwest of Sierra Leone, 1850 fathoms; midway between Cape of Good Hope and Kerguelen Island, 1375 fathoms; north of New Guinea, 1100 fathoms.

Scopeloberyx opercularis ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 8. N. lat. 36° 7', W. long. 10° 18', in 4740 m., off Portugal; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 103, Pl. v, fig. 6 (type).

Melamphaes opercularis ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 44 (north-east of Azores, in 2600 m.).

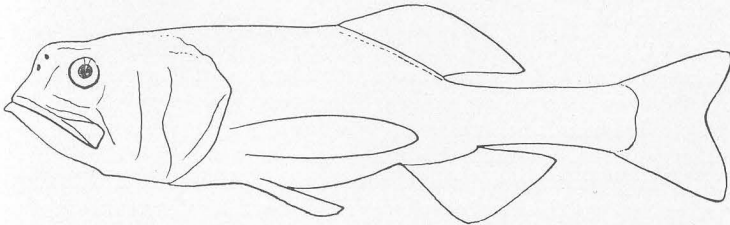


Fig. 252. *Melamphaes robustus*, from Zugmayer.

Head 2 2/3; depth 3 3/4; dorsal III, 11; anal I, 8; scales 30 in lateral series, about 12 ? transversely from dorsal origin. Body moderately elongate, compressed. Head large, with numerous mucous cavities. Snout oblique. Eye small, advanced, about half of snout. Lower jaw moderately protruded. Maxillary extends a little beyond eye. Dentition feeble; teeth brushlike in jaws, a small group on vomer. Interorbital with a median bony process as long as eye. Above and below eye 2 bony scalelike plates. Preopercle angle rounded. Opercle with a prolonged mem-

braneous point, supported by bony opercular process with 3 rounded points. Branchiostegals 8. Scales largest above on middle of side, small on posterior part of body. Row of dozen small scales along dorsal base, 6 along anal base and 2 rows of scales as 4 + 3 at each base of caudal lobes. Dorsal origin midway between mandible tip and caudal base. Anal begins opposite last third of dorsal base. Caudal emarginate. Pectoral reaches vent. Ventral inserted at about an eye diameter behind pectoral base, before dorsal origin, fin not reaching vent. Dusky. Length (caudal damaged) 80 mm. (Zugmayer.)

Eastern Atlantic.

Melamphaes megalops Lütken

Melamphaes megalops LÜTKEN, 1877, 'Overs. k. Danske Vidensk. Selsk. Forh., Kjøbenhavn,' p. 176, Pl. v, figs. 1-3. South of Azores.—GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 27, Pl. v, fig. 3 (copied).

Head $3\frac{1}{4}$; depth $3\frac{1}{3}$; dorsal III, 11; anal I, 9; pectoral 10 or 11; ventral I, 7; scales 34, transversely 9. Head very rough, foliaceous. Eye rather large, less than 4 in head and greater than snout. Lower jaw prominent, projecting. Interorbital $\frac{1}{4}$ greatest body depth. Scales large, a little smaller on caudal peduncle. Dorsal origin nearer snout tip than caudal base. Anal inserted about opposite last fourth of dorsal base. Caudal forked. Caudal peduncle long and slender, its least depth about $\frac{1}{4}$ its length, which is equal to rest of trunk. Pectoral long, extends beyond bases of dorsal and anal, or a little longer than head. Ventral inserted entirely before pectoral base, broad, stout, as long as pectoral and overlaps most of anal base. Black. (Lütken.)

Eastern Atlantic.

Melamphaes nigriceps (Zugmayer)

Poromitrella nigriceps ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 293, p. 7. N. lat. $37^{\circ} 4'$, W. long. $22^{\circ} 39'$, 3000 m., off Azores.; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 100, Pl. v, fig. 2 (type).

Head $2\frac{1}{2}$; depth $3\frac{2}{3}$; dorsal XII, 5; anal 11; pectoral 16; ventral 8; scales 30 ? in lateral series. Head large, abundantly furnished with mucous pores. Snout twice length of eye. Lower jaw projects. Mouth cleft reaches opposite center of eye. Front nostril lower and smaller than hind one, which is level with upper border of eye. Opercular apparatus complete. Branchiostegals 8. Scales cycloid. Dorsal begins midway between snout tip and caudal base. Anal origin below fifth dorsal spine, fin extends back as far as hind end of soft dorsal. Pectoral reaches hind base of anal, fin about $1\frac{2}{5}$ in head. Ventral reaches second anal ray. Color dark. Length 25 mm. (Zugmayer.)

Eastern Atlantic.

PLATYBERYX Zugmayer

Platyberyx ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 8. Type: *Platyberyx opalescens* Zugmayer. Monotypic.

Body strongly compressed. Head large, deep. Snout short, declivous. Eye greatly enlarged, anterior. Mouth large. Teeth minute. Head with mucous cavities. Opercle unarmed. Branchiostegals 5. Scales small, cycloid. Lateral line present. Fin rays all simple. Ventrals greatly elongated, rays 5.

Platyberyx opalescens Zugmayer

Figure 253

Platyberyx opalescens ZUGMAYER, 1911 (January 20), Bull. Inst. Océanogr. Monaco, No. 193, p. 8. N. lat. 36° 5', W. long. 9°, in 3660 m., off Portugal; 1911, Rés. Camp. Sci. Monaco, XXXV, p. 101, Pl. v, fig. 5 (type).

Head 3; depth 1 3/4; dorsal III, 28; anal II, 16; pectoral II, 14; ventral I, 5; scales 40 in lateral line, transversely 25. Body deepest about midway in its length. Eye lateral, equals postocular. Mouth strongly inclined, lower jaw slightly protruding. Maxillary reaches center of eye. Teeth brushlike, recurved. Interorbital and front covered with mucous cavities. Lower preopercle border and hind opercle border mem-

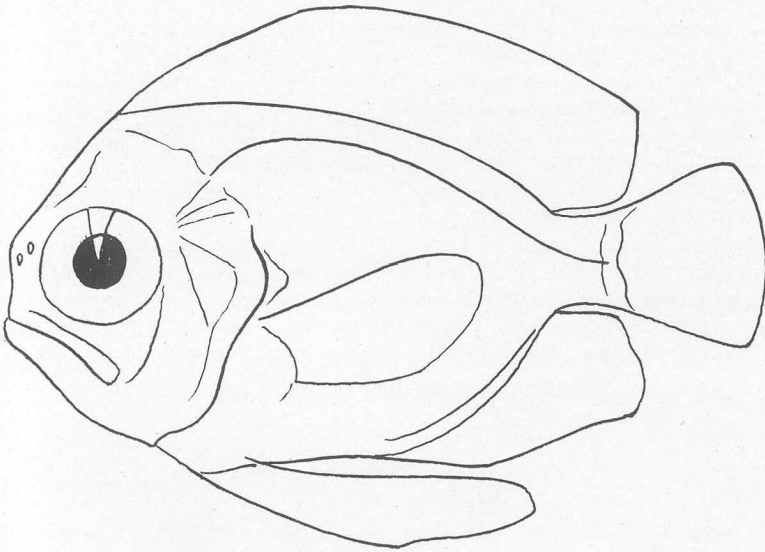


Fig. 253. *Platyberyx opalescens*, from Zugmayer.

branous. Scales small, with finely concentric striae. Lateral line greatly arched, complete. Dorsal begins above eye center, seventh to tenth rays longest or nearly half of body length. Anal like dorsal, lower begins behind middle of dorsal and ends in same vertical; longest rays less than head. Caudal truncate. Pectoral well developed, rays longer than those of anal. Ventral with second to fifth rays greatly elongated, fin equals greatest depth of trunk or reaches caudal peduncle. Brownish, with bright opal reflections. Opercle bluish violet. Dorsal, anal, and ventral black. Caudal transparent white. Length 52 mm. (Zugmayer.)

Eastern Atlantic.

Polymixiidae

Body rather elongated. Head compressed, with decurved profile. Mouth cleft lateral and nearly horizontal. Teeth fine, in bands in jaws and on palate. Two barbels at throat. Preopercle serrated. Gill openings large, membranes separate and free from isthmus. Vertebrae 29. Scales not serrated. Lateral line concurrent with dorsal profile of back. Dorsal moderately long, with several spines, graduated posteriorly. Anal opposite hind part of dorsal. Pectoral rays branched. Ventrals thoracic, with spine and 6 or 7 rays.

One genus.

POLYMIXIA Lowe

Polymixia LOWE, 1838, Trans. Cambridge Philos. Soc., VI, p. 198. Type: *Polymixia nobilis* Lowe. Monotypic.

Nemobrama VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II (2), p. 40. Type: *Nemobrama webbia* Valenciennes. Monotypic.

Nemobrama JORDAN, EVERMANN, AND CLARK, (1930) 1928, Rep. Comm. Fish U. S., part 2, p. 234. Type: *Nemobrama webbia* Valenciennes.

Dinemus POEY, 1860, 'Mem. Hist. Nat. Cuba,' II, pp. 107, 161. Type: *Dinemus venustus* Poey. Monotypic.

Body compressed. Head moderate. Eye large. Mouth large, inferior, upper jaw protruding. Teeth villiform, in both jaws, on vomer, palatines, and pterygoids. Opercle without spine. Preopercle indistinctly crenulated. Branchiostegals 4. Gill rakers moderate. Scales small. Lateral line complete. One dorsal with 4 or 5 spines. Anal with 3 or 4 spines. Caudal forked. Pectorals and ventrals low and short.

Species few, in rather deep water in tropical seas.

Polymixia nobilis Lowe

Salmon de alto (Canaries)

Figure 254

Polymixia nobilis LOWE, 1838, Trans. Cambridge Philos. Soc., VI, p. 198, Pl. IV, figs. 1-2. Madeira.—GÜNTHER, 1859, 'Cat. Fish. Brit. Mus.,' I, p. 16 (Madeira, St. Helena); 1869, Proc. Zool. Soc. London, p. 238 (St. Helena).—MELLISS, 1875, 'St. Helena,' p. 105.—GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 34, Pl. I, fig. 31 (Madeira, Canaries, St. Helena).—STEINDACHNER, 1819, Sitzs. Akad. Wiss. Wien, C (1), p. 356 (Las Palmas, Santa Cruz de Teneriffe, Valle de San Andres, in 100 to 250 m., east coast Grand Canary).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 313 (Canaries).

Nemobrama webbia VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II (2), p. 41, Pl. VIII. Canaries.

Head 3; depth 2 2/3; dorsal V, 30 to 38; anal III or IV, 16 to 18; scales 48 to 54 in lateral line. Body deepest below dorsal origin. Snout short, obtuse, upper jaw overlapping lower. Eye high, a little over 3 in head. Mouth cleft wide. Maxillary reaches a little behind eye. Barbels reach pectoral base. Teeth villiform, in broad bands in jaws, on vomer, palatines, and pterygoids. Interorbital 4 in head. Supra-

scapula slightly denticulated. Scales on top of head extend forward to near front of eyes; head otherwise scaly except for muzzle and maxillary. Scales rather oblique, irregular, with concentric striae apically. Dorsal begins a little before middle, forms a short lobe at front of rayed fin. Anal like dorsal, shorter and lower; third spine at about third of first ray. Caudal deeply forked, pointed lobes equal. Pectoral short,

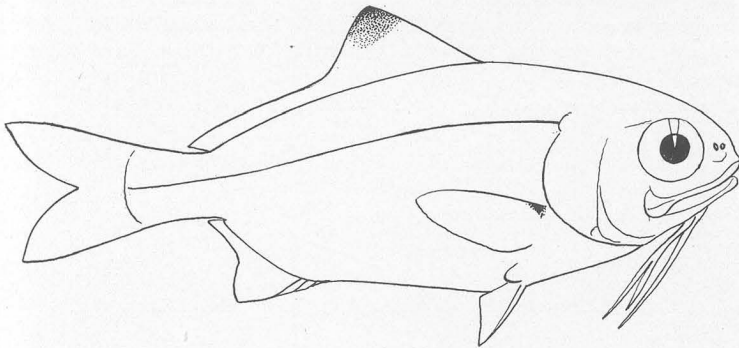


Fig. 254. *Polymixia nobilis*, from Günther.

pointed, reaches a little beyond dorsal origin. Ventral short, as long as eye, fin scarcely reaching beyond pectoral. Uniform greenish. Dorsal and anal black anteriorly. Length 250 mm. (Günther.)

Tropical Atlantic, Indian and Pacific Oceans, in rather deep water.

Diretmidae

Body deep, orbicular. Head large and deep. Caudal peduncle small, compressed. Snout very short. Eye large. Mouth large, well inclined. Premaxillaries wide behind. Preopercle prolonged downward, separating opercle from outer bones. Pseudobranchiae present. Branchiostegals 7. Body and cheeks scaly. Long dorsal and anal with simple rays. Caudal emarginate. Pectoral moderate. Ventral small, thoracic.

DIRETMUS Johnson

Diretmus JOHNSON, 1863, Ann. Mag. Nat. Hist., London, XIV, p. 403. Type: *Diretmus argenteus* Johnson. Monotypic.

Gyrionemus VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., pp. 18, 35. Type: *Gyrionemus nummularis* Vaillant. Monotypic.

Body greatly compressed, short, elevated. Abdomen prominent and keeled. Eyes advanced, very large. Mouth wide, oblique, lower jaw protruding. Maxillaries end at upper and inner extremity in a pair of short-pointed processes which form peculiar fanglike projections on the inside of mouth before vomer. Bones of head thin, with wide muciferous cavities; lower limb of preopercle denticulated. Body covered

with small coarsely spinous scales, without lateral line. Dorsal long, without spinous division. Anal similar. Pectoral large. Ventral thoracic, with more than 5 rays, spine enlarged scalpel-shaped plate marked with numerous oblique striae.

***Diretmus argenteus* Johnson**

Figure 255

Diretmus argenteus JOHNSON, 1863, Proc. Zool. Soc. London, p. 403, Pl. xxxvi, fig. 1. Madeira.—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman," Poiss., p. 355 (off Morocco, 1105 m.).—GÜNTHER, 1887, 'Rept. Voy. "Challenger," XXII, p. 45 (type).

Gyrionemus nummularis VAILLANT, *op. cit.*, pp. 18, 45.

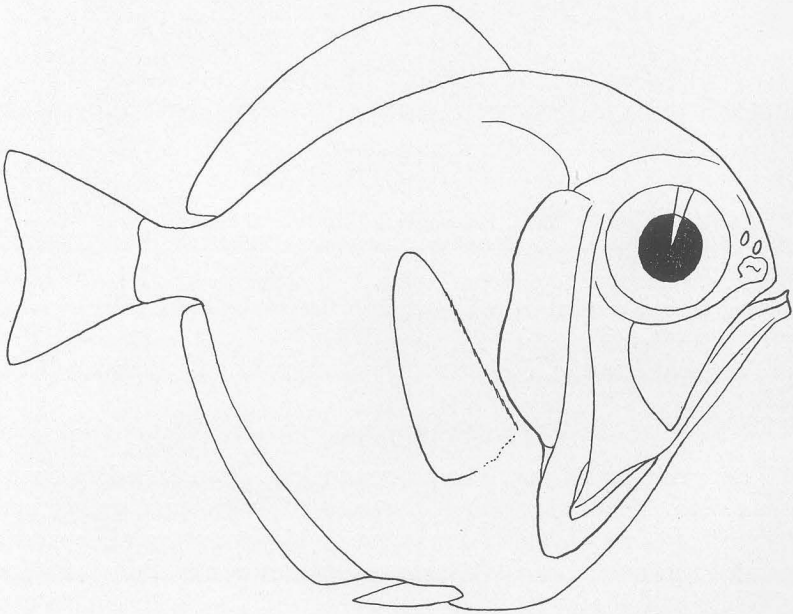


Fig. 255. *Diretmus argenteus*, from Zugmayer.

Head $2 \frac{2}{5}$; depth $1 \frac{2}{5}$; dorsal 27; anal 22; scales 60 between opercle and caudal base; 50 scales transversely; snout $5 \frac{2}{5}$ in head measured from upper jaw tip; eye $1 \frac{4}{5}$; maxillary $1 \frac{1}{4}$.

Body greatly compressed, orbicular, nape and abdomen keeled. Least depth of caudal peduncle equals its length or $3 \frac{1}{4}$ in total head length. Head obtuse. Snout $2 \frac{3}{4}$ in eye. Eye high. Mouth a little inclined from vertical, mandible conspicuously protruding. Maxillary reaches $\frac{2}{3}$ in eye; expansion very slightly less than eye. Premaxillary teeth minute, biserial, uniserial anteriorly; lower teeth uniserial; palate and tongue edentulous. Lower preopercle edge finely denticulated. Gill rakers

spiny, in moderate series. Scales deciduous, apical denticles 4, broad and minute spines on exposed surface. Cheeks covered with small scales. Maxillary and preopercle flange with radiating striae. No lateral line. Dorsal begins behind pectoral origin, second ray $2\frac{3}{5}$ in total head length; second anal ray $2\frac{3}{4}$; caudal emarginate, $1\frac{1}{5}$; pectoral 1; ventral 2. Silvery gray, darker near dorsal and anal. Pharynx black. Length 98 mm. (Johnson.)

Madeira.

Berycidae

Body oblong or ovate, compressed. Head with large muciferous cavities, covered by thin skin. Eye lateral, usually large. Mouth wide, oblique. Premaxillaries protractile. Maxillary rather large, usually with a supplemental bone. Bands of villiform teeth in jaws, usually on vomer and palatines. Canines sometimes present. Opercular bones usually spinous. Suborbitals narrow, not ensheathing cheeks. Gill membranes separate, free from isthmus. Gills 4, slit behind fourth. Gill rakers moderate. Pseudobranchiae present. Branchiostegals 7 or 8. Pyloric caeca numerous. Scales ctenoid, cycloid, foliate, or granular. Cheeks and opercles scaly. Dorsal fins continuous, with 2 to 8 weak spines. Anal spines 2 to 4. Caudal usually forked. Ventral thoracic, with 7 to 13 soft rays.

Fishes mostly of the deep seas, color red or black. Genera about four, also a number of fossils.

BERYX Cuvier

Alfoncifios

Beryx CUVIER, 1829, 'Règne Animal,' II, 2d Ed., p. 151. Type: *Beryx decadactylus* Cuvier. (Designated by Jordan and Evermann, 1917, Stanford Publications, 'Genera of Fishes,' part 1, p. 127.)

Body deep, compressed. Abdomen trenchant, without enlarged scutes. Head large, bones thin, ridges high, with deep muciferous cavities. Snout short. Eye large. Mouth oblique, mandible protruding. Jaws, vomer, and palatines with villiform teeth. Opercles serrated, usually with spine. Preopercle unarmed. Air vessel simple. Pyloric caeca numerous. Body with large ctenoid scales, regularly arranged. Dorsal continuous, spines 4 to 6. Anal spines 4, soft rays 26 to 30. Caudal forked. Ventral with about 10 soft rays.

Deep-sea fishes, bright red in color. Species few. Lowe gives the following:

Remarkable and striking in appearance, from their enormous opal eyes, and brilliant red or rosy tints, and abundant principally in the spring and summer, though scarcely absent from the market long at any season, they fail not early to attract the notice of the most incurious visitor. The two sorts differ not in season, taste or quality. They are generally esteemed as good table fishes; their flesh being white,

moderately firm, flaky, and well tasted, though possessing no peculiar delicacy of flavor. They are in highest season in the autumn : their usual size is from 12 to 18 inches long, weighing from 2 to 5 pounds. They are captured only at enormous depths and though I have been unsuccessful hitherto in obtaining one of either sort in spawn, yet I have reason to believe from certain observations, that their breeding season is the autumn.

KEY TO THE SPECIES

- a.*—Scales in lateral line 64 or 65; soft dorsal rays 16 to 19. *decadactylus*.
aa.—Scales in lateral line 71 to 76; soft dorsal rays 13 to 15. *splendens*.

Beryx decadactylus Cuvier

Alfonciño (Canaries)

Beryx decadactylus CUVIER, 1829, 'Hist. Nat. Poiss.,' III, p. 222. Madeira.—LOWE, 1833, Proc. Zool. Soc. London, I, p. 142 (Madeira).—VALENCIENNES, 1836–1844, 'Hist. Nat. Canaries,' II (2), p. 13 (Teneriffe).—LOWE, 1839, Trans. Zool. Soc. London, III, p. 1 (Madeira).—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 399 (Santa Cruz, Teneriffe); 1867, *op. cit.*, LVI (1), p. 603, Pl. I (Santa Cruz).—VON MARTENS, 1876, 'Preuss. Exped. Ost-Asien,' I, p. 385 (Madeira).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 313 (Canaries).—VAILLANT, 1918, Rés. Camp. Sci. Monaco, LII, p. 131 (Azores, N. lat. 37° 39' 45", W. long. 25° 24' 25", 550 m.).

Beryx splendens (not Lowe, 1833) LOWE, 1838, Trans. Cambridge Philos. Soc., VI, Pl. III (not descr.) (Madeira).

Head 2 1/2; depth 2 1/2; dorsal IV, 16 to 19; anal IV, 28 or 9; pectoral 14?; ventral I, 10; scales 64 or 65 in lateral line, 34 or 35 transversely. Body oblong, considerably compressed, deepest at dorsal origin. Eye very large, impinging on upper profile of head; 2 1/2 in head. Maxillary reaches almost to middle of orbit. Scales sharply ctenoid, with a strong median keel. Anal origin opposite tenth to twelfth dorsal rays and middle slightly behind last dorsal ray. Pectoral origin distant from snout a space equal to the anal base. Ventral inserted under pectoral axil. Brilliant scarlet, mouth a little pale. (Goode and Bean.)

Tropical Atlantic and Pacific, in depths to 300 or 400 fathoms.

Adult in the U. S. National Musum from Fayal, Azores, received from F. B. McGuire.

Beryx splendens Lowe

Alfonciño (Canaries)

Figure 256

Beryx splendens LOWE, 1833, Proc. Zool. Soc. London, p. 142. Madeira; 1838, Trans. Cambridge Philos., VI, p. 197 (not Pl. III) (Madeira); 1843, 'Fishes of Madeira,' part 2, p. 47, Pl. VIII (Madeira).—GÜNTHER, 1859, 'Cat. Fish. Brit. Mus.,' I, p. 16 (Madeira).—STEINDACHNER, 1867, Sitzs. Akad. Wiss. Wien, LVI (1), p. 604 (Teneriffe).—VON MARTENS, 1876, 'Preuss. Exped. Ost-Asien,' I, p. 385 (Madeira).—GÜNTHER, 1880, 'Rept. Voy. "Challenger,"' I, p. 3 (Madeira).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 313 (Canaries).

Head $3\frac{1}{2}$; depth $3\frac{1}{2}$; dorsal IV, 13 to 15; anal IV, 25 to 29; scales 71 to 76 in lateral line, 8 above, 20 below. Scales with whole surface spinous, with short reflexed points or prickles, rough to touch. Lateral line nearly straight, inconspicuous, follows curvature of back. Dorsal and anal rather high, insertion of latter under end

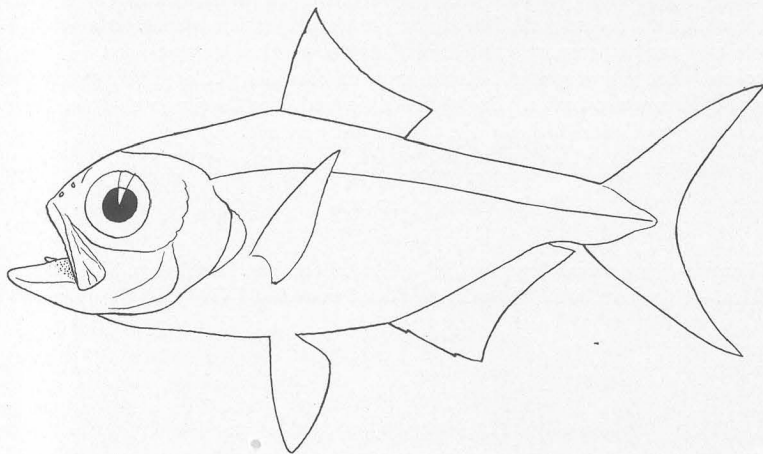


Fig. 256. *Beryx splendens*, from Lowe.

of dorsal. Caudal deeply forked. Pure resplendent silvery white; bright scarlet on fins, ridge of back, and head, inside mouth, lower jaw, and infraorbital; becomes deep rosy or scarlet after death. (Goode and Bean.)

Tropical Atlantic and Pacific, in depths over 400 fathoms. Lowe says that large examples are less frequent than of the preceding. He mentions one 608 mm. long.

Adult in the U. S. National Museum, from the Canaries, obtained through the Vienna Museum.

Trachichthyidae

Belly compressed, with serrated edge. Head large, compressed. Suborbitals usually broad. Vertebrae 26 to 28. Scales variously rough and deciduous. Dorsal fin single, not deeply notched, with 6 or 7 spines. Anal shorter than dorsal, with 1 to 3 spines. Ventral with spine and 6 rays. Color dark or blackish.

Bathypelagic. Size small or moderate.

KEY TO THE GENERA

- a.*—Vomer with fine teeth; dorsal spines 7 or 8. GEPHYROBERYX.
aa.—Vomer toothless; dorsal spines 6. HOPLOSTETHUS.

GEPHYROBERYX Boulenger

Gephyroberyx BOULENGER, 1902, Ann. Mag. Nat. Hist., London, (7) IX, p. 203.
Type: *Trachichthys darwini* Johnson. Monotypic.

Gephyroberyx auct.

Body rather short, ventral edge serrated. Snout short, rounded. Eye large. Mouth oblique. Teeth small, fine in jaws, on vomer, and palatines. Small spine on opercle and one at preopercle angle. Suborbital with radiating ridges. Gill rakers lanceolate. Branchiostegals 8. Strong spine on shoulder girdle. Body covered with large, rough, irregular scales. Dorsal fin single, with 7 or 8 strong well-spaced spines, median largest. Caudal forked. Vent far behind ventrals.

Bathypelagic in the Atlantic, Indian, and Pacific Oceans.

Gephyroberyx darwini (Johnson)

Figure 257

Trachichthys darwini JOHNSON, 1866, Proc. Zool. Soc. London, p. 311, Pl. xxxii. Madeira.—GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 25 (Madeira).

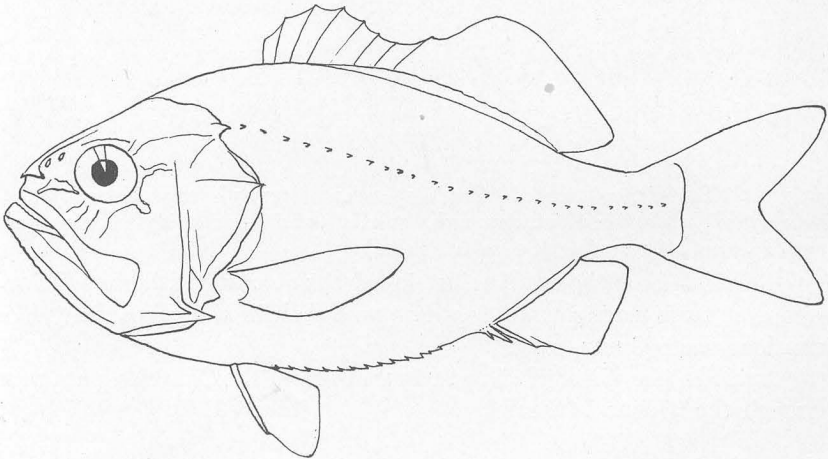


Fig. 257. *Gephyroberyx darwini*, from Goode and Bean.

Head $2\frac{1}{2}$; depth $2\frac{1}{3}$; dorsal VIII, 14; anal III, 12; scales 27 in lateral line. Body elliptical, compressed, high. Head obtuse, truncate. Snout $3\frac{1}{2}$ in head, measured from upper jaw tip. Eye elevated, $4\frac{1}{2}$ in head, $1\frac{1}{3}$ in snout. Mouth very large, nearly vertical, mandible well protruding. Maxillary reaches middle of eye, $1\frac{4}{5}$ in head; expansion equals eye. Teeth villiform, in narrow bands in jaws and on vomer. Nostrils close together, near upper front part of orbit, hind one larger. Opercle with strong roughened radiating ridges, ends with a strong spine behind. Preopercle with a longer strong spine at angle. Hind edge of suprascapula finely serrated. Scales broad, rather irregular, exposed edges roughly ctenoid. Large ventral

bucklers 10, extend from ventral bases to vent. Lateral line slightly elevated, slopes down till midway in caudal peduncle, then straight to caudal base. Fourth dorsal spine about 4 in total head length. First branched dorsal ray $2\frac{1}{2}$. Second branched anal ray 3. Caudal forked, $1\frac{2}{5}$; pectoral $1\frac{2}{3}$; ventral $2\frac{1}{8}$. Head and fins bright red. Back brownish red, passing into gray on sides. Belly white. Length 489 mm. (Johnson.)

Eastern Atlantic.

HOPLOSTETHUS Valenciennes

Hoplostethus VALENCIENNES, 1829, 'Hist. Nat. Poiss.,' IV, p. (469) 344. Type: *Hoplostethus mediterraneus* Valenciennes. Monotypic.

Body short, deep, much compressed. Head short, compressed, very blunt forward, deeper than long, with very conspicuous mucous cavities. Eye very large. Mouth greatly inclined, jaws equal when closed. Maxillary long, expanded behind, with a distinct supplemental bone reaching hind eye edge. Teeth very fine, villiform, in jaws, on palatines, and none on vomer. Opercle a little developed with vertical ridge in front and spine small or obsolete. Strong spine at preopercle angle, long vertical limb finely serrated. Suborbital with radiating ridges and few spines. Gill membranes separate, free from isthmus. Gill rakers lanceolate. Branchiostegals 8. Air vessel simple. Pyloric caeca numerous. Vertebrae 26, of which 15 caudal. Scales moderate or small, ctenoid. Abdomen with a series of bony plates, each ending in a retrorse spine. Dorsal short, continuous, spines 6, graduated. Anal with 3 graduated spines. Caudal forked, rudimentary rays spinous. Pectorals low, rather long. Ventrals rather short.

Bathypelagic. Species few, bright red in color.

KEY TO THE SPECIES

- a.—Dorsal rays 13, anal 9. *mediterraneus*.
 aa.—Dorsal rays 17, anal 11. *atlanticus*.

Hoplostethus mediterraneus Valenciennes

Alfonsin, Pargo do alto (Madeira)

Figure 258

Hoplostethus mediterraneus VALENCIENNES, 1829, 'Hist. Nat. Poiss.,' IV, p. (469), 344. Nice.—GÜNTHER, 1859, 'Cat. Fish. Brit. Mus.,' I, p. 9 (Madeira).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 401 (off Morocco, 535 m.).—PAPPENHEIM, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 198 (Cape Verde Islands, N. lat. $17^{\circ} 28'$, W. long. $29^{\circ} 42'$, in 3000 m.).

Hoplostethus mediterraneum GÜNTHER, 1887, 'Rept. Voy. "Challenger,"' XXII, p. 21 (Madeira).

Trachichthys pretiosus LOWE, 1839, Proc. Zool. Soc. London, p. 77. Madeira; 1843, 'Fishes of Madeira,' p. 55, Pl. ix (Madeira).

Head $2\frac{1}{2}$; depth $1\frac{7}{8}$; dorsal VI, 13; anal III, 9; pectoral II, 13 or 14; ventral I, 6; scales in lateral line 28 or 29; abdominal bucklers 11 to 13. Snout very short, abrupt, convex, about half of eye diameter. Eye very large, $2\frac{4}{7}$ to 3 in head. Mouth small, gape large; lower jaw protruding. Maxillary reaches a little beyond eye; expansion $\frac{4}{5}$ of eye. Teeth fine, small, in narrow bands in jaws and on palatines,

none on vomer. Nostrils close together just before eye and hind one twice size of front one. Interorbital convex, scarcely equals eye. Opercle with radiating rugose striae. Preopercle ends in a long, strong, flattened spine at angle. Upper suprascapular edge finely serrated. Dorsal inserted a little behind pectoral origin; sixth spine $2\frac{2}{3}$ in total length of head. Anal a little shorter than dorsal, first branched ray $2\frac{3}{4}$ in head. Caudal very large, nearly as long as head; rudimentary rays spinous. Pectoral obtuse, reaches a little beyond anal origin, $1\frac{3}{5}$ in head. Ventral obtuse, 2 in head. Pale claret, flanks and belly blackish to dull muddy scarlet, fuller

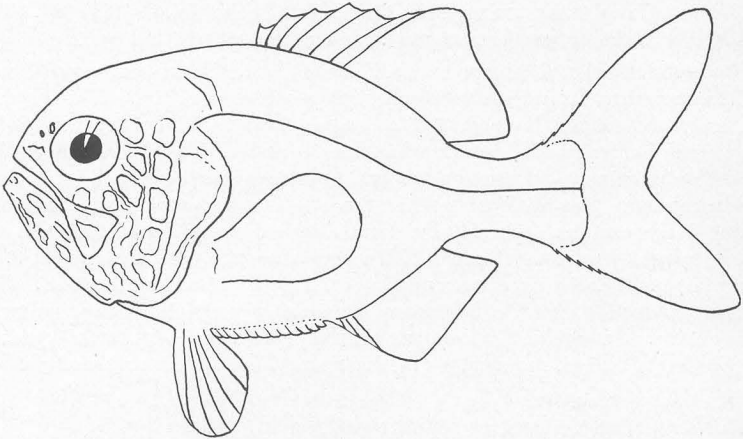


Fig. 258. *Hoplostethus mediterraneus*, from Lowe.

and more rosy above lateral line. Body paler and somewhat silvery toward belly. Fins all reddish. Iris greenish iridescent, opaline, with dusky brown clouds. Inside of mouth and pharynx mulberry-black. Length 203 mm. (Lowe.)

Tropical Atlantic and Pacific.

***Hoplostethus atlanticus* Collett**

Hoplostethus atlanticus COLLETT, 1889, Bull. Soc. Zool. France, XIV, p. 306. Flores, Azores, 1557 m.

Hoplostethus atlanticum RICHARD, 1910 (February), Bull. Inst. Océanogr. Monaco, No. 162, p. 147 (Azores, 1557 m.):

Head 3 (caudal included); depth $2\frac{7}{10}$ (caudal included); dorsal VI, 17; anal II, 11; pectoral I, 17; ventral I, 6. Eye a little greater than snout, $3\frac{1}{2}$ in head. Branchiostegals 9. Scales very small, equal $\frac{1}{7}$ vertical diameter of those in lateral line, which circular and with some spinules. Abdominal keel indistinct, with 20 bucklers. Dorsal and anal spines weak. Ventrals reach vent. Length 135 mm. (Collett.)

Eastern Atlantic. Collett says that it is very near *Hoplostethus mediterraneus*, but differs in its eyes, smaller scales, obsolete ventral keel, and greater number of fin rays.

Holocentridae

Soldier Fishes

Body oblong or ovate, moderately compressed. Head with large muciferous cavities. Snout sharp and produced in young, obtuse with age. Eye very large, lateral. Mouth moderate, oblique. Premaxillaries protractile. Maxillary very large, with a supplemental bone. Bands of villiform teeth in jaws, on vomer and palatines. Opercular and membrane bones of head generally serrated or spinescent along edges. Gill membranes separate, free from isthmus. Gills 4, slit behind fourth. Gill rakers moderate. Pseudobranchiae present. Air vessel large, sometimes connected with organ of hearing. Pyloric caeca 8 to 25. Vertebrae about 27. Scales strongly ctenoid or spinous. Sides of head scaly. Lateral line present. Dorsal fin very long, deeply divided, with about 11 strong spines depressible in a scaly groove. Anal with 4 spines, third longest and strongest. Caudal deeply forked, with sharp rudimentary rays. Ventrals thoracic, with a spine and 7 rays. General color red.

Fishes of the tropical seas, brilliantly colored and living about coral reefs or rocks.

HOLOCENTRUS Gronow

Holocentrus GRONOW, 1763, 'Zoophylac.,' p. 65. Type: *Perca adscensionis* Osbeck = *Holocentrus sogo* Bloch. (Designated by Jordan and Gilbert, 1883, Bull. U. S. Nat. Mus., No. 16, p. 459.)

Holocenthrus, *Holocentrum* auct.

Farer FORSKÅL, 1775, 'Descript. Animal.,' p. 44. Atypic. Type: *Sciaena samara* Forskål, assumed by vernacular name.

Eritrinus (Plumier) LACÉPÈDE, 1802, 'Hist. Nat. Poiss.,' IV, p. 87. Type: *Holocentrus sogo* Bloch. Monotypic. (Inadmissible.)

Erythrinus (Plumier) LACÉPÈDE, *op. cit.*, p. 347.

Corniger AGASSIZ, 1826, 'Pisc. Brasil. Spix,' p. 119. Type: *Corniger spinosus* Agassiz. Monotypic.

Rhynchichthys VALENCIENNES, 1831, 'Hist. Nat. Poiss.,' VII, p. 378. Type: *Rhynchichthys pelamidis* Valenciennes. Monotypic.

Rhynchichtys SWAINSON, 1839, 'Nat. Hist. Animals,' II, pp. 180, 263.

Rhinoberyx GILL, 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 237. Type: *Rhynchichthys brachyrhynchus* Bleeker. Monotypic.

Flammeo JORDAN AND EVERMANN, 1898, Bull. U. S. Nat. Mus., No. 47, III, p. 2871. Type: *Holocentrum marianum* Cuvier. Monotypic.

Sargocentron FOWLER, 1904, Proc. Acad. Nat. Sci. Philadelphia, p. 235. Type: *Holocentrum leo* Cuvier. Orthotypic.

Body oblong, moderately compressed, ventral profile nearly straight and back little elevated. Caudal peduncle slender. Head compressed, narrowed forward. Snout greatly projecting in young, obtuse in adult. Eye excessively large. Mouth small, terminal, lower jaw projecting in adult. Maxillary broad, striate, with supple-

mental bone, not extending to middle of eye. Opercle with a strong spine above, below edge sharply serrate. Strong spine at preopercle angle. Orbital ring, preorbital, preopercle, interopercle, subopercle, occiput, and shoulder girdle with sharply serrate edges. Scales moderate, closely imbricated, hind edges strongly spinous. Lateral line complete. Dorsal fin deeply emarginate, spines usually 11, depressible in a groove. Soft dorsal short and high. Anal with 4 spines, first and second quite small, third very long and strong and fourth smaller. Caudal widely forked, both lobes with rudimentary spinous rays. Ventrals large, spine strong.

Species numerous in tropical seas. Remarkable for sharp spines almost everywhere over surface of body.

KEY TO THE SPECIES

- a.*—Body uniform red. *ascensionis*.
aa.—Red, with longitudinal bands; spinous dorsal with a black blotch in front, sometimes another posteriorly. *hastatus*.

Holocentrus ascensionis (Osbeck)

Gaqui (Anno Bom)

Perca adscensionis OSBECK, 1765, 'Reise Ost-Ind., China,' p. 388. Ascension Island.

Amphacanthus ascensionis SCHNEIDER, 1801, 'Syst. Ichth. Bloch,' p. 210.

Lutjanus ascensionis LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' IV, p. 197.

Holocentrus ascensionis FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 267 (Gaboon).

Holocentrus sogo Bloch, 1790, 'Naturg. Ausl. Fische,' IV, p. 61, Pl. CCXXXII. Africa.

Sciaena rubra (not Forskål) SCHNEIDER, 1801, 'Syst. Ichth. Bloch,' p. 82 (on

Perca rubra Catesby, 1732, 'Nat. Hist. Carolina,' II, Pl. III, lower figure [Carolina, Florida, Bahamas]).

Holocentrus rostratus GRAY, 1854, 'Cat. Fish Gronow,' p. 173. Near the Equator.

Holocentrum longipinne GÜNTHER, 1868, Proc. Zool. Soc. London, p. 225 (St. Helena).—MELLISS, 1875, 'St. Helena,' p. 105, Pl. XX, fig. 2.—GÜNTHER, 1880, 'Rept. Voy. "Challenger,"' I, p. 5 (Ascension Island).—OSORIO, 1892, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) II, p. 89 (St. Thomé); 1895 (March), *op. cit.*, (2) III, p. 244 (Bom alimento).—CUNNINGHAM, 1910, Proc. Zool. Soc. London, p. 97 (St. Helena).—CLARK, 1913, Proc. Roy. Phys. Soc. Edinburgh, XIX, p. 391 (St. Helena), p. 385 (Ascension Island).

Holocentrum longipine OSORIO, 1898 *op. cit.*, (2) V, p. 195 (Ilha do Principe, Ilha de S. Thomé, Ilha de Anno Bom).

Holocentrum sancti pauli GÜNTHER, 1880, 'Rept. Voy. "Challenger,"' I, p. 4. St. Paul's Rock, mid-Atlantic.

Head $2\frac{7}{8}$ to $3\frac{1}{5}$; depth $2\frac{3}{4}$ to 3; dorsal XI, 15 or 16; anal IV, 10 to 12; scales 48 to 50 in lateral line to caudal base and 4 more on latter; 4 scales above lateral line, 7 below; 7 to 11 predorsal scales; snout 4 in head; eye $2\frac{2}{3}$ to $3\frac{1}{2}$; maxillary $2\frac{1}{3}$ to $2\frac{2}{5}$; interorbital $4\frac{1}{4}$ to $5\frac{2}{3}$.

Body elongately ellipsoid, deepest at about depressed pectoral tip. Caudal peduncle compressed, least depth $1\frac{3}{4}$ to 2 in its length or $4\frac{1}{3}$ to $4\frac{1}{2}$ in head.

Head width 2 to 2 1/5 in its length. Snout conic, length 3/5 to 3/4 its width. Eye large, advanced, hind pupil edge little before middle in head length. Mouth small, lower jaw slightly included in upper. Maxillary reaches to or little beyond front pupil edge, about 2/5 in eye in young; expansion 2 1/5 to 2 1/4 in eye. Teeth fine, conic, in bands in jaws, on vomer and palatines. Nostrils together; front one is a small simple pore little behind last third in snout; hind one is much larger, oval, nearly half pupil diameter. Interorbital slightly convex. Opercular spines 2, upper larger, twice size of lower. Preopercular spine strong, moderate, little longer than upper opercular. Preorbital with a broad spine little before nostrils, projecting downward, edge behind and rest of suborbitals serrated, with small spine below front pupil edge. Fine serrae along edges of preopercle and opercle; subopercle and interopercle with few scattered spines.

Gill rakers 4+14, lanceolate, equal gill filaments or half of eye. Scales narrowly imbricated; basal points 4 or 5; apical serrae 34 to 39; basal striae fine, largely vertically parallel. Cheeks with 5 rows of scales. Tubes in lateral line simple, large, little exposed.

Spinous dorsal inserted little before pectoral origin; third dorsal spine 2 to 2 1/10 in total head length. Soft dorsal origin at about last third between hind eye edge and caudal base, slightly advanced in young; third ray 1 2/5 to 1 1/2 in head. Anal opposite soft dorsal, third spine 1 3/4 to 2. Caudal strongly forked, lobes slender, pointed, equal or slightly less than head. Pectoral small, 1 3/4 to 2 2/5 to anal; 1 3/5 to 1 7/8 in head. Ventral inserted close behind pectoral base, 1 1/3 to 1 2/5 to anal; 1 1/4 to 1 1/3 in head. Vent about half an eye diameter before anal.

Bright red. Sometimes there is a white streak backward from eye. Length 300 mm.

Tropical Atlantic. Described above from American (Bahamas) examples. It is said to reach 608 mm. in length.

Holocentrum sancti-pauli Günther was based on an example 407 mm. long. The differences which may appear are only such as may be due to age.

***Holocentrus hastatus* Valenciennes**

Sjhojho (Senegambia)

Figure 259

Holocentrum hastatum VALENCIENNES, 1829, 'Hist. Nat. Poiss.,' III, p. 208, Pl. LIX. West Africa.—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 262 (Gorée, St. Jago, Cape Verde).—GÜNTHER, 1859, 'Cat. Fish. Brit. Mus.,' p. 39 (No locality).—TROSCHEL, 1866, Archiv Naturg., p. 200 (Cape Verde Islands).—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV (1), p. 20 (Senegambia).—GUIMARAES, 1882, Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, p. 31 (St. Jago, Cape Verde).—STEINDACHNER, 1882, *op. cit.*, XLV (1), p. 1, Pl. I, fig. 1 (Gorée).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 37 (St. Louis, Gorée).—OSORIO, 1898, Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 195 (Cape Verde, Principe Island, St. Thomas Island).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 45 (southwest of St. Lucia Island, Cape Verde, 15 m.).

Holocentrus hastatus FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 279 (Loando, Angola).

Head $3 \frac{1}{5}$ to $3 \frac{1}{3}$; depth 3 to $3 \frac{1}{3}$; dorsal XI, 15, rarely 14; anal IV, 10; scales 48 to 51 in lateral line to caudal base and 6 to 8 more on latter; 5 scales above lateral line, 8 below; snout $3 \frac{7}{8}$ to $4 \frac{1}{5}$ in head; eye 3 to $3 \frac{1}{6}$; maxillary $2 \frac{1}{6}$ to $2 \frac{1}{2}$; interorbital $2 \frac{3}{4}$ to $3 \frac{1}{5}$.

Body elongately ellipsoid, deepest at depressed pectoral tip. Caudal peduncle compressed, least depth half its length or $3 \frac{2}{5}$ to 4 in head. Head width $1 \frac{7}{8}$ in its length. Snout convex, length $\frac{3}{4}$ to $\frac{4}{5}$ its width or $3 \frac{7}{8}$ to $4 \frac{1}{5}$ in head. Eye advanced, pupil slightly before center in head length. Mouth small, lower jaw included slightly in upper. Maxillary reaches opposite eye center; expansion $1 \frac{3}{4}$ to 2 in eye. Teeth fine and conic, in bands in jaws, on vomer and palatines. Nostrils about midway in snout. Interorbital level. Opercular spines 2, short, of equal length

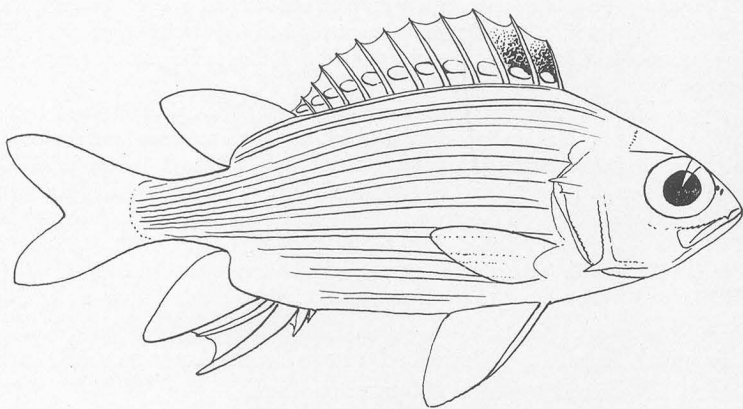


Fig. 259. *Holocentrus hastatus*, from Steindachner.

and spine at preopercle about twice as long. Serrae strong on preopercle, opercle, suborbital, and preorbital ridges and edges.

Gill rakers v, 4+14, lanceolate, equal to gill filaments or half of eye. Scales with 4 or 5 basal lobes; apical serrae 16 to 18; striae basally mostly vertically parallel. Scales narrowly imbricate; cheek with 5 rows. Tubes in lateral line simple.

Spinous dorsal inserted over pectoral origin; fourth spine $1 \frac{7}{8}$ to 2 in head. Soft dorsal origin much nearer caudal base than pectoral origin, or at last third between hind edge of pupil and caudal base; second ray $1 \frac{1}{2}$ to $1 \frac{3}{5}$ in head; first ray $1 \frac{3}{4}$ to 2. Caudal strongly forked, $1 \frac{1}{3}$ to $1 \frac{2}{5}$ in head; pectoral $1 \frac{1}{2}$ to $1 \frac{3}{5}$; ventral $1 \frac{1}{4}$ to $1 \frac{1}{3}$. Dull brownish (red in life), each row of scales with a median pale streak. Back gray-brown, line of demarcation runs along close below lateral line. Fins brown. Smaller examples with dusky tint on outer portion of membranes between first and second dorsal spines and another between tenth and eleventh. Length 96 mm.

West Africa, from Cape Verde Islands to Angola. Steindachner's figure shows only a dark blotch between the first and second dorsal spines,

a sub-basal row of white spots on the spinous dorsal and each row of scales with a pale longitudinal streak or band. The lower opercular spine is indicated much shorter and smaller than the upper.

Quite likely *Holocentrum sicciferum* Cope from the Bahamas and *Holocentrus puncticulatus* Barbour are related species, the latter having been based on an example 100 mm. long from Flatts Inlet, Bermuda.

The above description from the "Eclipse" examples obtained at Loando, Angola, in the U. S. National Museum.

MYRIPRISTIS Cuvier

Myripristis CUVIER, 1829, 'Hist. Nat. Poiss.,' III, p. 119. Type: *Myripristis jacobus* Cuvier. (Designated by Jordan and Evermann, 1917, Stanford Publications, 'Genera of Fishes,' part 1, p. 127.)

Myripristis GILL, 1863, Proc. Acad. Nat. Sci. Philadelphia, p. 83.

Myripristes auct.

Rhamphoberyx GILL, 1863, *op. cit.*, p. 87. Type: *Rhamphoberyx poecilopus* Gill. (Designated by Jordan, 1919, Stanford Publications 'Genera of Fishes,' part 3, p. 324.)

Muzzle short. Eye usually large. Mouth cleft oblique, lower jaw prominent. Villiform teeth in both jaws, on vomer and palatines. Opercular bones serrated. Opercle generally with spine. Preopercle without spine. Branchiostegals 8, seldom 7. Air vessel divided by contraction, front part extending to otocrane. Pyloric appendages in moderate number. Scales large, ctenoid. Two dorsals, scarcely united. Anal spines 4. Caudal forked. Ventral rays 7.

Tropical seas. Like *Holocentrus* but without preopercular spine.

Myripristis jacobus Cuvier

Ghuame (Anno Bom)

Myripristis jacobus CUVIER, 1829, 'Hist. Nat. Poiss.,' III, p. 121. Martinique, Brazil, Havana.—GÜNTHER, 1869, Proc. Zool. Soc. London, p. 238 (St. Helena).—CAPELLO, 1871, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, p. 194 (St. Jago, Cape Verde Islands).—MELLISS, 1875, 'St. Helena,' p. 105.—OSORIO, 1895 (March), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 244 (Bom alimento); 1898, *op. cit.*, (2) V, p. 195 (Anno Bom).

Myripristis viridensis TROSCHEL, 1866, Archiv Naturg., p. 199. Cape Verde Islands.—GUIMARÃES, 1884, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, p. 11 (St. Jago).—OSORIO, *loc. cit.* (Cape Verde, Principe Islands).

Myripristis viridescens ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 45 (north-east of St. Lucia Island, Cape Verde, 20 m.).

Head $2\frac{2}{3}$ to 3; depth $2\frac{1}{3}$ to $2\frac{1}{2}$; dorsal X, I, 13, 1 or 14, 1; anal IV, 12, 1; scales 35 in lateral line to caudal base and 4 more on latter; 3 scales above lateral line, 7 below; about 8 predorsal scales; snout $4\frac{1}{2}$ to 5 in head measured from upper jaw tip; eye $2\frac{1}{10}$ to $2\frac{1}{3}$; maxillary $1\frac{7}{8}$; interorbital 4 to $4\frac{2}{5}$.

Body elongately ellipsoid, deepest about middle of pectoral. Caudal peduncle well compressed, least depth $1\frac{2}{5}$ to $1\frac{1}{2}$ in its length or $3\frac{1}{4}$ to $3\frac{7}{8}$ in head.

Head width $1\frac{3}{5}$ to $1\frac{3}{4}$ in its length. Snout convex length $\frac{1}{3}$ to $\frac{2}{5}$ its

width. Eye very large, advanced, pupil slightly before center in head length; diameter twice snout length. Mouth small, lower jaw slightly protruding. Maxillary reaches opposite hind pupil edge, little beyond in young; expansion $1 \frac{4}{5}$ to 2 in eye. Teeth fine, conic, in bands in jaws, on vomer and palatines. Larger examples with a row of 5 enlarged denticles on each side of upper jaw anteriorly; on outer face of mandible on each side in front is a cluster of 6 enlarged short denticles flaring out. Nostrils close together and close before middle of front eye edge, posterior vertical slit much larger than anterior. Interorbital convex. Opercle with a moderate spine. Fine serrae on edges of opercle, interopercle, subopercle, preopercle, and suborbitals.

Gill rakers $10 + 20$, finely lanceolate, twice length of gill filaments or 2 in eye. Scales narrowly imbricate; basal edge has from none to 2 short points; apical denticles 37 to 50; striae basally largely vertical, fine, parallel. Cheek with 4 rows of scales. Tubes in lateral line simple, short.

Spinous dorsal origin begins a little behind that of pectoral; third spine 2 to $2 \frac{1}{8}$ in total head length; first branched dorsal ray $1 \frac{1}{2}$ to $1 \frac{3}{4}$ in head; third anal spine slightly shorter than fourth, 3 to $3 \frac{1}{8}$ in head; first branched anal ray $1 \frac{3}{5}$ to $1 \frac{3}{4}$; caudal with long slender lobes, nearly or quite equals head; pectoral $1 \frac{1}{4}$ to $1 \frac{3}{4}$ to anal, fin $1 \frac{2}{5}$ to $1 \frac{1}{2}$ in head; ventral $1 \frac{1}{3}$ to $1 \frac{2}{5}$ to anal, fin $1 \frac{2}{5}$ to $1 \frac{3}{4}$ in head. Vent a little over $\frac{1}{3}$ of eye before anal.

Brown (red in life). Blackish bar along hind edge of gill opening and at pectoral axil (blood-red in life). Fins, pale with whitish edges. Each row of scales on trunk with broad pale median band longitudinally. Length 163 mm.

Tropical Atlantic. Described above from American (West Indies) examples.

Myripristis viridensis Troschel is based on an example 178 mm. From the original description I cannot find that it differs in any way from the present species.

ORDER LOPHOBRANCHII

Tuft Gills

Snout produced, with toothless mouth at end. Mouth very small, bounded above by premaxillaries. Gill covers reduced to a large simple plate. Gills tufted, formed of small rounded lobes attached to gill rakers. Air vessel simple, without air duct. Skin with bony plates. Muscular system little developed. Pectoral fins with elevated bases.

A large group of remarkably modified fishes, quite unlike the typical spiny-rayed forms.

Syngnathidae

Pipe Fishes

Body elongate, angularly or laterally compressed or rounded, usually slender. Tail long. Head slender. Snout terminal, long, tubelike, with short toothless jaws at end. Mouth oblique, bordered by small premaxillaries, maxillaries, and mandible. Two nasal open-

ings. Gill openings reduced to a small aperture behind upper part of opercle. One branchiostegal, terminally divided. Pseudobranchiae well developed. Body covered with bony plates, firmly connected and forming a bony carapace, arranged regularly in series and forming rings which correspond with vertebrae, with the exception of the first. Tail long, sometimes prehensile, or may have a small caudal fin. Males with an egg pouch, usually placed below on tail, sometimes on abdomen, often formed of two folds of skin meeting on the median line. Eggs are received into this pouch and retained until some time after hatching, then the pouch opens to allow the young to escape. Dorsal fin rarely absent, single, nearly median, of soft rays only. Anal usually present and opposite dorsal, minute. Pectoral small or absent. No ventrals.

Small fishes, found sometimes in fresh waters and in all warm seas. Poor swimmers, moving about in a vertical position by undulating movements of the dorsal fin.

KEY TO THE GENERA

- a.*—SYNGNATHINAE. Tail not prehensile, usually with a caudal fin; axis of head usually in line with axis of body.
- b.*—Caudal fin present.
- c.*—Caudal well developed.
- d.*—Male with egg pouch abdominal. DORYICHTHYS.
- dd.*—Male with egg pouch under tail. SYNGNATHUS.
- cc.*—Caudal fin rudimentary; male with eggs attached to abdomen without closed pouch ENTELURUS.
- bb.*—Caudal fin absent, tail threadlike; male with eggs attached to abdomen.
- NEROPHIS.
- aa.*—HIPPOCAMPINAE. Tail prehensile; head shaped like that of a horse, placed at a wide angle with body axis; egg pouch at base of tail. HIPPOCAMPUS.

DORYICHTHYS Kaup

Doryichthys KAUP, 1853, *Archiv Naturg.*, p. 233. Type: *Doryichthys bilineatus* Heckel. Monotypic.

Doryrhamphinarum KAUP, 1856, 'Cat. Loph. Fish Brit. Mus.,' p. 62. Type: *Syngnathus heterosoma* Bleeker. Orthotypic.

Micropphis KAUP, *op. cit.*, p. 63. Type: *Syngnathus deocata* Buchanan-Hamilton. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 2, p. 254.)

Upper keels of trunk and tail discontinuous, lower keels discontinuous or continuous and median (lateral) keels of trunk and lower keels of tail continuous or not. Keels of shields of rings more or less serrated, generally ending in a free spine behind. Intermedial shields (scutella) present, as are also a prenuchal and 2 nuchal shields. Opercle with complete longitudinal keel and radiating ridges. Snout longer than remaining part of head. Dorsal rather long, with more than 30 rays, opposite vent, above at least 7 rings of largest part of tail. Anal behind middle of length. Caudal is well developed, usually middle ray is prolonged. Eggs small

and numerous, isolated in open cells belonging to swollen skin of somewhat dilated abdomen of male; not covered by cutaneous folds but laterally protected by ventrally diverging plates belonging to lower lateral edges of trunk.

Fishes of fresh and brackish water connected with tropical seas.

KEY TO THE SPECIES

- a.*—Rings 18 or 19 + 23 to 26. *lineatus*.
aa.—Rings 20 to 21 + 22 to 24. *aculeatus*.

Doryichthys lineatus (Kaup)

Doryichthys lineatus KAUP, 1856, 'Cat. Loph. Fish Brit. Mus.,' p. 59. Bahia, Mexico, Guadeloupe.—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 183 (Old Calabar, Gaboon).

Head 3 to vent; depth $2\frac{1}{6}$ in snout; dorsal 40; rings 20 + 22; snout $1\frac{2}{3}$ in head from upper jaw tip; eye $4\frac{1}{4}$ in snout.

Body long, compressed, deepest about midway between head and vent; tail without caudal is slightly less than trunk without head. Body ridges distinct, without spines; upper lateral ridge extends to last ring of dorsal fin base, but is not continuous with upper lateral caudal ridge; median lateral ridge continuous with lower lateral caudal ridge; lower lateral ridge of trunk also continuous with lower lateral caudal ridge; rings all with fine parallel vertical striae. Head width $\frac{1}{6}$ its total length. Constriction of snout subterminal. Eye center at about last third in head. Lower jaw protruding vertically. Interorbital about $\frac{4}{5}$ of eye, concave. Opercle with a complete horizontal ridge and 3 more radiating obliquely down and back. Upper postocular ridge reaches occiput. Median occipital ridge well developed, extends halfway in a ring beyond pectoral base. Dorsal fin on 3 trunk rings and 6 caudal rings, uniformly low. Pectoral base broad, its length equals eye. Anal very small, about $\frac{2}{3}$ of eye. Caudal $3\frac{2}{3}$ in total head length. Largely uniform brown, paler on belly. Length 130 mm.

Tropical Atlantic. Described above from an American example (Santo Domingo). Its color is described as yellowish brown with 5 or 6 black crossbars beneath the snout. The abdominal brood pouch extends from the chest back and around the vent, margined on each side by strong processes from the body rings.

Doryichthys aculeatus Kaup

Doryichthys aculeatus KAUP, 1856, 'Cat. Loph. Fish Brit. Mus.,' p. 61. Egypt.

Microphis (*Doryichthys*) *aculeatus* DUMÉRIL, 1870, 'Hist. Nat. Poiss.,' II, p. 599 (type).

Microphis aculeatus DUNCKER, 1914 (1915), Mitt. Nat. Mus. Hamburg, XXXII, p. 44 (West Africa, Senegal, Port Congo).

Microphis (*Doryichthys*) *smithii* DUMÉRIL, *op. cit.*, p. 599 (on *Doryichthys* new species, J. A. Smith, 1867, Proc. Roy. Soc. Edinburgh, III, p. 227. Old Calabar).

Doryichthys lineatus (part) GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 183 (types of *Doryichthys aculeatus* Kaup).

Doryichthys falkensteini REICHENOW, 1878, Sitzs. Gesell. Naturf. Fr. Berlin, p. 92. Chinchoxo.

Doryichthis juillerati ROCHEBRUNE, 1880, Bull. Soc. Philom., Paris, (7) IV, p. 168. Dakar et Gorée; 1883, 'Faune Sénégalaise,' Poiss., I, p. 151, Pl. VI, fig. 5 (types).

Dorsal 43 to 52, on 2 or 3 + 6 or 7 rings; anal 4; pectoral 19 or 20; caudal 8 or 9; rings 20 or 21 + 22 to 24. Snout somewhat shorter than one-half of length of head, equals the space between front orbital edge and hind edge of second body ring. Well-developed longitudinal keel on opercle, with one to 4 radiating striae below. All body edges roughened. Dark brown, clear below. Indications of spots on lower surface of rostrum, sometimes obsolete. Length 174 mm. (Duncker.)

West Africa, from the Senegal to Portuguese Congo.

SYNGNATHUS Linné

Pipe Fishes

Syngnathus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 416. Type: *Syngnathus acus* Linné. (Designated by Fowler, 1906, Proc. Acad. Nat. Sci. Philadelphia, p. 93.)

Acus MÜLLER, 1767, 'Delinat. Natur.,' II, p. 141. Type: *Syngnathus acus* Linné. Tautotypic. (Inadmissible.)

Tiphle RAFINESQUE, 1810, 'Caratteri Nuov. An. Sicil.,' p. 18. Type: *Tiphle hexagonus* Rafinesque = *Syngnathus typhle* Linné. Tautotypic.

Typhle auct.

Siphostoma RAFINESQUE, *loc. cit.* Type: *Syngnathus pelagicus* Linné. (Designated by Jordan and Evermann, 1917, Stanford Publ., 'Genera of Fishes,' part 1, p. 79.)

Siphonostoma, *Spiphonostomus* auct.

Typhlinus RAFINESQUE, 1815, 'Analyse de la Nature,' p. 90. Type: *Tiphle hexagonus* RAFINESQUE. (*Typhlinus* Rafinesque proposed to replace *Tiphle* Rafinesque.)

Péromeme DUMERIL, 1856, Mém. Acad. Sci. Paris, XXVII, part 1, p. 170. Type: *Syngnathus rondeleti* De la Roche. (Designated by Jordan, 1918, Stanford Publications, 'Genera of Fishes,' part 2, p. 268.) (Inadmissible.)

Dermatostethus GILL, 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 283. Type: *Dermatostethus punctipinnis* Gill. Monotypic.

Parasyngnathus DUNCKER, 1914 (1915), Mitt. Nat. Mus. Hamburg, XXXII, p. 79. Type: *Syngnathus argyrostictus* Kaup. Orthotypic.

Body long, very slender, not compressed, hexagonal or tetragonal, tapering into a long tetragonal tail. Upper keels of trunk and tail discontinuous; lower keels of trunk and tail continuous; median keels of trunk and lower keels of tail discontinuous, but former and upper keels of tail are continuous or subcontinuous. Head generally slender, tapering gently into a longer or shorter tubelike snout with or without a median keel. Opercle with a straight longitudinal keel, which is complete or restricted to the basal part; oblique lines or edges radiate from keel or are wanting. Dorsal with 21 to 45 rays, which inserted exclusively on front tail rings up to ninth or also on 1 to 3 of last trunk-rings; base of dorsal not elevated; pectorals, anal and caudal present. Eggs isolated in cutaneous cells on ventral surface of front part of tail, entirely protected by cutaneous folds, which may contain more or less developed bony plates; these folds begin next to anus, reach far behind subdorsal rings of tail, and coalesce in a median line, splitting lengthwise to release young fishes.

A large genus of the temperate and tropical seas; some in brackish and fresh water.

KEY TO THE SPECIES

- a.*—*PARASYNGNATHUS*. Opercle with a complete horizontal keel; median keels of trunk and upper keels of tail subcontinuous. *kaupi*.
aa.—*SYNGNATHUS*. Opercle with a rather low incomplete horizontal keel, restricted to its basal third; median keels of trunk and upper keels of tail subcontinuous.
b.—Dorsal 29 to 31; trunk 1 7/10 in tail. *pelagicus*.
bb.—Dorsal 35 to 45; trunk twice to nearly 2 1/2 times in tail.
c.—Dorsal on 1 or 2 body rings and 6 to 9 caudal rings. *acus*.
cc.—Dorsal on 4 body rings and 6 caudal rings. *pellegrini*.

***Syngnathus kaupi* Bleeker**

Syngnathus kaupi BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, (2) XVIII, p. 24, Pl. iv, fig. 2. Guinea.—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 174 (says of Bleeker's colored figure, "the colours are merely imaginary").—DUMÉRI, 1870, 'Hist. Nat. Poiss.,' II, p. 547 (copied).—STEINDACHNER, 1894, Notes Leyden Mus., XVI (1), p. 89 (Liberia).—LÖNNBERG, 1895, Oefvers. Svensk. Akad. Forh., LII, No. 3, p. 193 (Cameroons).—DUNCKER, 1914 (1915), Mitt. Nat. Mus. Hamburg, XXXII, p. 85 (Liberia, Guinea, Gaboon).

Syngnathus kaupii BUETTIKOFER, 1890, 'Reis. Liberia,' II, p. 480.—STEINDACHNER, 1895, Notes Leyden Mus., XVI, p. 80 (Grand Cape Mount, Liberia).

Head and body about 2/5 of total length; dorsal 25 to 27; anal 2 or 3; bony rings 14 + 13 or 34. Body a little deeper than wide; lateral line and upper caudal ridge not continuous; bony rings without spines. Snout about 1 1/2 times as long as postocular part of head. Opercle crossed by a straight ridge. Ridge along upper surface of head and on nape. Dorsal begins above vent, occupies 7 rings. Pectoral and caudal well developed, small. Pouch half as long as tail. Dark brown with more or less distinct light spots on body; a regular series of yellowish dark edged ocelli, one to each bony ring, on each side of body, just above ventrolateral ridge; large light spots on each side of the brood pouch; female with dark and light vertical bars on sides of head; caudal fin black, edged with yellowish above and beneath. Length 125 mm. (Boulenger.)

West coast of Africa from Liberia to the Congo.

***Syngnathus pelagicus* Linné**

Syngnathus pelagicus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 337. Swimming in fucus.—OSBECK, 1765, Reise Ost-Ind. China, p. 400 (open sea in floating seaweed).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 136 (southwest of Azores, N. lat. 30° to 31°, W. long. 42°).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613, Fig. 463 (off Azores).—PELLEGRIN, 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 27 (Port-Étienne).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 216 (Arquin Bank).—FOWLER, 1921, Proc. Acad. Nat. Sci. Philadelphia, p. 443 (N. lat. 24° 21', W. long. 34° 32'; N. lat. 23° 59', W. long. 37° 59').—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 251 (Baie du Lévrier).

Head 2 3/4 to 2 4/5 to vent; depth 1 1/5 to 1 3/5 in postocular; dorsal 28 to

33; rings 16 or 17 + 29 to 32; snout $1 \frac{4}{5}$ to $1 \frac{5}{6}$ in head from upper jaw tip; eye $3 \frac{3}{5}$ to $3 \frac{2}{3}$ in snout. Body moderately long, robust, combined head and trunk $1 \frac{1}{8}$ to $1 \frac{1}{4}$ in tail.

Body ridges distinct, without spines, edge of each ridge rugose, smooth in young; upper lateral trunk ridge extends as far back as base of dorsal fin, not continuous with upper lateral caudal ridge; latter begins on third ring of dorsal base, becomes superior behind dorsal; median lateral trunk ridge reaches 2 rings of dorsal base, discontinuous with other ridges; lower lateral trunk ridge continuous with that of caudal. Head width $4 \frac{1}{6}$ to $4 \frac{3}{4}$ in total head length. Snout long, little constricted. Eye at last $\frac{2}{5}$ in head. Lower jaw slightly protruding vertically. Interorbital $1 \frac{1}{2}$ to $1 \frac{4}{5}$ in eye, deeply concave. Opercle with short basal horizontal ridge, about $\frac{1}{5}$ extent of opercle length. Upper postocular ridge $\frac{2}{3}$ to occiput, low. Median occipital ridge moderate, extends slightly beyond pectoral base. Dorsal on 2 to 4 body rings and 4 to 7 caudal rings. Pectoral $4 \frac{1}{4}$ to $4 \frac{3}{5}$ in head; caudal $3 \frac{2}{3}$ to $3 \frac{3}{4}$. Brown, mostly uniform. Some examples variegated with darker on back. Lower half of side of trunk with silver-white vertical bars on tail, light transverse line on each ring. Dark or brown crossbars of deeper shade than general color between silver bars alternately, bars grouped in twos or threes and often confluent. In males silvery bars formed as spots. Dark horizontal streak on snout before eye.

Length 145 mm.

Widely distributed in tropical seas. Described above from examples obtained in America, off Azores (N. lat. $24^{\circ} 21'$, W. long. $34^{\circ} 32'$; N. lat. $23^{\circ} 59'$, W. long. $37^{\circ} 59'$) and West Indies.

Syngnathus acus Linné

Culevra (Canaries), Sinkindi (Senegambia)

Figure 260

Syngnathus acus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 337. Europe.—KAUP, 1856, 'Cat. Loph. Fish Brit. Mus.,' p. 41 (Atlantic Ocean).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 157 (Madeira).—ROCHEBRUNE, 1883, 1885, 'Faune Sénégalie,' Poiss., p. 151 (Guet N'Dar, Barbarie).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 333 (Canaries).

Syngnathus rubescens KAUP, 1856, 'Cat. Loph. Fish Brit. Mus.,' p. 43 (Canaries).—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 403 (Santa Cruz, Tenerife).—DUMÉRIL, 1870, 'Hist. Nat. Poiss.,' II, p. 557 (Canaries).



Fig. 260. *Syngnathus acus*, from Smitt.

Head $2 \frac{5}{6}$ to 3 to vent; depth $1 \frac{1}{5}$ to $1 \frac{3}{5}$ in postocular; dorsal 29 to 43; rings 15 to 20 + 33 to 45; snout $1 \frac{1}{2}$ to $1 \frac{3}{4}$ in head measured from upper jaw tip; eye $4 \frac{7}{8}$ to 6 $\frac{1}{4}$ in snout.

Body long, rather robust, compressed, as wide as deep; combined head and trunk

1 1/4 to 1 1/3 in tail. Body ridges distinct, without spines, edge of each rugose, smooth in young; upper lateral trunk ridge extends as far back as base of dorsal fin, not continuous with upper lateral caudal ridge; latter begins on ring nearly opposite dorsal fin origin, becoming superior behind dorsal; median lateral trunk ridge reaches ring of dorsal origin little below beginning of upper lateral caudal ridge; lower lateral trunk ridge continuous with that of caudal. Head width 5 1/3 to 5 3/4 in total head length. Snout long, slender, constricted, subterminal. Eye center about last 2/7 in head, slightly behind last third in young. Lower jaw slightly protruding vertically. Interorbital 3/5 to 3/4 of eye, deeply concave. Opercle with short basal horizontal ridge, about 1/5 extent of opercle length, about 1/2 in young. Upper postocular ridge extends 3/4 to occiput; absent in young. Median occipital ridge moderate, not quite reaching pectoral base; obsolete in young. Dorsal on 1 to 2 (once 3) body rings and 6 to 9 caudal rings. Pectoral 5 3/4 to 7 1/3 in head; caudal 2 4/5 and 4 7/8. Back dull brown, paler below. Length to 333 mm.

Eastern Atlantic. Described above from European examples (Italy and Sweden). Most examples with upper lateral caudal keel continuous with median lateral keel of trunk.

***Syngnathus pellegrini* Fowler**

Syngnathus pellegrini FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 265, Fig. 11. Gaboon; 1921, Proc. Acad. Nat. Sci. Philadelphia, p. 444 (types).

Head 3 to 3 1/8 to vent; depth 1 1/5 to 1 2/5 in postocular region; dorsal 36 to 38; rings 18 + 36 to 38; snout 2 1/8 to 2 1/5 in head from upper jaw tip; eye 2 1/4 to 2 3/4 in snout.

Body slender, slightly wider than deep, greatly elongated; combined head and trunk 1 1/2 to 1 3/5 in tail. Body ridges distinct, without spines, smooth; upper lateral trunk ridge extends back as far as eighth basal ring of dorsal fin, not continuous with upper lateral caudal ridge; median lateral trunk ridge extends as far as fifth basal ring of dorsal fin, discontinuous with upper lateral caudal ridge; lower lateral trunk ridge continuous with lower lateral caudal ridge. Head width 3 7/8 to 4 in its total length. Snout with constriction a little nearer its tip than eye. Eye ellipsoid, front pupil edge nearly midway in head length. Lower jaw protrudes. Interorbital narrow, 1 1/3 to 2 in eye, deeply concave. Opercle with short horizontal ridge anteriorly, 1/5 to 1/4 length of bone. Upper postocular ridge not to occiput, quite short in young. Median occipital ridge well developed, extends back little beyond pectoral base or well over first body ring. Dorsal fin on 4 trunk rings and 6 caudal rings. Pectoral 4 1/5 to 5 1/2 in head; caudal 2 3/4 to 3. Largely uniform brownish, belly and lower surfaces of head and tail mostly paler. No markings. Length 113 mm.

Coast of the French Congo. Described above from the types, No. 975 (type) to 978 (paratypes) A. N. S. P., collected by P. B. Du Chaillu. Related to *Syngnathus acus* but apparently unique among West African forms in the advanced dorsal.

ENTELURUS Duméril

Entelurus DUMÉRIL, 1870, 'Hist. Nat. Poiss.,' II, p. 605. Type: *Syngnathus aequoreus* Linné. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 3, p. 357.)

Acus SWAINSON, 1839, 'Nat. Hist. Animals,' II, p. 333. Type: *Syngnathus aequoreus* Linné. (Designated by Jordan, 1919, Stanford Publications, 'Genera of Fishes,' part 2, p. 205.)

Ptérure DUMÉRIL, 1856, Mém. Acad. Sci. Paris, XXVII, part 1, p. 169. Type: *Syngnathus aequoreus* Gmelin. Monotypic.

Hymenolomus DUMÉRIL, *loc. cit.*, p. 607. Type: *Syngnathus hymenolomus* Richardson. Monotypic.

Protocampus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 193. Type: *Syngnathus hymenolomus* Richardson. Monotypic.

Osphyolax COPE, 1875, Proc. Acad. Nat. Sci. Philadelphia, p. 450. Type: *Osphyolax pellucidus* Cope. Monotypic.

Upper body keels continuous; lower body keels discontinuous; lateral and lower body keels continuous. Dorsal and caudal present, latter rudimentary. Anal small. Pectoral wanting. Brood organ abdominal, without lateral folds, eggs attached to the loose integument of abdomen of male.

One species in the open Atlantic.

Entelurus aequoreus (Linné)

Figure 261

Syngnathus aequoreus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 337. Open sea.

Nerophis aequoreus GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 191 (Atlantic north of Azores), p. 515 (north of Azores).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (Azores).

Entelurus aequoreus DUNCKER, 1915, Mitt. Nat. Mus. Hamburg, XXXII, p. 32 (northeast Atlantic to Azores to 35° W.).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 130 (from Germon from between Azores and Portugal, off Azores, N. lat. 37° to 38°, W. long 23° to 26°, surface).

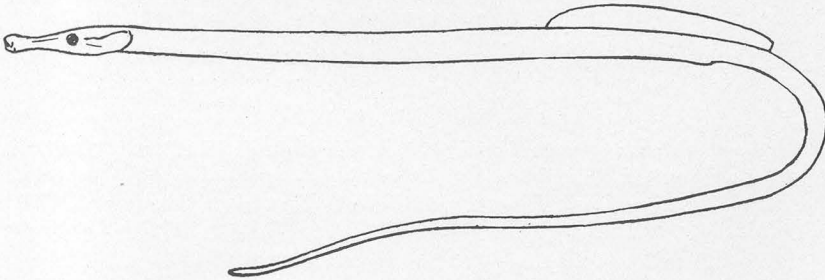


Fig. 261. *Entelurus aequoreus*, from Day.

Head $5 \frac{3}{4}$ to vent; depth 2 in postocular; dorsal 37; rings 29 + 62 ?; snout 2 in head measured from upper jaw tip; eye 4 in snout.

Body slender, very long, little compressed, deeper than wide; combined head and trunk but slightly shorter than tail. Body ridges low, a little pronounced; upper lateral trunk ridge continuous with that of upper caudal; median lateral trunk ridge continuous with lower caudal ridge; lower lateral trunk ridge discontinuous with caudal ridge. Head width $6\frac{1}{5}$ its total length. Snout with constriction about median. Eye with front edge midway in head; diameter $3\frac{4}{5}$ in snout. Lower jaw protruding. Interorbital narrow, width $\frac{3}{4}$ of eye, deeply concave. Opercle without ridge, with many fine radiating rugose striae. No postocular ridge. Low, feeble, median postocular cranial ridge, barely halfway to gill opening. Dorsal fin on 8 trunk and 3 caudal rings. No pectoral. Rudimentary caudal about half of eye diameter. Vent about opposite last third in dorsal base. Pale uniform brownish. Length 283 mm.

Northeastern Atlantic, south to the Azores. Described above from the type of *Osphyolax pellucidus* Cope, No. 860, A. N. S. P., obtained in the open Atlantic.

NEROPHIS Rafinesque

Nerophis RAFINESQUE, 1810, 'Indice Ittiol. Sicil.,' p. 37. Type: *Nerophis maculatus* Rafinesque. Monotypic.

Scyphius RISSO, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 185. Type: *Syngnathus fasciatus* Risso. (Designated by Jordan and Evermann, Stanford Publications, 1917, 'Genera of Fishes,' part 1, p. 119.)

Nematosoma EICHWALD, 1831, 'Zool. Special.,' part 3, p. 60. Type: *Nematosoma ophidium* Eichwald. Monotypic.

Body smooth, rounded, with scarcely any of the keels distinct; upper keels of body continuous; lower keels discontinuous; lateral and lower keels continuous. Dorsal present. Anal, caudal and pectoral absent. Tail pointed, threadlike, not prehensile. Scutella and lateral line present; 1 nuchal; 1 prenuchal. Brood organ abdominal, without lateral folds, eggs attached to the loose integument of the abdomen of male.

Several species in the Atlantic, Baltic, and Black Seas.

KEY TO THE SPECIES

- a.—Dorsal rays 24 to 28; rings 17 to 19 + 46 to 54.....*lumbriciformis*.
 aa.—Dorsal rays 33 to 34; rings 28 to 32 + 68 to 77.....*ophidium*.

Nerophis lumbriciformis (Fries)

Syngnathus lumbriciformis FRIES, 1838, Archiv Naturg., IV (1), p. 249, Pl. VI, fig. 5. Bohuslan.

Nerophis lumbriciformis DUNCKER, 1915, Mitt. Nat. Mus. Hamburg, XXXII, p. 37 (Mogador, Morocco).

Dorsal 24 to 28, on 2 or 3 + 4 to 6 rings; rings 17 to 19 + 46 to 54. Snout hooked, very short, nearly equals $\frac{3}{5}$ of postorbital. Opercle smooth. Back of female slightly compressed, when spawning, with a rudimentary predorsal and abdominal median dermal ridge. Male little compressed below, with extended keels below and abdomen level. Newly born young with rough body edges and rayless pectoral. Back brown, marbled with blackish brown and yellowish. Sides and

lower surfaces of head, opercle, and front of body with dark brown spots and crossbars on pale body color. Length 144 mm. (Duncker.)

Northeast Atlantic and Mediterranean.

Nerophis ophidion (Linné)

Figure 262

Syngnathus ophidion LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 337. Europe.

Nerophis ophidion PELLEGRIN, 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 29 (Baie de Cansado).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 251 (Baie du Lévrier).



Fig. 262. *Nerophis ophidion*, from Smitt.

Dorsal 33 or 34, on 3 to 5 + 6 to 8 rings; rings 28 to 32 + 68 to 77. Snout equals postorbital, erect, thick. Opercle smooth. Spawning female with strong abdominal and weak median predorsal dermal fold. Young of 100 mm. with rayless pectorals. Yellowish green. Spawning female with lateral and ventral bright bluish longitudinal streaks upon anterior body rings. Length 256 mm. (Duncker.)

Coasts of Europe, Mediterranean and Black Seas.

HIPPOCAMPUS Rafinesque

Sea Horses

Hippocampus RAFINESQUE, 1810 (April), 'Caratteri Nuov. An. Sicil.,' p. 18.

Type: *Syngnathus hippocampus* Linné. Monotypic.

Hippocampus PERRY, 1910 (May), 'Arcana,' II, Pl. XVIII. Type: *Hippocampus erectus* Perry = *Syngnathus hippocampus* Linné. Monotypic.

Macleayina FOWLER, 1907 (January 28, 1908), Proc. Acad. Nat. Sci. Philadelphia, p. 426. Type: *Hippocampus bleekeri* Fowler. Orthotypic.

Body strongly compressed, more or less elevated, belly gibbous, of 10 to 12 rings, tapers abruptly to a long quadrangular prehensile tail. Head with a distinct curved neck, placed nearly at a right angle with the direction of body, surmounted by a compressed occipital crest, on top of which is an angular, starlike coronet. Opercle with a convex keel bent upward to branchial opening. Top and sides of head with spines. Appearance remarkably horselike, similar to conventional knight at chess. Body and tail covered with bony plates forming rings, on body each with 6 spines or tubercles; on tail with 4. Usually no cutaneous flaps. Dorsal moderate, opposite vent, on elevated base on trunk and tail. Anal usually present, minute. Pectorals present, short, broad.

Numerous species in all warm seas. They swim vertically, head uppermost, by vibrating the dorsal fin. Attached by their prehensile

tails to seaweed and other floating objects, they are carried frequently great distances by currents. The egg pouch of the male is a permanent sac at the base of the tail, ending near the vent.

KEY TO THE SPECIES

a.—Spine above nostril and before coronet simple.

b.—Snout much shorter than postocular region.

c.—Spines on head and neck sometimes with simple filaments; brown, with bluish-white dots. *hippocampus*.

cc.—Many tubercles, especially on head, with greatly ramified filaments; rose colored, indistinctly marbled with brownish and white. *ramulosus*.

bb.—Snout longer, equals postocular or longer. *punctulatus*.

aa.—Spine above nostril and before coronet, each one forked. *bicuspis*.

Hippocampus hippocampus (Linné)

Caballito del mar (Canaries)

Syngnathus hippocampus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 338. Open sea.

Hippocampus brevisrostris VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II (2), p. 93 (Canaries).—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 403 (Santa Cruz, Teneriffe).

Hippocampus antiquorum GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 199 (Fernando Po).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 333 (Canaries).

Head $1\frac{3}{4}$ to $1\frac{7}{8}$ in trunk measured over back from gill opening; depth $1\frac{2}{5}$ to $2\frac{1}{8}$ in trunk length; width of trunk $3\frac{1}{2}$ to 4; trunk $1\frac{3}{5}$ to 2 in tail; dorsal 16 to 19; rings 12 + 35 or 36; snout $2\frac{2}{3}$ to $2\frac{4}{5}$ in head measured from snout tip; eye $4\frac{1}{2}$ to 6 $\frac{1}{8}$; dorsal base $1\frac{3}{5}$ to 2.

Body deep, trunk short, compressed. Tail tapering, quadrangular, with a rather robust point. Head deep, compressed. Snout a little long, profile deeply concave behind. Eye small, rounded, a trifle anterior. Mouth small, terminal, superior, upper jaw scarcely protruding upward. Interorbital forms a moderate isosceles triangle, angle before nostrils. Gill opening small, lateral, opens upward, high and close to nape near nuchal keel. Coronet high, concave above, 2 lateral and 1 hind tubercles, also elevated prominence from ridge in front with a tubercle anteriorly; coronet larger or more prominent in young. Tubercle each side of head below coronet. Interorbital with each edge of triangle continued as a bony ridge to above eye behind, then forming a supra-orbital tubercle. Shoulder girdle with 3 tubercles. Bones on head striate. Rings with concave surfaces, with well-developed tubercles that become obsolete backward on tail. Young with all tubercles more prominent than in adult. Dorsal rather low, begins in front of tenth ring and extends 3 body and 1 caudal rings. Anal small, short on first caudal ring. Pectoral with a broad base, rays rather short.

Brown, with bluish-white dots, more or less formed into lines on head below and on opercle. Dorsal fin with a black submarginal band. Length 153 mm.

Eastern Atlantic and Mediterranean. Described from Italian and Minorca examples. Compared with a series of American examples

from the eastern Atlantic States, representing *Hippocampus hudsonius* De Kay, I cannot find any characters worthy of specific distinction.

***Hippocampus ramulosus* Leach**

Hippocampus ramulosus LEACH, 1815, 'Zool. miscellany,' I, p. 105, Pl. XLVII. Locality ?.—LOWE, 1837, Trans. Zool. Soc. London, II, p. (184) 192 (Madeira); 1860, 'Fishes of Madeira,' p. 6 (Madeira).—KAUP, 1856, 'Cat. Loph. Fish Brit. Mus.,' p. 10, Pl. I, fig. 6, *a-b* (Canaries).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 201 (type; Madeira).—DUMÉRIL, 1870, 'Hist. Nat. Poiss.,' II, p. 507 (Canaries).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 613 (Fig. 11, p. 89) (west of Canaries).

Dorsal 18. Snout a little less than space between hind edge of eye and gill opening. Coronet very elevated, top with several points. Tubercles very prominent and pointed. Rose colored, indistinctly marbled with brownish and white. Dorsal fin with blackish submarginal band. (Günther.)

Eastern Atlantic and Mediterranean, also reported from East Africa. Lowe gives its length as 128 mm.

***Hippocampus punctulatus* Guichenot**

Hippocampus punctulatus GUICHENOT, 1850, in Sagra, 'Hist. Nat. Cuba,' p. 174, Pl. v, fig. 2. Cuba.—FOWLER, 1922, Proc. Acad. Nat. Sci. Philadelphia, p. 446 (St. Thomas, Portuguese Guinea).

Hippocampus guttulatus (not Cuvier) DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 261 (Gambia).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 202 (Gambia; West Africa).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 152 (Casamence, Rio Pango, Gambia; type of *Hippocampus deani*).—OSORIO, 1890 (September), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, II (2), p. 58 (Angola); 1898, *op. cit.*, V (2), p. 200 (Cape Verde, St. Thomas Island, Angola).—PELLEGRIN, 1907, Act. Soc. Linn. Bordeaux, LXII, p. 77 (Gorée, Rufisque); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 29 (Baie du Lévrier, Gorée, Rufisque).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 251 (Baie du Lévrier).

Hippocampus deani DUMÉRIL, *op. cit.*, p. 261. Sierra Leone.—GÜNTHER, *op. cit.*, p. 203 (copied).—DUMÉRIL, 1870, 'Hist. Nat. Poiss.,' II, p. 510 (type).

Head $1\frac{1}{4}$ to $1\frac{2}{5}$ in trunk measured over back from gill opening; depth of trunk $1\frac{2}{5}$ to $2\frac{1}{4}$; width of trunk $3\frac{2}{3}$ to 4; trunk $1\frac{7}{8}$ to 2 in tail; dorsal 18 to 20; rings 12 + 33 to 38; snout 2 to $2\frac{1}{6}$ in head measured from snout tip; eye $7\frac{1}{2}$ to $8\frac{1}{5}$; dorsal base $2\frac{1}{5}$ to $3\frac{1}{8}$.

Body deep, less so in young and females, compressed. Tail rather robust, tapering, quadrangular, with a rather robust tip. Head deep, compressed. Snout long, upper profile straight. Eye small, rounded, its center but slightly behind center in head length. Mouth terminally superior, upper jaw well protruded upward. Interorbital forms a narrow isosceles triangle, angle little before nostrils. Gill opening small, superolateral, close to nape near nuchal shield. Coronet high, concave above, 2 lateral and 1 hind tubercle, also elevated prominence from ridge in front, with prominent tubercle anteriorly in adult. Tubercle each side of head below coronet. Interorbital with each edge of triangle continued as bony ridge to a point over the eye and behind, where it forms the supra-orbital tubercle, conspicu-

ous in the adult. Shoulder girdle with 3 tubercles. Bones of head striate. Rings with concave surfaces, with well-developed, conspicuous tubercles with age, less developed on tail. Dorsal moderately high, begins on tenth ring, on 3 body and 1 caudal rings. Anal small, short, on first caudal ring. Pectoral short, rounded, base broad.

Brown, with numerous deep brown waved or vermiculated longitudinal lines, narrow on under surface of head posteriorly and on belly. Body with bluish-white minute dots, most numerous on head and tail. Snout with a longitudinal brown line over iris to pupil, also another brown line from pupil to supra-orbital tubercle and other radiating brown lines from pupil below and posteriorly. Dorsal grayish, blotched with deep brown and blackish. Pectoral and ventral pale brownish white. Length 178 mm.

Tropical Atlantic. Described above from an example from São Thome, Portuguese Guinea, obtained by Dr. F. B. Stevenson. I also have included other specimens, all American (Bermuda, Florida, West Indies, Mexico, and Uruguay).

Hippocampus bicuspis Kaup

Hippocampus bicuspis KAUP, 1856, 'Cat. Loph. Fish Brit. Mus.,' p. 13, Pl. III, fig. 1. Gorée.—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 261 (type).—GÜNTHER, 1870, 'Cat. Fish. Brit. Mus.,' VIII, p. 205 (copied).—DUMÉRIL, 1870, 'Hist. Nat. Poiss.,' II, p. 513 (type).—ROCHEBRUNE, 1883–1885, 'Faune Sénégalie,' Poiss., p. 153 (type).

Spine preceding coronet and one over nostril forked. Only one very young female specimen, which was sent from Gorée to the Paris Museum by M. Rang. Body rings 11, of which the first, fourth, seventh, and eleventh with bigger spines and projections. Yellowish dorsal supported by 3 rings. Body very slender, its greatest breadth not exceeding in width length of last 4 body rings. Snout with 2 traces of dark crossbars. Color yellowish brown, darker on back and tail. (Kaup.)

Gorée. Only known from the type.

ORDER AULOSTOMI

Trumpet Fishes

Snout produced, small mouth at its end. Gills pectinate. First four vertebrae elongated. Vertical fins developed, spines usually present before dorsal. Ventral fins abdominal or subabdominal.

Families six, still greater or extreme modifications of the *Hemibranchii*.

KEY TO THE FAMILIES

- a.—No dermal armature; caudal various.
- b.—Body moderately long, compressed; scales ctenoid; dorsal spines developed, all short; caudal small, rhombic, median rays not produced. AULOSTOMIDÆ.
- bb.—Body depressed or subcylindrical, very long; no scales; no

- dorsal spines; two median caudal rays produced as long filament. **FISTULARIIDAE.**
- aa.—Dermal armature superficial, developed anteriorly, especially about back; axis of tail continuous with that of abdomen; spinous dorsal developed. **MACRORHAMPHOSIDAE.**

Aulostomidae

Trumpet Fishes

Body elongate. Head long. Mouth at end of the long compressed tubelike snout. Barbel present at symphysis of lower jaw. Pre-maxillaries feeble, not protractile, toothless. Maxillaries wide. Teeth minute. Gills 4, slit behind fourth. Gill rakers obsolete. Air vessel large. Two pyloric caeca. First 4 vertebrae elongated. Body covered with small ctenoid scales, absent from head and front part of back. Lateral line continuous. Spinous dorsal present. Soft dorsal and anal long, alike, posterior. Caudal small, rhombic, middle rays largest, but not produced in a filament. Pectoral broad, rounded. Ventral rounded.

One genus, represented in tropical seas.

AULOSTOMUS Lacépède

Aulostomus LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 356. Type: *Fistularia chinensis* Linné. Monotypic.

Aulostoma auct.

Polypterichthys BLEEKER, 1853, 'Nat. Tijds. Ned. Indie,' IV, p. 608. Type: *Polypterichthys valentini* Bleeker. Monotypic.

Body compressed. Mouth small. Lower jaw prominent. Maxillary triangular, with a supplemental bone. Teeth in bands in lower jaw and on vomer and pterygoids, but none on palatines. Gill membranes separate, free from isthmus. Pseudobranchiae well developed. Branchiostegals 4. Prepectoral space scaly. Spinous dorsal of 9 to 12 very slender, free, weak spines. Soft dorsal and anal alike, rather long, rays 23 to 28, with 4 anterior spinelike. Ventrals of 6 articulated rays.

Shore fishes of tropical seas.

Aulostomus maculatus Valenciennes

Guia pandála (Bom alimento)

Figure 263

Aulostoma maculatum VALENCIENNES, 1839, 'Règne Animal,' 3d Ed., Pl. xcii, fig. 2. San Domingo.

Aulostomus maculatus ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 38 (south-west Santa Lucia, Cape Verde Islands, 16 m.).

Aulostoma coloratum GÜNTHER, 1868, Proc. Zool. Soc. London, p. 225 (St. Helena).—MELLISS, 1875, 'St. Helena,' p. 108.—VAILLANT, 1888, 'Expéd. Sci. "Travailleur" et du "Talisman,"' Poiss., p. 342 (St. Helena).—OSORIO, 1894 (Febru-

ary), *Jorn. Sci. Math. Phys. Nat., Acad., Lisboa*, III (2), p. 178 (St. Thomas Island); *op. cit.*, p. 184 (Bissau); 1895 (March), *op. cit.*, III (2), p. 247 (Bom Alimento); 1898, *op. cit.*, V (2), p. 198 (Bissau, St. Thomas Island, Anno Bom, Angola).—CLARK, 1913, *Proc. Roy. Phys. Soc. Edinburgh*, p. 391 (St. Helena).

Aulostoma chinense CAPELLO, 1871, *Jorn. Sci. Math. Phys. Nat., Acad., Lisboa*, p. 281 (St. Jago, Cape Verde).

Head $2\frac{3}{4}$ to $2\frac{7}{8}$; depth 4 to $4\frac{1}{4}$ in head; dorsal X–III, 19 to 20; anal III, 22; scales 220 in lateral line to caudal base; 14 scales above lateral line to dorsal origin, 16 below; snout $1\frac{2}{5}$ to $1\frac{1}{2}$ in head from upper jaw tip; eye $2\frac{1}{5}$ to $2\frac{1}{3}$ in postocular; maxillary $1\frac{3}{5}$; interorbital 3.

Body strongly compressed, edges convex. Caudal peduncle compressed, least depth $3\frac{1}{4}$ to $3\frac{1}{2}$ in its length or 3 in postorbital. Snout strongly compressed, width $8\frac{1}{5}$ in its length. Eye with front edge at last third in head in young, slightly more posterior with age. Mouth small, mandible slightly protruding. Maxillary small, expansion $1\frac{2}{3}$ in eye. Front nostril about $\frac{3}{4}$ of eye before front edge of eye; hind nostril larger, about midway between front one and eye. Interorbital

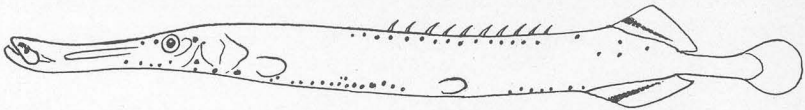


Fig. 263. *Aulostomus maculatus*, from Valenciennes.

depressed, medianly slightly concave. Preopercle, opercle, and some of cranial bones with fine radiating striae. Gill opening extends forward opposite hind pupil edge. No gill rakers. Gill filaments little less than eye. Scales fine, only on trunk, on fins only extending on caudal base; with 2 or 3 basal radiating striae, forming 4 basal lobes; apical denticles 20 or 21; circuli moderate. Exposed upper surface of shoulder girdle with fine radiating striae. First dorsal ray $1\frac{1}{6}$ to $1\frac{1}{2}$ in postocular; first anal ray $1\frac{1}{3}$ to $1\frac{2}{5}$; caudal 1 to $1\frac{1}{8}$; pectoral $1\frac{1}{4}$ to $1\frac{3}{5}$; ventral $1\frac{3}{5}$ to $1\frac{3}{4}$.

Brownish, little paler below. On each side of abdomen 3 or 4 narrow silvery white longitudinal lines, extending on head as rather irregular short streaks or bars or spots. Dark streak along each side of back, more or less broken in spots or blotches. Front of dorsal and anal each with a dusky horizontal band, near middle of each fin. Caudal with two rounded dusky spots. Pectoral and ventral pale, uniform. Length 310 mm.

Tropical Atlantic. Described above from American (West Indies) examples.

Fistulariidae

Cornet Fishes

Body greatly elongate, depressed or partly cylindrical, very long. Head very long. Both jaws, also usually vomer and palatines, with

minute teeth; none on pterygoids. Gill membranes separate, free from isthmus. Gill rakers obsolete. Branchiostegals 5 to 7. Pyloric appendages few. Intestine short. Air vessel large. Vertebrae numerous, first 4 elongate. Skin entirely naked or covered with minute, conical, hooked spinelets, which persist or disappear with age; besides median longitudinal single row of narrow keeled scales may occur on back and ventral surface. Soft dorsal short, posterior; rays 16 to 18, with 3 anterior extremely short. Caudal forked. Pectorals with broad base, preceded by smooth area. Ventrals wide apart, abdominal, far before dorsal, rays 6.

Tropical shore fishes related to the sticklebacks in structure, but differing in the elongated snout and ventral fins.

FISTULARIA Linné

Cornet Fishes

Fistularia LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 312. Type: *Fistularia tabacaria* Linné. Monotypic.

Sollenostomus GRONOW, 1763, 'Zoophylac.,' p. 119. Type: *Fistularia tabacaria* Linné. (Designated by Jordan and Evermann, Stanford Publications, 1917, 'Genera of Fishes,' part 1, p. 21.) (Inadmissible.)

Petimbuaba CATESBY, 1771, 'Nat. Hist. Carolina,' 2d Ed., II, p. 187. Type: *Fistularia tabacaria* Linné. Monotypic. (Inadmissible.)

Aulus (Commerson) LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 350. Type: *Fistularia tabacaria* Linné. Monotypic. (Inadmissible.)

Cannorhynchus CANTOR, 1849, Jour. Asiatic Soc. Bengal ('Cat. Malay. Fish. '), XVIII, p. 211. Type: *Fistularia tabacaria* Linné. (*Cannorhynchus* Cantor proposed to replace *Fistularia* Linné.)

Flagellaria GRAY, 1854, 'Cat. Fish Gronow,' p. 156. Type: *Flagellaria fistularis* Gray. Monotypic.

Body much depressed, wider than deep. Front bones of skull much produced, forming a long tube, hexangular in cross-section, ending in a narrow mouth. Membrane uniting bones of tube below is very lax so that tube is greatly dilatable. Gills 4, a slit behind the fourth. Pseudobranchiae present. Bony plates on body mostly covered with skin. Lateral line on trunk curved toward median line of back in tube-shaped ossifications; bending downward farther on and running along the middle of side; here the tubes gradually form narrow long bony shields, each with a more or less prominent keel or spine; lateral line continued on caudal filament and again enclosed in tubes. Caudal with two middle rays produced in long filament. Pectorals small. Ventrals very small. Vent close to ventrals.

Although two well-marked species occur in most tropical seas, it is usually impossible to indicate or to locate them by means of the numerous references to *Fistularia petimba* Lacépède or *Fistularia serrata* Cuvier. Many writers were unaware of the distinctive characters, so well-pointed out by Weber and Beaufort.

KEY TO THE SPECIES

- a.—Skin naked or smooth, without single median row of narrow keeled scales before dorsal and anal; reddish brown above, with numerous, large, rounded blue spots.....*tabacaria*.
 aa.—Skin rough with minute spinelets, with single row of narrow keel-like scales before and behind dorsal and anal; uniform brown above, white below. .*villosa*.

Fistularia tabacaria Linné

Guia panda ala (Anno Bom), Nanon (Senegambia)

Fistularia tabacaria LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 312. Tropical America.—CAPELLO, 1871, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, p. 281 (St. Jago, Cape Verde Islands).—BUETIKOFER, 1890, 'Reis. Liberia,' II, p. 479.—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 38 (southwest of Santa Lucia, Cape Verde Islands, in 16 m.).—FOWLER, 1921, Proc. Acad. Nat. Sci. Philadelphia, p. 439 (Banda Point, West Africa).

Fistularia tabaccaria GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' III, p. 529 (St. Thomas Island, Gulf of Guinea).—BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, XVIII, No. 2, p. 107 (Guinea).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 98 (Gorée, Dakar, Banc d'Argain, Cape Verde).—STEINDACHNER, 1895, Notes Leyden Mus., XVI, p. 36 (Grand Cape Mount, Liberia).—OSORIO, 1895 (March), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 245 (Bom alimento); 1898, *op. cit.*, (2) V, p. 198 (Cape Verde, St. Thomas Island, Anno Bom, Angola).—PELLEGRIN, 1907, Act. Soc. Linn. Bordeaux, LXII, p. 87 (Dakar); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 28 (Dakar).

Fistularia ocellata DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 263 (Gorée).

Head $2\frac{3}{5}$ to $3\frac{7}{8}$; depth $1\frac{1}{2}$ to $2\frac{1}{8}$ in postocular region of head; greatest body width $1\frac{1}{8}$ to $1\frac{7}{8}$; dorsal 13 to 16; anal 13 to 16; lower jaw $4\frac{2}{5}$ to $5\frac{4}{5}$ in head; snout $1\frac{1}{4}$ to $1\frac{1}{3}$ in head measured from its own tip; eye $7\frac{1}{8}$ to $11\frac{1}{3}$; maxillary $6\frac{1}{2}$ to 7 in snout; interorbital width $7\frac{1}{2}$ to $13\frac{3}{4}$.

Body very long, depressed, slender in profile. Head long, depressed. Snout elongate, tapering but little forward, and each lateral edge with a series of serrations; these series more developed in young. Eye elongately ellipsoid, vertical diameter half of horizontal; center slightly behind last fourth in total head length. Mouth slightly oblique, lower jaw projecting in front and overlapping upper. Preopercle in adult with especially developed rugose finely radiating striae, only as few keels in young. Opercles with radiating striae. Bones of cranium with fine longitudinal striae. Bony interorbital narrow, but little over third of total interorbital width. Ridges of bones on head all more or less rugose or minutely spinescent in young. Gill opening extends forward opposite front pupil edge. No gill rakers. Skin smooth, without rugosities, except as mentioned above, and no median row of keels down middle of back or belly. Dorsal inserted near last fourth in space between gill opening and caudal base, more forward in young; fourth ray about equals postocular region. Anal opposite, similar. Caudal forked, lobes about equal and filament equals or little longer than head, usually longer in young. Pectoral $1\frac{3}{5}$ in postocular, reaches little over $\frac{1}{3}$ to ventral. Ventral $1\frac{4}{5}$ in postocular, inserted trifle behind first third in space between pectoral origin and that of anal.

Color reddish brown on back, with numerous large, unequal, oblong pale blue spots, usually in series. Lower surface of body paler. Reaches 1830 mm.

Tropical Atlantic. Described above largely from American (eastern United States, West Indies, and Brazil) examples. An example was obtained at the mouth of the Congo, 705 mm. long. In alcohol it is now uniform dark brown on the back and upper surface, the lower pale or whitish. The bright colors noted above fade out, especially the blue spots, so that the back appears uniform. The Banda Point specimen in the Academy is simply a dried head. It is much larger, or 355 mm. long, and differs only in that the lateral keels on each side are smooth.

***Fistularia villosa* Klunzinger**

Fistularia villosa KLUNZINGER, 1871, Verh. Zool. Bot. Gesell. Wien, XXI, p. 516. Red Sea.—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 215 (Cape Blanco, Arguin Bank).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 250 (Cape Blanco, Arguin Bank).

Head $2\frac{3}{5}$; depth $11\frac{1}{8}$ in head, equals orbit; head width $12\frac{2}{5}$ in its length; dorsal rays 15; anal rays 14; snout $1\frac{1}{3}$ in head from snout tip; eye $12\frac{1}{3}$, $9\frac{1}{2}$ in snout; maxillary slightly longer than orbital socket, $7\frac{2}{5}$ in snout; bony inter-orbital 2 in eye. Skin rough velvety to touch; median vertebral row of narrow keels to dorsal and behind to caudal; similar ventral row from behind anal to caudal. Fifth dorsal ray $6\frac{3}{4}$ in total head length; fifth anal ray $6\frac{1}{2}$; caudal $7\frac{1}{5}$, well forked; caudal peduncle depressed, least depth half of width; pectoral $8\frac{7}{8}$; ventral $18\frac{1}{2}$. Back Prout's brown, lighter or wood brown below. Silvery sheen on opercle. Fins pale brown. Length 420 mm.

Tropical seas. Metzelaar reports it up to 710 mm., and Weber and Beaufort 1500 mm. Described above from an example from Natal.

Macrorhamphosidae

Snipe Fishes

Body oblong or elevated. Head prolonged anteriorly to form long tube with short jaws at end. No teeth. Gill openings wide. Gills 4, slit behind fourth. Pseudobranchiae large. Branchiostegals 4. Branchi-hyals and pharyngeals mostly present, fourth superior pharyngeals only wanting. Air vessel large. Vertebrae about 24. No pyloric caeca. Intestinal canal short. Head and body all covered by small rough scales, formed by a scaly plate in the epidermis, with hind border more or less toothed and with one or more keels on its surface; each scale connected by a stalk with bony plate imbedded in the cutis; besides trunk armored with large bony plates, which are stiff, immovable, and partly hidden by scales; the ventral part of armor reaching from isthmus to anus, broken only by a groove for the ventrals, produces a sharp ventral keel; dorsal cuirass formed by 2 rows of bony plates, the lower partly connected with transverse processes of vertebrae. Two

dorsal fins, continuous or separated, or both connected by series of short isolated spines; first dorsal of 4 to 7 spines, with the second very long and strong; soft dorsal and anal moderate in length. Caudal emarginate, median rays not produced. Pectoral short, inserted more or less midway in height of body. Ventral small, abdominal, without spine.

Small fishes of the tropical and temperate seas.

MACRORHAMPHOSUS Lacépède

Snipe Fishes

Macrorhamphosus LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 136. Type: *Silurus cornutus* Forskål = *Balistes scolopax* Linné. Monotypic.

Centriscus (not Linné) CUVIER, 1817, 'Régne Animal,' II, p. 350. Type: *Balistes scolopax* Linné. Monotypic.

Macrognothus (not Lacépède, 1803) GRAY, 1854, 'Cat. Fish Gronow,' p. 147. Type *Balistes scolopax* Linné. (Designated by Jordan, Stanford Publications, 1919, 'Genera of Fishes,' part 2, p. 259.)

Orthichthys GILL, 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 234. Type: *Centriscus velitaris* Pallas. Monotypic.

Body compressed, oblong, graduating into caudal peduncle. Back straight. No lateral line, but lateral line canals are present on head. Dorsal armor of each side of body consists of 2 series of bony plates, each series formed by 3 well-developed and a fourth much smaller plate. No patch of bristles on nape. First dorsal spine short. Dorsal fins not continuous but separated by an interspace or connected by a series of 3 to 7 short isolated spines.

Pelagic.

KEY TO THE SPECIES

- a.—MACRORHAMPHOSUS. Diameter of eye not less than postorbital length of head.
 b.—Depth 3 1/2 to 4 1/4 in length; dorsal spine inserted above origin or anterior part of anal, strong, serrated, 3/8 to 2/3 of space from opercle to caudal. *scolopax*.
 bb.—Depth 4 1/2 to 6 1/2 in length; dorsal spine inserted before vent, serrated or not, 1/5 to 2/5 space from head to caudal, when laid back, nearly or quite reaching origin or sometimes posterior end of soft dorsal. . . *gracilis*.
 aa.—ORTHICHTHYS. Diameter of eye less than postorbital length of head. . . *velitaris*.

Macrorhamphosus scolopax (Linné)

Figure 264

Balistes scolopax LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 329. Mediterranean.

Centriscus scolopax VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II (2), p. 69 (Canaries).—STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1), p. 687 (Teneriffe).—ZUGMAYER, 1911, Rés. Camp. Sci. Monaco, XXXV, p. 117 (north of Azores, N. lat. 45°, W. long. 30°, in 932 to 150 m.).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 396, Fig. 268 (off Cape Blanco, in 10 m.).

Macrorhamphosus scolopax JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 340 (Canaries).—REGAN, 1914, Ann. Mag. Nat. Hist., London, (8) XIII, p. 18 (Madeira).

Head $1\frac{4}{5}$ to $2\frac{1}{8}$; depth $3\frac{3}{4}$ to $4\frac{1}{2}$; dorsal V or VI-11 or 12; anal 18 or 19; snout $1\frac{3}{4}$ to $3\frac{2}{3}$ in head; eye $2\frac{1}{2}$ to $4\frac{1}{2}$ in snout.

Body greatly compressed, deepest about pectoral base. Caudal peduncle well compressed, least depth $1\frac{2}{3}$ to $1\frac{3}{4}$ its length or $1\frac{3}{5}$ to $1\frac{2}{3}$ in postocular. Head width $4\frac{4}{5}$ to $5\frac{1}{4}$ in its length. Snout well compressed, basal width $3\frac{1}{4}$ to 5 in its length. Eye large, front eye edge at last third in head, about last $\frac{2}{5}$ in young. Mouth very small, rostrum very gradually tapering forward. Nostrils rather close together; front one about $\frac{3}{5}$ to $\frac{2}{3}$ an eye diameter before its front edge, nearly $\frac{4}{5}$ in young. Interorbital very slightly convex. Gill opening forward opposite front pupil edge. Gill rakers $5 + 14$ short weak points, about $\frac{1}{5}$ gill filaments, which $2\frac{1}{4}$ in eye. Scales strong, with 5 or 6 longitudinal keels, each ending in point so that other marginal points may be interpolated and 9 to 12 points may occur. Origin of spinous dorsal above vent or anal origin, spine very variable in length, or tip extending till opposite last dorsal rays or even beyond caudal tips.

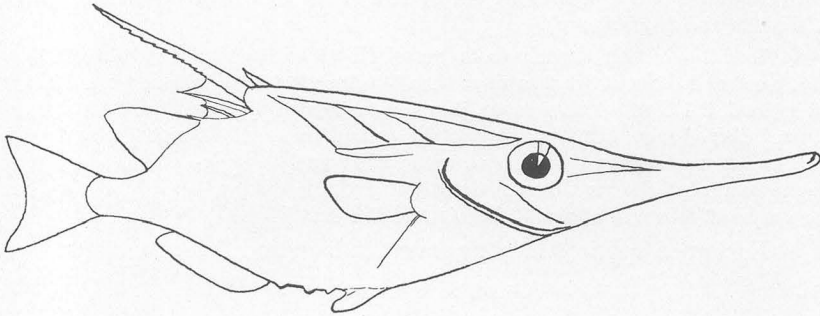


Fig. 264. *Macrorhamphosus scolopax*, from Day.

Soft dorsal little higher than anal; its base about half or little more than that of anal. Caudal small, 4 to $4\frac{1}{2}$ in head; pectoral 2 to $2\frac{3}{4}$; ventral $1\frac{7}{8}$ to $2\frac{1}{3}$ in pectoral.

Brownish. Length 158 mm.

Tropical Atlantic and Mediterranean. Described above from Italian examples. Rosy or olive in life, with silvery reflections.

***Macrorhamphosus gracilis* (Lowe)**

Jhombi (Senegambia)

Centriscus gracilis LOWE, 1839, Proc. Zool. Soc. London, p. 86. Madeira; 1839, Trans. Zool. Soc. London, p. 12 (Madeira).—GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' III, p. 521 (Madeira).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 98 (Banc d'Argain, Gorée, Cape Ste.-Marie, Cape ROXO).—STEINDACHNER, 1891, Sitzs. Akad. Wiss. Wien, C (1), p. 361 (Valle Bufadero, Teneriffe, Grand Canary).

Macrorhamphosus gracilis REGAN, 1914, Ann. Mag. Nat. Hist., London, (8) XIII, p. 19 (Madeira).

Depth 5 to 6; dorsal IV or V-11; anal 17; pectoral 15; ventral 5. Second dorsal spine short or moderate, not reaching caudal base. Above brownish, below silvery. (Lowe.)

Eastern Atlantic. Regan says, "the ventral scutes are much less distinctly keeled than in *M. scolopax*, and the snout is shorter than in that species, only twice as long as the rest of the head in the adult fish."

One in the Museum of Comparative Zoölogy, 128 mm. long, from Fayal, Azores.

Macrorhamphosus velitaris (Pallas)

Centriscus velitaris PALLAS, 1770, 'Spicil. Zool.,' VIII, p. 36, Pl. XIV, fig. 8. Amboyna.

Macrorhamphosus velitaris REGAN, 1914, Ann. Mag. Nat. Hist., London, (8) XIII, p. 20 (Madeira and Sierra Leone).

Centriscus gracilis (part) GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' III, p. 521 (Madeira and Sierra Leone).

Head 2 to 2 1/2; depth 4 to 5; dorsal III-10 to 12; anal 18; pectoral 13 to 15; ventral 5. Snout 3 1/2 to more than 4 in length, 1 7/10 in head; eye 4 1/2 to 6 in head, 2 1/2 to 3 1/2 in snout, its diameter less than postorbital. First dorsal spine short, begins behind vent and far behind middle in length; second spine somewhat shorter than half of head, with small spinelets along its hind edge; third spine somewhat shorter than half length of second. Silvery, darkish on back and top of head. Length 85 mm. (Weber and Beaufort.)

Eastern Atlantic, Mediterranean, Indian, and Pacific Oceans.

ORDER PERCOMORPHI

Spiny-Rayed Fishes

Mouth edge formed by premaxillary above. Maxillary normally distinct, always present, sometimes ossified with premaxillary. Shoulder girdle connected by post-temporal with skull. Hypercoracoid and hypocoracoid distinct, ossified, former usually perforate. No mesocoracoid or interclavicles. Pharyngeals well developed, lower rarely united, third upper largest, fourth often absent. Opercular apparatus complete. Front vertebrae unmodified, without ossicula auditus. Gill opening before pectorals. Gills laminated. Air vessel typically without duct in adult. Scales variable, typically ctenoid. Lateral line usually extends high. Front dorsal and anal rays typically simple or spinous and all fin rays often articulate. Pectorals placed above plane of abdomen, actinosts always present. Ventrals mostly anterior, normally attached by pelvis to shoulder girdle, usually with spine and 5 rays, sometimes absent, sometimes without spine or with many rays, or otherwise modified.

The vast majority of living fishes are included in this group. The

fossils are usually very incomplete. The order is incapable of definition from any one or group of characters, as comparatively few have been studied. This is also true of the suborders, groups, alliances, and series formed by different natural segregations of families and genera, so that no key is here given.

SUBORDER PERCESOCES

Perch-Pikes

Opercle unarmed. Branchial arches well developed, all bones present except fourth upper branchial. Third upper pharyngeal much enlarged and lower pharyngeals distinct from one another. Pelvic bones not joined to shoulder girdle. Lateral line median or obsolete. Spinous armature of fins but moderately developed. Spinous dorsal usually present and other fins also with spines. Pectorals elevated, about level with upper hind opercle angle. Ventrals abdominal, of 1 spine and 5 rays, graduated from outer rays, which are longest to the inner which are shortest.

An interesting transition group from soft-rayed to spiny-rayed fishes. Chiefly shore and fresh-water forms, many of small size, some large and very voracious.

KEY TO THE FAMILIES

- a.*—Head long, pointed; teeth very strong, unequal; gill rakers obsolete; lateral line present.....SPHYRAENIDAE.
aa.—Head shorter, less pointed; teeth small or absent; gill rakers long, slender; lateral line absent.
b.—Head and body elongate; stomach not gizzard-like; carnivorous.....ATHERINIDAE.
bb.—Head short, broad; stomach gizzard-like; intestines long; mud and vegetation feeders.....MUGILIDAE.

Sphyraenidae

Barracudas

Body greatly elongate, partly terete. Head very long, pointed. Mouth cleft horizontal. Jaws elongate; lower protruded conspicuously; upper not protractile, edge formed by premaxillaries and behind by broad maxillaries. Teeth large, fanglike, unequal, implanted in sockets in both jaws and on palatines, none on vomer. Opercular bones without spines on serratures. Gill openings wide, membranes not united, free from isthmus. Gills 4, slit behind fourth. Pseudobranchiae well developed. Branchiostegals 7. Air vessel large, bifurcate in front.

Pyloric appendages numerous. Scales small, cycloid. Head scaly on top and on sides. Lateral line well developed, straight. First dorsal over ventrals, with 5 strong spines. Second dorsal well back of first, like anal and opposite. Caudal forked. Pectoral short, low, within or below body axis. Ventral abdominal, before middle in body, with spine and 5 rays.

Large carnivorous, active, pikelike fishes, voracious. They live in warm seas and many are valued as food.

SPHYRAENA Rosé

Barracudas

Sphyraena Rosé, 1793, 'Artedi syn. nom. pisc.,' 2d Ed., p. 52. Atypic. (Type: *Esox sphyraena* Linné. Tautotypic.)—KLEIN, 1778, 'Gesellsch. Schauplatz,' VI, p. 464. Type: *Esox sphyraena* Linné. Tautotypic. (Inadmissible.)

Sphyrena auct.

Umbla CATESBY, 1771, 'Hist. Nat. Carolina,' 2d Ed., p. 1. Type: *Esox barracuda* Walbaum. Monotypic. (Inadmissible.)

Acus (Plumier) LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, pp. 325, 327. Type: *Sphyraena acus* Lacépède. Tautotypic. (Name preoccupied by Müller, Catesby, and Valmont; species non-binomial.)

Sphaerina SWAINSON, 1839, 'Nat. Hist. Animals,' II, p. 175 (242). Type: *Sphaerina europaea* Swainson. Monotypic.

Agrioposphyraena FOWLER, 1903, Proc. Acad. Nat. Sci. Philadelphia, p. 749. Type: *Esox barracuda* Walbaum. Orthotypic.

Agriosphyraena auct.

Body very elongate. Head usually large. Snout long, conic, pointed. Eye large, median, high. Mouth large. Strong, sharp, unequal teeth in both jaws and on palatines, none on vomer; usually a large, sharp canine near lower jaw tip. Gill rakers very short or obsolete. Scales moderate or small. Second dorsal with 1 or 2 flexible spines in front and 8 or 9 divided rays. Anal origin opposite or behind that of second dorsal fin, of 1 or 2 flexible spines and 7 to 9 divided rays. Pectoral origin before that of first dorsal. Ventral origin before, below or behind that of first dorsal.

Warm parts of the Atlantic and Indo-Pacific and neighboring seas.

KEY TO THE SPECIES

- a.—SPHYRAENA. Scales more than 100 in lateral line to caudal base; top of head rather narrow, usually slightly convex.
- b.—Scales 136 to 145 in lateral line to caudal base. *sphyraena*.
- bb.—Scales 110 to 115 in lateral line to caudal base. *guachancho*.
- aa.—AGRIOPOSPHYRAENA. Scales larger, less than 90 in lateral line to caudal base. *barracuda*.

Sphyraena sphyraena (Linné)

Picuda, Vicuda (Canaries)

Esox sphyraena LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 313. Mediterranean Sea.—BOWDICH, 1825, 'Excurs. Madeira,' p. 125 (Madeira).

Esox sphyraena POGGI, 1881, (article in 'Guidebook of Canary Isls.'). 'Guia de Santa Cruz de Teneriffe,' [p. d. 36].

Sphyraena sphyraena JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 340 (Canary Islands).—FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 279 (Loando, Angola); 1923, Proc. Acad. Nat. Sci. Philadelphia, p. 33 (Funchal Bay, Madeira).

Sphyraena viridescens CUVIER, 1829, 'Hist. Nat. Poiss.,' III, p. 339. St. Jago, Cape Verde Islands.—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 262 (St. Jago).

Sphyraena becuna (not Lacépède) DUMÉRIL, 1858, *op. cit.*, X, p. 262 (Gorée).

Sphyraena vulgaris GÜNTHER, 1860, 'Cat. Fish. Brit. Mus.,' II, p. 335 (Lanzarote).—TROSCHER, 1866, Archiv Naturg., p. 204 (Cape Verde Islands).—STEINDACHNER, 1867, Sitzs. Akad. Wiss. Wien, LVI (1), p. 701 (Santa Cruz, Teneriffe).—CAPELLO, 1871, Journ. Sci. Math. Phys. Nat., Acad., Lisbon, p. 201 (Mossamedes, Angola).—BAADER, 1873-1874, Ber. Senckenberg. Naturf. Gesell., p. 182 (Mogador).—GÜNTHER, 1880, 'Rept. Voy. "Challenger,"' I, p. 3 (St. Jago).—VINCIGUERRA, 1882-1883, Ann. Mus. Civ. Storia Nat., Genova, XVIII, p. 617 (Santa Cruz di Teneriffe).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 70 (Gorée; Cape Verde).—VINCIGUERRA, 1890, Lo Spallanzani, (2) XIX, p. 480 (Las Palmas, Grand Canary).—OSORIO, 1890 (September), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) II, p. 56 (Benguella, Angola).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 322 (Grand Canary).—OSORIO, 1898, *op. cit.*, (2) V, p. 197 (Angola).—PELLEGRIN, 1907, Act. Soc. Linn. Bordeaux, LXII, p. 88 (Rufisque); 1912, Bull. Soc. Zool. France, XXXVII, p. 291 (Mossamedes); 1913, Bull. Soc. Zool. France, XXXVIII, p. 116 (Baie du Lévrier); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 33 (Baie du Lévrier, Rufisque, Senegal, Mossamedes).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 260, Fig. 20 (Baie du Lévrier).

Sphyraena hupferi FISCHER, 1885, Jahrb. Hamburg. Wiss. Anst., II, p. 70. Cameroon.

Head $2\frac{4}{5}$ to $3\frac{1}{3}$; depth $7\frac{3}{4}$ to 10; dorsal V-I, 9, 1; anal II, 9, 1; scales 136 to 145 in lateral line to caudal base and 5 to 7 more on latter; 11 or 12 scales above lateral line, 13 or 14 below; 70 to 75 predorsal scales; snout $2\frac{1}{6}$ to $2\frac{1}{4}$ in head measured from upper jaw tip; eye 5 to $5\frac{4}{5}$; maxillary $2\frac{1}{3}$ to $2\frac{3}{5}$; interorbital $5\frac{1}{8}$ to $6\frac{1}{2}$.

Body partly cylindrical, slender. Caudal peduncle compressed, least depth 3 to $3\frac{3}{4}$ in its length or $5\frac{2}{5}$ to 8 in total head length. Head slender, conic, width $3\frac{7}{8}$ to $4\frac{1}{5}$ in its total length. Snout conic, width $2\frac{1}{2}$ to $2\frac{4}{5}$ in its length. Eye with front edge slightly before middle in total head length; $2\frac{2}{5}$ to $2\frac{3}{4}$ in snout; a little less than interorbital, greater in young. Mouth moderate, lower jaw well protruded. Maxillary reaches nostril; expansion half of eye. Four large upper canines forward, a pair on each side; each palatine with 4 large compressed canines; lower teeth uniserial, compressed, smaller forward, larger medianly; large lower canine forward in mandible, directed posteriorly. Nostril at about last fifth in snout length, high, small simple pore. Interorbital slightly convex.

Gill opening forward nearly opposite hind maxillary end. Scales with 110 to 123 radiating basal striae; circuli fine. Scales very small, smaller on head and caudal base; cheek with 17 rows of scales to preopercle edge; small scales on front of soft dorsal and anal basally. Lateral line slopes from hind edge of gill opening

above until midway along side, then to caudal base. Spinous dorsal inserted little nearer lower jaw tip than caudal base, about midway in young; second spine $3 \frac{3}{5}$ to $4 \frac{1}{10}$ in total head length. Soft dorsal inserted midway between first dorsal origin and caudal base; first branched ray $3 \frac{3}{4}$ to $3 \frac{4}{5}$ in total head length. Anal similar and opposite soft dorsal; first branched ray $4 \frac{1}{4}$ to $4 \frac{1}{3}$ in total head. Caudal well forked, 2 to $2 \frac{2}{5}$ in head. Pectoral $3 \frac{2}{5}$ to $3 \frac{2}{3}$ in head, not reaching dorsal. Ventral inserted below or a little behind spinous dorsal origin, $3 \frac{7}{8}$ to 4 in head.

Dark olivaceous above, sides and below silvery whitish. Sometimes dark streaks along side of back vertically and young blotched with darker than body color. Length 363 mm.

Eastern Atlantic and Mediterranean. Described above from Madeira and Italian examples.

Adult in the U. S. National Museum from the Canaries, obtained through the Vienna Museum.

One 305 mm. long in the Museum of Comparative Zoölogy, from Funchal, Azores.

Sphyraena hupferi Fischer is based on an example 540 mm. long, with 157 scales in the lateral line. It is described with 14 to 16 dark crossbars along the back.

***Sphyraena guachancho* Cuvier**

Galongo (Bom), Bacuda (São Thomé)

Figure 265

Sphyraena guachancho CUVIER, 1829, 'Hist. Nat. Poiss.,' III, p. 252. No locality [probably Havana].—BOULENGER, 1901, 'Poiss. Bassin du Congo,' p. 364 (Congo).—REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 128 (Lagos).—BOULENGER, 1916, 'Cat. Fresh-water Fishes Africa,' IV, p. 105, Fig. 64 (St. Louis, Gambia, Lagos, Degana, Benito River).—EHRENBAUM, 1914, Fischerbote, VI, p. 109 (Cameroon).—PELLEGRIN, 1923, 'Poiss. Eaux douces Af. Occ.,' p. 336 (Senegal; Congo).

Sphyraena dubia BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, XVIII, No. 2, p. 70, Pl. xv, fig. 2. Ashantee.—OSORIO, 1890 (September), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) II, p. 56 (Benguella, Angola).—STEINDACHNER, 1895, Notes Leyden Mus., XVI, p. 32 (Cape Mount, Liberia).—OSORIO, 1898, *op. cit.*, (2) V, p. 197 (Cape Verde; Angola).—PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 153 (Lagune de Grand Bassan, Ivory Coast), p. 154 (Libreville, Gaboon); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 34 (Lagune de Grand Bassan; Libreville).

Sphyraena afra PETERS, 1876 (1877), Monatsb. Akad. Wiss. Berlin, p. 842 (Congo).

Sphyraena jello (not Cuvier) STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV (1), p. 39 (Senegambia).

Sphyraena bocagei OSORIO, 1891, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) II, p. 114. São Thomé and Rolhos Islands; 1895 (March), *op. cit.*, (2) III, p. 245 (Anno Bom Island); 1988, *op. cit.*, (2) V, p. 197 (St. Thomas Island, Rolas, Anno Bom).

Head $2\frac{3}{4}$ to $3\frac{1}{5}$; depth $7\frac{2}{3}$ to $7\frac{4}{5}$; dorsal V-I, 9, 1 or 10, 1; anal I, 8, 1 or 9, 1; scales 110 to caudal base and 13 more on latter; 13 or 14 scales above lateral line to soft dorsal origin, 16 or 17 below; 38 to 40 predorsal scales; snout $2\frac{1}{10}$ to $2\frac{1}{5}$ in head measured from upper jaw tip; eye $5\frac{1}{4}$ to $8\frac{1}{3}$; maxillary $2\frac{1}{10}$ to $2\frac{1}{4}$; interorbital $4\frac{2}{5}$ to $5\frac{1}{2}$.

Body well compressed, edges rounded, much shorter in young. Caudal peduncle compressed, least depth $2\frac{3}{4}$ to 3 in its length of $4\frac{1}{4}$ to 5 in total head length. Head large, slender, acuminate, flattened sides slightly approximate below; larger in young; width $3\frac{3}{4}$ to 4 in its total length. Snout conic, width at front of eyes $2\frac{1}{3}$ to $2\frac{3}{5}$ in its length. Eye moderate, high, front edge midway in total head length; $2\frac{1}{4}$ to $4\frac{1}{5}$ in snout; 1 to $2\frac{1}{10}$ in interorbital, greater than interorbital in young. Mouth large, mandible protruding space about equal half of eye in adult, less in young. Maxillary not quite to eye in young, reaches front eye edge in adult; expansion $1\frac{1}{2}$ to 2 in eye. Nostril small elevated pore, about last sixth in snout. Interorbital broadly depressed.

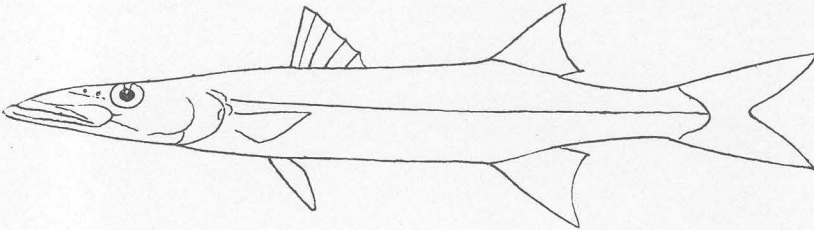


Fig. 265. *Sphyraena guachancho*, from Boulenger.

Gill opening forward not quite opposite nostril. No gill raker. Gill filaments $1\frac{1}{4}$ in eye; pseudobranchiae about $\frac{3}{4}$ of gill filaments. Scales with 50 to 150 basal radiating striae; circuli fine. Scales in even longitudinal rows; 22 rows across cheek, which with opercles is the only squamous portion of head, rest naked; soft dorsal and anal with fine scales forward basally in young, naked with age; caudal base scaly. Lateral line complete, from gill opening above to middle of caudal basally; tubes simple, well exposed. First dorsal origin a little nearer nostril than second dorsal origin, slightly more backward in young; second spine $3\frac{1}{2}$ to $3\frac{3}{4}$ in total head length; depressed fin $1\frac{3}{4}$ to $2\frac{7}{8}$ to soft dorsal. Soft dorsal inserted midway between origin of first dorsal and caudal base, little advanced in young; first branched ray $2\frac{2}{5}$ to 3 in total head length. Anal opposite, similar; first branched ray $2\frac{3}{5}$ to 3 in total head. Caudal widely forked, upper lobe $1\frac{1}{3}$ to $1\frac{3}{5}$ in total head length. Pectoral extends to or slightly beyond origin of first dorsal; $3\frac{1}{8}$ to $3\frac{4}{5}$ in total head. Ventral inserted little before origin of first dorsal, fin $3\frac{1}{5}$ to $3\frac{3}{4}$ in total head.

Dusky brown above, with about 23 deep brown streaks slightly inclined from vertical along side of trunk. Iris slaty. Dorsals and caudal dusky, also anal. Pectoral and ventral pale olivaceous brown, dusky at origin. Length 891 mm.

Tropical Atlantic. Described from a large example obtained at the mouth of the Congo and a series of American (West Indies) examples.

Sphyraena bocagei Osorio does not appear to differ. It is based on an example 250 mm. with 135 scales in the lateral line.

***Sphyraena barracuda* (Walbaum)**

Figures 266 and 267

Esox barracuda WALBAUM, 1792, 'Arted. Pisc.,' III, p. 94 (on *Barracuda* Catesby, 1771, 'Nat. Hist. Carolina,' II, p. 1, Pl. I. Bahamas).

Sphyraena picuda GÜNTHER, 1860, 'Cat. Fish. Brit. Mus.,' II, p. 336 (Niger River).

Head 3 to 3 1/3, 2 3/5 in young; depth 5 3/5 to 8 2/5; dorsal V-I, 9 or 10; anal I, 9; scales 75 to 85 in lateral line to caudal base and 8 to 10 more on latter; 11 or 12 scales above lateral line, 10 or 11 below; 25 to 30 predorsal scales; snout

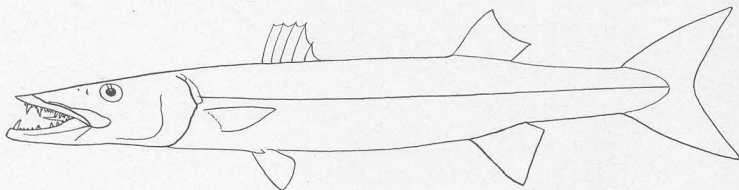


Fig. 266. *Sphyraena barracuda*, from Goode.

2 1/8 to 2 1/4 in head measured from upper jaw tip; eye 4 3/4 to 7; maxillary 2 to 2 1/2; interorbital 4 3/4 to 5 1/2.

Body well compressed, shorter in young. Caudal peduncle compressed, least depth 2 to 2 1/5 in its length or 4 to 5 1/4 in total head length. Head large, compressed, longer in young; width 3 2/5 to 3 3/4 in its total length. Snout conic, flattened somewhat above, about twice as long as wide. Eye large, high, a little behind middle in head, larger in young; 2 1/2 to 2 3/4 in snout; 1 to 1 1/5 in interorbital. Mouth large, lower jaw projecting, blunt, conic. Maxillary reaches nearly or quite to front edge of pupil, only to hind nostril in young. Premaxillary teeth small, irregular, mostly uniform, a little shorter and more robust behind, also with 2 pairs of large compressed canines of which front ones point down and backward; lower teeth uniserial, compressed, knifelike, small in front, larger backward; palatine teeth uniserial, compressed, like upper canines in size, even; often large lower canine, pointing back. Nostrils near together; front one simple small pore; hind one short vertical slit close before eye. Inter-orbital broad, concave.

Gill rakers absent, only edge of branchial arch rough. Scales with 50 to 52 basal radiating striae; circuli fine. Scales moderately small, smaller on head and caudal base; cheek with 13 rows of scales to preopercle edge. Lateral line slopes abruptly at first, median after ventral. Spinous dorsal inserted midway between

lower jaw tip and hind end of depressed soft dorsal; nearer caudal base in young; second spine 3 to $3 \frac{1}{8}$ in total head length. Soft dorsal inserted about midway between spinous dorsal origin and caudal base; slightly more forward in young; second branched ray $2 \frac{3}{5}$ to $2 \frac{7}{8}$ in total head length. Anal inserted slightly behind insertion of soft dorsal, similar; second branched ray 3 to $3 \frac{1}{8}$ in total head length. Caudal well forked, $1 \frac{3}{4}$ to $1 \frac{7}{8}$ in total head length. Pectoral small, reaches spinous dorsal, $2 \frac{3}{4}$ to 4 in head. Ventral like pectoral, inserted nearer pectoral origin than that of spinous dorsal, 3 to $3 \frac{1}{4}$ in head.

Dark olivaceous on back, sides and lower surface silvery white, also iris. Fins more or less dusky, lower ones paler. Dark streak from snout tip through eye to gill opening, most conspicuous in young. Back of young with about 8 large saddle-

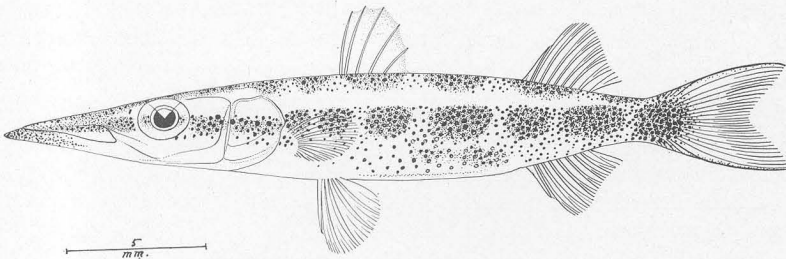


Fig. 267. *Sphyræna barracuda*, young.

like rings and from front and hind edge of each large dusky spot pendant along median portion of sides. Blotches all very variable, often disconnected and fading out with age. Reaches 1830 mm.

Tropical Atlantic. Described above from American (West Indies and Florida) specimens.

Atherinidae

Silversides

Body rather elongate, subcylindrical or somewhat compressed. Eyes lateral, without adipose lids. Mouth cleft moderate, usually terminal, oblique, reaches to or beyond front of eye. Jaws equal or not. Teeth small, in jaws, sometimes on vomer, palatines, or pterygoids, rarely absent. Opercular bones without spines or serratures. Gill openings wide, membranes not united, free from isthmus. Gills 4, slit behind fourth. Gill rakers usually long and slender. Pseudo-branchiae present. Branchiostegals 5 or 6. Third and fourth upper pharyngeals joined together, with teeth. Air vessel present. No pyloric appendages. Vertebrae 32 to 60, of which 23 caudal. Scales moderate or small, usually cycloid, sometimes ctenoid. No lateral line, some scales often with pits or rudimentary mucous tubes. Two dorsals,

well separated, first 3 to 8 slender flexible spines, second of 4 or 5 soft rays or spine and 3 to 6 unbranched rays. Anal like soft dorsal, often larger, with weak spine. Caudal emarginate. Pectorals high, moderate or small. Ventrals small, usually abdominal, not far back, with small spine and 5 rays.

Mostly small carnivorous fishes, abounding in great schools near the shores of temperate and tropical seas, a few in fresh water. Most have a silvery band along the sides, sometimes underlaid by dark pigment. Those of sufficient size are valued food fishes.

Ischnomembras gabunensis Fowler¹ was based on 2 examples, originally labeled as having been obtained in the Gaboon River by Du Chaillu. As these have proved unquestionably the American *Menidia menida* (Linné), a species never otherwise reported from West Africa, I suggest the possibility of an error in the alleged Gaboon River label.

ATHERINA Linné

Atherina LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 315. Type: *Atherina hepsetus* Linné. Monotypic.

Membras BONAPARTE, 1836, 'Fauna Ital.,' Pesci., III, fasc. xvii-xviii. Atypic. Type: *Atherina mochon* Valenciennes. (Designated by Jordan, 1916, Copeia, No. 32, p. 47.)

Taeniomembras OGILBY, 1898, Proc. Linn. Soc. New South Wales, XXIII, p. 41. Type: *Atherina microstoma* Günther. Monotypic.

Body elongate, partly cylindrical or feebly compressed, belly rounded. Head well compressed, rather attenuated. Mouth oblique, short. Mandible small, weak. Teeth small, conic, in jaws, on vomer and palatines. Vertebrae 43 to 56. Scales cycloid, moderate to rather large, extend on parts of head. Dorsal spines feeble, 5 to 9. Soft dorsal and anal opposite, similar. Pectoral short. Ventral inserted well behind pectoral base.

Widely distributed in the warm seas of the globe.

KEY TO THE SPECIES

- a.—Scales 50 to 60 in median lateral series.
 b.—Branched anal rays 12 or 13.....*hepsetus*.
 bb.—Branched anal rays 15 or 16.....*presbyter*.
 aa.—Scales 40 to 50 in median lateral series; branched anal rays 12 or 13...*caspia*.

Atherina hepsetus Linné

Bixim (Anno Bom Island)

Atherina hepsetus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 315. Mediterranean Sea.—GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' p. 393 ("Canaries").—STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1), p. 676 (Teneriffe).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 321 (Canaries).—JORDAN AND HUBBS, 1919,

¹ 1903, Proc. Acad. Nat. Sci. Philadelphia, p. 731, Pl. XLII, upper fig. Gaboon River, West Africa; 1919, Proc. U. S. Nat. Mus., LVI, p. 266 (types).

Stanford Publications, 'Studies in Ichthyology,' p. 36 (Canaries).—FOWLER, 1923, Proc. Acad. Nat. Sci. Philadelphia, p. 33 (Machico, east coast of Madeira).

Atherina boyeri (not Risso) GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' III, p. 394 (Madeira, Mogador).—OSORIO, 1893 (August), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 139 (St. Thomas Island); 1895 (March), *op. cit.*, p. 247 (Anno Bom Island); 1898, *op. cit.*, (2) V, p. 198 (Cape Verde, St. Thomas, Anno Bom).—JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 340 (Canaries).

Head $3\frac{3}{4}$ to $4\frac{1}{3}$; depth $5\frac{2}{5}$ to 6; dorsal VII to IX-I, 10 to 12; anal I, 12 or 13; scales 50 to 53 in median lateral series; 8 to 10 scales transversely between soft dorsal and anal origins; 25 to 29 predorsal scales; snout $3\frac{3}{5}$ to 4 in head; eye $2\frac{4}{5}$ to $3\frac{1}{8}$; maxillary $2\frac{3}{5}$ to $2\frac{4}{5}$; interorbital $3\frac{1}{10}$ to 4.

Body elongately fusiform, deepest at ventral origin, slightly flattened, sides compressed. Caudal peduncle compressed, least depth $3\frac{1}{2}$ to $3\frac{2}{3}$ in its length or $3\frac{3}{4}$ to 4 in head. Head width $2\frac{1}{5}$ to $2\frac{1}{4}$ its length. Snout long, pointed. Eye advanced. Mouth moderate, very oblique, mandible slightly projecting. Maxillary reaches eye. Teeth little evident, jaws forming thin cutting edge, none on palate. Nostrils lateral, above and before eye. Interorbital little wider than snout. Gill rakers 8 + 21, lanceolate, about $\frac{1}{3}$ longer than gill filaments or half of eye. Scales each with 1 basal point and 11 or 12 basal parallel transverse striae; scales small, thin, imbricate. Spinous dorsal origin much nearer snout tip than caudal base, spines pungent, second spine $2\frac{1}{10}$ to $2\frac{2}{5}$ in head. Soft dorsal inserted behind anal or much nearer spinous dorsal than caudal base; second ray $2\frac{2}{5}$ to $2\frac{1}{2}$ in head. Anal like soft dorsal, opposite; first ray $2\frac{1}{8}$ to $2\frac{1}{6}$ in head. Caudal moderately forked, $1\frac{2}{5}$ to $1\frac{1}{2}$ in head. Pectoral high, nearly reaches ventral origin, $1\frac{1}{4}$ to $1\frac{1}{3}$ in head. Ventral inserted midway between hind eye edge and anal origin, $2\frac{1}{8}$ to $2\frac{2}{5}$ in head.

Pale brownish generally, each scale on back edged sharply with crowded dusky-brown dots. Median lateral leaden-silvery band, not so wide as eye, though wider than pupil. Snout largely dusky, side of head below, breast and abdomen pale or whitish. Iris silvery white. Dorsals and caudal gray, other fins whitish. Length 52 to 112 mm.

Eastern Atlantic and Mediterranean. Described above from examples from Italy and Madeira.

***Atherina presbyter* Cuvier**

Figure 268

Atherina presbyter CUVIER, 1829, 'Règne Animal,' II, 2d Ed., p. 235. Atlantic coasts of France (on Duhamel).—LOWE, 1839, Trans. Zool. Soc. London, II, p. 184 (Madeira).—TROSCHER, 1866, Archiv Naturg., p. 224 (Cape Verde Islands).—STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1), p. 677 (Teneriffe).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 322 (Canaries).—MURRAY AND HJORT, 1912, 'The Depths of the Ocean,' p. 397 (off Cape Blanco, 10 m.).

Head 5; depth 6; dorsal VII or VIII-I, 12; anal I, 15 or 16; scales 60 in median lateral series; 11 scales transversely. Snout moderately produced. Eye $3\frac{1}{2}$ in head, equals snout or interorbital. Mouth cleft oblique. Maxillary extends to below front edge of eye. Teeth distinct in jaws and on vomer. Origin of spinous

dorsal above middle of ventrals. Space between dorsal and caudal equals or rather more than head. Silvery streak occupies fifth series of scales and adjoining halves of fourth and sixth. (Günther.)

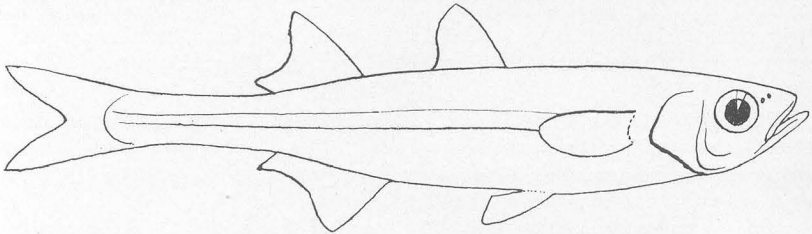


Fig. 268. *Atherina presbyter*, from Day.

Eastern Atlantic, from the British Isles to Madeira, Canaries, and Cape Verde Islands.

Atherina caspia (Eichwald)

Atherina presbyter var. *caspia* EICHWALD, 1831, 'Zool. Special.,' III, p. 72. *Sinu balchanensi* (Caspian Sea).

Atherina mochon CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 252 (Port-Étienne).

Head $3 \frac{4}{5}$ to $4 \frac{1}{5}$; depth 5 to $6 \frac{1}{8}$; dorsal VI to VIII-I, 10 or 11; anal I, 12 to 14; scales 46 to 49 in median lateral series to caudal base, 8 to 10 transversely, 20 to 23 predorsal; snout $3 \frac{1}{3}$ to 4 in head; eye $2 \frac{3}{4}$ to $3 \frac{1}{3}$; maxillary $2 \frac{1}{4}$ to $2 \frac{1}{2}$; interorbital $3 \frac{1}{3}$ to $3 \frac{3}{4}$.

Body elongately fusiform, deepest at ventral origin, compressed, sides slightly flattened. Caudal peduncle depth $3 \frac{4}{5}$ to $4 \frac{1}{2}$ in head. Head width 2 to $2 \frac{1}{10}$ in its length. Snout conic, pointed. Eye advanced. Mouth moderate, oblique, lower jaw protruding. Maxillary reaches to or a little beyond eye. Teeth minute, form very narrow bands in jaws, sometimes a small patch on vomer and a small band on each palatine and tongue. Nostrils lateral, above and before eye. Interorbital a little wider than snout, flattened. Gill rakers $6 + 17$ to 20, lanceolate. Scales large, thin, not especially imbricated. Spinous dorsal origin much nearer snout tip than caudal base, spines slender, third 2 in total head length; soft dorsal inserted a little behind anal origin, much nearer spinous dorsal than caudal base, first ray $2 \frac{1}{4}$; first anal ray 2. Caudal deeply emarginate, $1 \frac{2}{5}$ in head. Pectoral high, reaches ventral base, $1 \frac{2}{5}$ to $1 \frac{4}{5}$ in head. Ventral inserted much nearer anal origin than hind edge of eye, $1 \frac{3}{4}$ to $2 \frac{1}{6}$ in head.

Pale brown, more or less dull silvery. Narrow silvery lateral band, wide as pupil, to caudal. Fins pale. Length 104 to 108 mm.

Mediterranean and east Atlantic to Port-Étienne. Sometimes in fresh water. According to Boulenger reaches 120 mm. Described above from Mediterranean and Italian examples (including types of *Atherina lacustris* Bonaparte and *A. sardinella* Fowler).

Mugilidae

Gray Mulletts

Body oblong, more or less compressed. Mouth small. Jaws with small feeble teeth or none, when present of various form. Premaxillaries protractile. Gill openings wide, membranes separate and free from isthmus. Gills 4, slit behind fourth. Gill rakers long and slender. Pseudobranchiae large. Branchiostegals 5 or 6. Air vessel large, simple. Intestinal canal long. Peritoneum usually black. Vertebrae 24. Scales rather large, cycloid. No lateral line, but furrows often deepened on middle of each scale so as to form lateral streaks. Two short dorsals, well separated, first of 4 stiff spines and last much shorter than others. Second dorsal longer than first, like anal. Anal spines 2 or 3, graduated to last. Ventrals abdominal, not far back, of spine and 5 rays.

Small or moderate-sized fishes, valued as food, living in fresh waters and on the coasts of warm countries. They feed on organic matter contained in mud.

KEY TO THE GENERA

- a.*—No true teeth in the jaws.....MUGIL.
aa.—Single series of small teeth in upper jaw; lower jaw with a sharp front margin.
 MYXUS.

MUGIL Linné

Gray Mulletts

Mugil LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 316. Type: *Mugil cephalus* Linné. Monotypic.

Albula (not Gronow, 1763; Osbeck, 1761) CATESBY, 1771, 'Nat. Hist. Carolina,' 2d Ed., II, p. 6. Type: *Mugil curema* Valenciennes. Monotypic. (Inadmissible.)

Cestreus KLEIN, 1777, 'Gesellsch. Schauplatz,' V, p. 460. Type: *Mugil cephalus* Linné. (Inadmissible.)

Chelon ROSÉ, 1793, 'Artesi syn. nom. pisc.,' 2d Ed., p. 118. Atypic. Type: *Mugil chelo* Cuvier.

Cephalus (Plumier) LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, pp. 384, 386. Type: *Mugil cephalus* Linné. Tautotypic. (Inadmissible.)

Arnion GISTEL, 1848, 'Naturg. Thierr.,' p. x. Type: *Mugil cephalus* Linné. (Arnion Gistel proposed to replace *Mugil* Linné.)

Querimana JORDAN AND GILBERT, 1882, Proc. U. S. Nat. Mus., V, p. 588. Type: *Myxus harengus* Günther. Monotypic.

Liza JORDAN AND SWAIN, 1884, Proc. U. S. Nat. Mus., VII, p. 261. Type: *Mugil capito* Cuvier. Orthotypic.

Oedalechilus FOWLER, 1903, Proc. Acad. Nat. Sci. Philadelphia, p. 748. Type: *Mugil labeo* Cuvier. Orthotypic.

Body oblong, rather robust or somewhat compressed. Eye large. Adipose eyelid large, when present nearly concealing eye; little developed in young. Mouth

small, partly inferior, lower jaw angulated. Jaws with one or few series of short flexible ciliiform teeth, less developed in young. No vomerine or palatine teeth. Preorbital usually entire, more serrate in young. Stomach muscular, like gizzard of fowl. Anal spines 3, only 2 developed in young.

A large genus with many species, feeding on mud and living in great schools along the shores and brackish lagoons in all warm regions. Some enter fresh-water and many are valued as food.

KEY TO THE SPECIES

- a.*—MUGIL. Front of jaws broadly convex as seen from above.
b.—Soft dorsal and anal mostly naked, at least terminally.
c.—Large pointed scaly flap in pectoral axil.
d.—Eye with adipose eyelid largely covering eye; soft anal rays 8.
e.—Scales 36 to 40 to caudal base. *cephalus*.
ee.—Scales 33 or 34 to caudal base. *brasiliensis*.
dd.—Eye with adipose eyelid rudimentary or absent; soft anal rays 9.
ramada.
cc.—Pectoral without axillary scale; eye with rudimentary adipose eyelid or none.
f.—Upper lip not more than half diameter of eye.
g.—Scales 34 to 46 to caudal base.
h.—Soft anal rays 9, rarely 8.
i.—Pectoral 3/5 to 2/3 of head. *saliens*.
ii.—Pectoral 3/4 to 1 in head.
j.—Scales 42 to 46 to caudal base. *auratus*.
jj.—Scales 34 to 36 to caudal base. *hoeffleri*.
hh.—Soft anal rays 11. *falcipinnis*.
gg.—Scales 28 or 29 to caudal base. *grandisquamis*.
ff.—Upper lip thick, papillose, more than half of eye; soft anal rays 9. *provencalis*.
bb.—Soft dorsal and anal rays densely covered with small scales; soft anal rays 9.
curema.
aa.—OEDALECHILUS. Front of jaws broadly truncate as seen from above; soft anal rays 11. *labeo*.

Mugil cephalus Linné

Cabezote (Canaries), Thian (Senegambia), Lissa, Gmel, Zoulé (Cape Blanco)

Mugil cephalus LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 316. European Ocean, entering rivers.—LOWE, 1843, Proc. Zool. Soc. London, XI, p. 86 (Machico River mouth, Madeira).—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 263 (Senegal).—GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' III, p. 417 (River Niger).—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LX (1), p. 952 (St. Louis).—PETERS, 1876 (1877), Monatsb. Akad. Wiss. Berlin, p. 248 (Victoria, Cameroon).—GÜNTHER, 1880, 'Rept. Voy. "Challenger,"' I, p. 3 (St. Jago).—POGGI, 1881, (article in 'Guidebook of Canary Isls.'). 'Guía de Santa Cruz de Tenerife,' [p. d. 35].—ROCHEBRUNE, 1883-1885, 'Faune Sénégalaise,' Poiss., p. 95 (Senegal).—BUETTIKOFER 1890, 'Reis. Liberia,' II, p. 479.—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 323 (Grand Canary).—STEINDACHNER, 1895, Notes Leyden Mus., XVI,

p. 33 (Messurado River mouth, Liberia).—PELLEGRIN, 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanc, Cape Verde); 1905, Act. Soc. Linn. Bordeaux, LXI, p. 35, Fig. (Baie du Lévrier et toute la côte); 1907, *op. cit.*, LXII, p. 87 (Rufisque, Senegal); 1913, Bull. Soc. Zool. France, XXXVIII, p. 155 (Banana, Congo); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 31 (Baie du Lévrier, Senegal, Rufisque, Banana).—REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 127 (Lagos).—BOULENGER, 1916, 'Cat. Fresh-water Fishes Africa,' IV, p. 80, Fig. 47 (Senegal, Cape Verde, Lagos, Niger, Banana, Cubinda).—FOWLER, 1917, Proc. U. S. Nat. Mus., LVI, p. 251 (Elmina, Ashantee).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 257 (Port-Étienne).

Mugil tang BLOCH, 1794, 'Naturg. Ausl. Fische,' XI, p. 134, Pl. CCXCV. Africa.—SCHNEIDER, 1801, 'Syst. Ichth. Bloch,' p. 115 (copied).

Mugil ashanteensis BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, XVIII, No. 2, p. 9, Pl. XIX, fig. 2. Ashantee.—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LX (1), p. 953 (St. Louis).

Mugil ashantensis BUETTIKOFER, 1890, 'Reis. Liberia,' II, p. 479.

Mugil oeur (not Forskål) STEINDACHNER, 1882. Denkschr. Akad. Wiss. Wien, XLIV (1), p. 40 (Senegambia).—ROCHEBURNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 95 (Rufisque, Gorée).

Mugil monodi CHABANAUD, 1926, Bull. Soc. Zool. France, p. 8.—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 258, Figs. 17-19 (Port-Étienne; Agadir, Morocco).

Head 3 to 4; depth 3 1/2 to 4 2/3; dorsal IV-I, 8; anal III, 8, young II, 9; scales 36 to 40 in median lateral series to caudal base and 3 to 6 more on latter; 13 or 14 scales transversely; 17 to 28 predorsal scales; snout 3 3/4 to 4 1/8 in head; eye 3 1/5 to 4 4/5; maxillary 3 1/2 to 4 1/8; interorbital 2 to 2 2/3.

Body long, compressed. Caudal peduncle compressed, least depth 1 1/3 its length or 2 1/3 in head. Head broad above, larger in young; width 1 1/2 its length. Snout wide, convex, length 2/5 to 2/3 its width. Eye rounded, near first third in head; larger in young; adipose lid absent in young, greatly developed with age. Mouth wide, oblique, jaws about equal. Teeth minute, obsolete in young. Nostrils well separated; front one is a small pore at first 2/5 in snout; hind one transverse slit at last fourth in snout. Interorbital broadly convex. Preorbital edge denticulate in young, serrae minute with age. Gill rakers 21 to 40 + 45 to 83, slender, 2 1/2 to 2 3/5 in eye; fewer in young. Scales with 4 parallel, close-set basal striae. Scales mostly uniform, larger on top of head; soft dorsal and anal mostly naked, only very few minute scales scattered about bases; caudal covered densely with minute scales, also pectoral and ventral largely covered with small scales; pointed axillary ventral scale 1 4/5 in fin. Spinous dorsal inserted midway between snout tip and caudal base, little more backward in young; first spine 1 7/8 to 2 in head. Soft dorsal inserted little nearer spinous dorsal origin than caudal base, first branched ray 1 2/3 to 2 in head. Anal inserted before soft dorsal, similar; second spine 2 1/2 to 2 4/5 in head; first branched ray 1 2/3 to 1 5/6. Caudal large, broadly emarginate, tip of each lobe pointed, little longer than head. Pectoral small, wide, inserted level with eye, not quite reaching first dorsal, 1 1/3 to 1 2/5 in head. Ventral 1 1/2 to 1 3/4, inserted little nearer pectoral origin than anal, reaches halfway to anal in adult, little longer in young.

Dark olive or bluish dusky on back, sides and below silvery white. Each row

of scales on sides above with darker longitudinal streak. Iris whitish. Dorsal and caudal grayish, other fins whitish. Ventral yellowish. Reaches 760 mm.

Circumtropical. Described above from American (Middle States) and Mediterranean examples. Also adult 465 mm. and 15 smaller, 47 to 292 mm. from the mouth of the Congo, obtained by the Congo Expedition. In very young the pectoral axillary scale is absent, and in rather large examples is quite short.

Mugil oeur Steindachner is described from West African material. I cannot find, however, anything in his description to preclude it from the present species.

I cannot but think that the nominal *Mugil monodi* Chabanaud is a color variety of the present species. It is described with the dorsal, caudal, and pectoral greenish yellow and the ventrals and anal bright orange-yellow.

***Mugil brasiliensis* Agassiz**

Mugil brasiliensis AGASSIZ, 1829, 'Pisc. Brasil. Spix,' p. 72. Atlantic Ocean, Brazil.—TROSCHER, 1866, Archiv Naturg., p. 22 (Cape Verde Islands).—CAPELLO, 1871, Journ. Sci. Math. Phys. Nat., Acad., Lisboa, p. 280 (Mossamedes, Angola), p. 281 (Cape Verde at St. Jago).—OSORIO, 1893 (August), Journ. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, p. 134 (St. Thomas Island, Rio Quija); 1898, *op. cit.*, (2) V, p. 198 (Cape Verde, St. Thomas).

Mugil curema (not Valenciennes) STEINDACHNER, 1895, Notes Leyden Mus., XVI, p. 34 (Grand Cape Mount Bay, Liberia).

Mugil metzelaari CHABANAUD, 1926, Bull. Soc. Zool. France, p. 12.—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 258 (note).

Head $3 \frac{2}{3}$ to $3 \frac{4}{5}$; depth $4 \frac{1}{5}$ to $4 \frac{1}{4}$; dorsal IV-I, 8; anal III, 8; scales 33 or 34 in median lateral series to caudal base and 4 more larger on latter; 12 scales transversely; 23 to 25 predorsal scales; snout $4 \frac{4}{5}$ to 5 in head; eye 5 to $5 \frac{1}{2}$ in head; maxillary 4; interorbital 2 to $2 \frac{3}{4}$.

Body elongately fusiform, deepest at spinous dorsal origin. Caudal peduncle well compressed, least depth $1 \frac{1}{3}$ to $1 \frac{2}{5}$ its length or $2 \frac{1}{4}$ to $2 \frac{2}{5}$ in head. Head width $1 \frac{1}{2}$ to $1 \frac{3}{4}$ in its length. Snout obtuse, length half its width. Eye with hind pupil edge about first third in head; center of eye at first third in young; adipose eyelid broad, only exposes median third; equals snout in profile, or $1 \frac{1}{2}$ to $2 \frac{1}{2}$ in interorbital. Mouth broad, closed lower jaw included, forming broad obtuse angle. Upper lip quite narrow. Maxillary little exposed, extends opposite hind nostril but not to eye. Teeth minute, fine, close set, row in both jaws. Nostrils well separated; front one simple pore near first $\frac{2}{5}$ in snout; hind one slight vertical slit, larger, elevated, midway between front one and eye. Interorbital broadly convex. Preorbital finely denticulate. Gill rakers 38 + 50, finely lanceolate, half of gill filaments, which about equal eye. Scales in even longitudinal series; 11 to 15 basal radiating striae; apical denticles 36 to 50 rows of short low points. Soft dorsal and anal only with narrow anterior area of basal small scales, rest of fin naked; caudal base scaly. Axillary pectoral scale about $\frac{1}{3}$ of fin and axillary

ventral scale little less than half of fin. Spinous dorsal origin midway between snout tip and caudal base; first spine $1\frac{7}{8}$ in head. Soft dorsal origin nearer that of spinous dorsal than caudal base; first branched ray $1\frac{4}{5}$ to $1\frac{7}{8}$ in head. Anal begins slightly before soft dorsal origin; first branched ray $1\frac{3}{5}$ to $1\frac{4}{5}$ in head. Caudal forked, lobes pointed, 1 to $1\frac{1}{3}$ in head. Pectoral $1\frac{2}{5}$ to $1\frac{1}{2}$ in head. Ventral inserted about opposite last third in pectoral, fin $1\frac{3}{5}$ to $1\frac{3}{4}$ in head.

Brown above, sides and below silvery white. Rows of scales along back and upper side with slightly darker streaks, sometimes obsolete. Length 220 mm.

Tropical Atlantic. Described above from American (West Indies, Brazil, and Surinam) examples.

Mugil ramada Risso

Dane Dane (Senegambia)

Mugil ramada RISSO, 1826, 'Hist. Nat. Eur. Mérid.,' III, p. 390. Nice, France.

Liza ramada FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 251 (Elmina, Ashantee), p. 266 (types of *Liza alosoides* Fowler).

Mugil capito ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 95 (Senegal, Casamence).—BOULENGER, 1901, 'Poiss. Bass. Congo,' p. 355 (Congo).—PELLEGRIN, 1912, Bull. Soc. Zool. France, XXXVII, p. 291 (Praya Amelia); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 31 (Praya Amelia, Angola).—BOULENGER, 1916, 'Cat. Fresh-water Fishes Africa,' IV, p. 83, Fig. 49 (Morocco, Angola).—VAILLANT, 1919, Rés. Camp. Sci. Monaco, LII, p. 131 (Mazaghon, Morocco).

Liza alosoides FOWLER, 1903, Proc. Acad. Nat. Sci. Philadelphia, p. 746, Pl. XLV, upper fig. Gaboon River.

Head 3 to $3\frac{3}{4}$; depth $3\frac{1}{6}$ to $4\frac{4}{5}$; dorsal IV-I, 8; anal, III, 8; scales 36 to 43 in median lateral series to caudal base and 4 to 6 larger on latter; 12 or 13 scales transversely; 23 to 33 predorsal scales; snout $3\frac{3}{4}$ to 5 in head; eye $3\frac{1}{4}$ to $5\frac{3}{4}$; maxillary $3\frac{1}{2}$ to $4\frac{1}{5}$; interorbital $2\frac{1}{2}$ to 3.

Body moderately long, well compressed, deepest at about spinous dorsal origin. Caudal peduncle well compressed, least depth $1\frac{3}{4}$ to 2 in its length or $2\frac{3}{4}$ to $2\frac{4}{5}$ in head. Head width $1\frac{2}{3}$ to $1\frac{3}{4}$ in its length. Snout broad, width $\frac{2}{3}$ to $\frac{3}{4}$ its length. Eye center at first third in head; no adipose lid; diameter $1\frac{1}{6}$ to $1\frac{1}{4}$ in snout, $1\frac{3}{4}$ to $2\frac{1}{5}$ in interorbital. Mouth wide, lower jaw included within upper and would form an obtuse angle. Maxillary with little of end exposed, not quite reaching eye. Maxillary with a row of fine, close set, flexible, minute teeth, none in mandible. A little row of fine teeth each side of vomer. Upper lip broad, width little less than pupil diameter. Nostrils together; front nostril at least $\frac{2}{5}$ in snout; hind one 3 times as large, little nearer anterior than eye. Interorbital broadly convex. Preorbital edge denticulate. Gill rakers 47 to 50 + 50 to 75, finely lanceolate, $1\frac{1}{2}$ in gill filaments, which equal eye. Scales in even longitudinal series; 7 to 11 basal radiating striae; 83 to 85 series of short low apical denticles; circuli fine. Small scales at front of soft dorsal and anal basally. Ventral with axillary scale $\frac{2}{5}$ of fin; no pectoral axillary scale. Spinous dorsal inserted little nearer snout tip than caudal base, midway between in young; first spine $1\frac{3}{4}$ to $1\frac{4}{5}$ in head. Soft dorsal inserted little nearer spinous dorsal origin than caudal base; first branched ray $1\frac{7}{8}$ to $2\frac{1}{8}$ in head. Anal origin slightly before that of

soft dorsal; first branched ray $1 \frac{7}{8}$ to 2 in head. Caudal well forked, nearly or quite equals head. Pectoral $1 \frac{1}{2}$ to $1 \frac{3}{5}$ in head. Ventral inserted about opposite last third of pectoral, $1 \frac{1}{2}$ to $1 \frac{2}{3}$ in head.

Brown above, sides and below pale to silvery white. Longitudinal dark streaks absent or obsolete. Length 230.

Eastern Atlantic, from Scandinavia and the Mediterranean to South Africa.

Described above from Ashantee and Italian examples. Boulenger gives its length as 330 mm.

Mugil saliens Risso

Mugil saliens Risso, 1810, 'Ichth. Nice,' p. 345. Nice, France.—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 263 (Senegal).—ROCHEBRUNE, 1883–1885, 'Faune Sénégalaise,' Poiss., p. 96 (Senegal).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 259 (Baie du Lévrier).

Liza saliens FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 278 (Loando, Angola).

Head $3 \frac{1}{2}$ to $3 \frac{7}{8}$; depth $3 \frac{1}{4}$ to $3 \frac{7}{8}$; dorsal IV–I, 8; anal III, 9; scales 34 to 44 in median lateral series to caudal base and 5 or 6 more on latter; 13 or 14 scales transversely; 25 to 37 predorsal scales; snout $3 \frac{2}{5}$ to 4 in head; eye 4 to $4 \frac{2}{3}$; maxillary $3 \frac{3}{5}$ to $4 \frac{1}{5}$; interorbital $2 \frac{1}{3}$ to $2 \frac{3}{4}$.

Body moderately long, well compressed, deepest about spinous dorsal origin. Caudal peduncle well compressed, least depth $1 \frac{1}{5}$ to $1 \frac{3}{5}$ its length or $2 \frac{1}{10}$ to $2 \frac{1}{3}$ in head. Head width $1 \frac{1}{2}$ to 2 in its length. Snout wide, length $\frac{3}{5}$ to $\frac{2}{3}$ its width. Eye with center at first third in head, without adipose lids, $1 \frac{1}{5}$ in snout, $1 \frac{3}{4}$ to $1 \frac{4}{5}$ in interorbital. Mouth wide, lower jaw included within upper and would form an obtuse angle. Maxillary exposed, not quite reaching eye. Row of minute teeth in upper jaw. Nostrils small, together, front one midway in profile of snout, simple pore; hind one is a short vertical slit at last third in snout. Interorbital broadly convex. Preorbital denticulate. Gill rakers 30 + 50, finely lanceolate, about $\frac{2}{3}$ of gill filaments, which little more than eye. Scales in even longitudinal series; 8 to 10 basal radiating striae; 42 to 60 series of short low apical denticles; circuli fine. Few small scales at front of soft dorsal and anal basally. Ventral with axillary scale $\frac{3}{5}$ of fin; no pectoral axillary scale. Spinous dorsal inserted little nearer snout tip than caudal base, about midway in young; second spine $1 \frac{4}{5}$ to $2 \frac{1}{4}$ in head. Soft dorsal inserted little nearer spinous dorsal origin than caudal base; first branched ray $1 \frac{4}{5}$ to $2 \frac{2}{5}$ in head. Anal origin slightly before that of soft dorsal; first branched ray $1 \frac{2}{3}$ to $2 \frac{1}{8}$ in head. Caudal well forked, equals head or little longer. Pectoral $1 \frac{2}{5}$ to $1 \frac{1}{2}$ in head. Ventral inserted about opposite last third of pectoral, $1 \frac{3}{5}$ to $1 \frac{7}{8}$ in head.

Brown above, silvery white on sides and below. Fins brownish, paired ones more whitish. Length 203 mm.

Eastern Atlantic, from France and the Mediterranean to South Africa. Described above from Angola examples obtained by the U. S. "Eclipse" Expedition and Italian specimens. Boulenger gives the length as 330 mm.

Mugil auratus Risso

Demm (Senegambia), Lavaranche, Tagaoua (Cape Blanco)

Figure 269

Mugil auratus RISSO, 1810, 'Ichth. Nice,' p. 344. Nice, France.—LOWE, 1843, Proc. Zool. Soc. London, p. 86 (Madeira); 1860, 'Fishes of Madeira,' p. 103, Pl. XXIII (Madeira).—GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' III, p. 442, Fig. (head below) (Lanzarote).—STEINDACHNER, 1868, Sitzs. Akad. Wiss. Wien, LVII (1), p. 682 (Teneriffe).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 323 (Canaries).—PELLEGRIN, 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanc, Cape Verde); 1905, Act. Soc. Linn. Bordeaux, LX, p. 36, Fig. (Baie du Lévrier); 1907, *op. cit.*, LXII, p. 87 (Senegal, Rufisque); 1913, Bull. Soc. Zool. France, XXXVIII, p. 116 (Baie du Lévrier).—PIETSCHMANN, 1913, Jahrb. Nassau Ver. Naturk., Wiesbaden, LXVI, p. 182 (Gomera Island, Canaries).—PELLEGRIN, 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 31 (Baie du Lévrier, Senegal, Rufisque).—BOULENGER, 1916, 'Cat. Fresh-water Fishes Africa,' IV, p. 86, Fig. 50 (Madeira, Canaries, Cape Verde Islands, St. Louis, Banana).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 259 (Baie du Lévrier).

Liza aurata JORDAN AND GUNN, 1898, Proc. Acad. Nat. Sci. Philadelphia, p. 340 (Canaries).

Mugil breviceps VALENCIENNES, 1836, 'Hist. Nat. Poiss.,' XI, p. 78. Gorée.—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 263 (Gorée).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 96 (Gorée).

Mugil madeirensis LOWE, 1839, Proc. Zool. Soc. London, p. 82. Madeira; 1842, *op. cit.*, XI, p. 86 (Madeira); 1839, Trans. Zool. Soc. London, III, p. 8 (Madeira).

Mugil chelo (not Cuvier) LOWE, 1839, Trans. Zool. Soc. London, II, p. 184 (Madeira).

Mugil cryptocheilus DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 263 (Gorée).

Mugil cryptocheilus ROCHEBRUNE, *op. cit.*, p. 96 (Gorée).

Mugil dumerili STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LX (1), p. 959. Richardtoll and St. Louis.

Head $3\frac{1}{4}$ to $3\frac{1}{2}$; depth $4\frac{3}{5}$ to $4\frac{3}{4}$; dorsal IV-I, 1, 7, 1 or I, 8, 1; anal III, 9, 1, rarely 8, 1; scales 42 to 46 in median lateral series to caudal base and 4 more on latter; scales 13 or 14 transversely; 34 to 40 predorsal scales; snout $3\frac{1}{2}$ to $4\frac{1}{6}$ in head; eye $4\frac{1}{6}$ to $5\frac{2}{5}$; maxillary $4\frac{1}{6}$ to $4\frac{1}{3}$; interorbital 3.

Body elongately fusiform, deepest at spinous dorsal origin. Caudal peduncle well compressed, least depth $1\frac{3}{5}$ to 2 in its length or $2\frac{1}{3}$ to $2\frac{3}{4}$ in head. Head width $1\frac{2}{3}$ to $1\frac{3}{4}$ in its length. Snout obtuse, length $\frac{2}{3}$ its width. Eye with center at first third in head, without adipose lids, 1 to $1\frac{2}{5}$ in snout; $1\frac{1}{4}$ to 2 in interorbital. Mouth broad, when closed lower jaw is included in upper, its angle obtuse. Upper lip moderate, its width $3\frac{1}{4}$ to 4 in eye. Maxillary extends beyond hind nostril, not to eye. Teeth very minute, weak. Nostrils near together; posterior simple short vertical slit about last third in profile of snout; anterior simple small pore about midway in snout. Interorbital evenly convex. Preorbital denticulate. Gill rakers 30 + 45, finely lanceolate, longest $2\frac{1}{6}$ in gill filaments, which $4\frac{1}{5}$ in head. Scales in even longitudinal series; with 9 to 15 basal radiating striae; 62 to 65 rows of short low apical points. Soft dorsal and anal covered with

small scales basally forward. Caudal largely covered with small scales, at least basally. Ventral axillary scale half of fin; none or only rudiment at pectoral. Spinous dorsal slightly nearer snout tip than caudal base; about midway in young; first spine $1\frac{2}{3}$ to $1\frac{7}{8}$ in head. Soft dorsal origin nearer that of spinous dorsal than caudal base; first branched ray 2 to $2\frac{1}{4}$ in head. Anal begins very slightly before soft dorsal origin; first branched ray 2 to $2\frac{1}{8}$ in head. Caudal deeply forked, lobes pointed, equal to or slightly longer than head. Pectoral reaches little beyond ventral origin, $1\frac{1}{4}$ to $1\frac{3}{4}$ in head. Ventral inserted about opposite last third of pectoral, $1\frac{3}{5}$ to $1\frac{4}{5}$ in head.

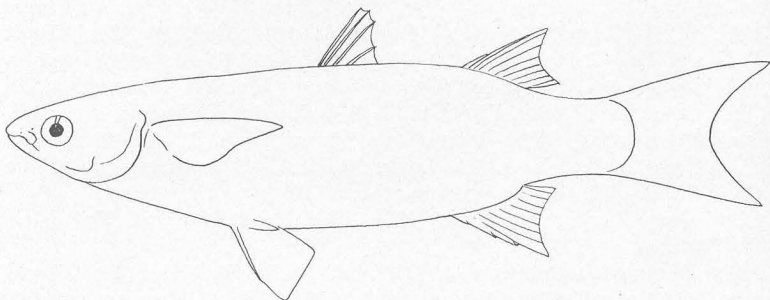


Fig. 269. *Mugil auratus*, from Steindachner.

Brown above, sides and below whitish. Each row of scales with slightly darker longitudinal streak on back and upper sides. In life several yellowish spots between the eye and gill opening. Paired fins whitish, others brownish. Length 283 mm.

Eastern Atlantic and Mediterranean, from Scandinavia to South Africa. Described above from a series of Italian examples. Boulenger gives the dimensions as 400 mm.

Mugil breviceps Valenciennes is likely a variant of the present species. It is described with the head shorter in proportion or six times in the length.

***Mugil hoefleri* Steindachner**

Lavaranche (Baie du Lévrier)

Mugil hoefleri STEINDACHNER, 1882, Anz. Akad. Wiss. Wien, XLV (1), p. 11, Pl. IV, fig. 1. Gorée; 1882, Denkschr. Akad. Wiss. Wien, XLV (1), p. 11, Pl. IV, fig. 1 (type).—PELLEGRIN, 1905, Bull. Soc. Zool. France, XXX, p. 137 (Cape Blanc, Cape Verde); 1905, Act. Soc. Linn. Bordeaux, LX, p. 36 (Baie du Lévrier); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 32 (Baie du Lévrier).—BOULENGER, 1916, 'Cat. Fresh-water Fishes Africa,' IV, p. 96, Fig. (copied).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 260 (Baie du Lévrier).

Liza hoefleri FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 252 (Elmina, Ashantee).

Mugil smithii STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLV (1), p. 11 (nom. in syn.).

Head $3 \frac{4}{5}$; depth $4 \frac{1}{5}$; dorsal IV-I, 8; anal III, 9; scales 36 in median lateral series to caudal base and 5 more on latter; 13 scales transversely; 25 predorsal scales; snout $4 \frac{1}{5}$ in head; eye $3 \frac{3}{5}$; maxillary 4; interorbital 3.

Body elongate, rather slender, or deepest at spinous dorsal origin, well compressed. Caudal peduncle with least depth $1 \frac{1}{5}$ its length or $2 \frac{1}{4}$ in head. Head width half its length. Snout length nearly $\frac{3}{5}$ its width. Eye advanced, hind edge about midway in head length. Mouth broad; would form obtuse angle. Row of minute ciliate teeth in upper jaw. Maxillary exposed, almost to eye. Nostriils close together, front one about midway in snout length. Interorbital broadly convex. Preorbital denticulate. Gill rakers 35 + 46, about $\frac{3}{4}$ of gill filaments or $1 \frac{1}{4}$ in eye. Scales with 9 or 10 basal radiating striae. Cheek with 3 rows of scales. Apparently no axillary ventral flap, and 3 scales between depressed spinous dorsal tip and soft dorsal origin. A few scales on front of anal basally. Spinous dorsal inserted about midway between front pupil edge and caudal base; first spine $1 \frac{4}{5}$ in head. Soft dorsal inserted very slightly nearer caudal base than spinous dorsal origin; first branched ray $1 \frac{4}{5}$ in head. Anal inserted slightly before soft dorsal; first branched ray $1 \frac{3}{5}$ in head. Caudal about equals head. Pectoral $1 \frac{1}{6}$ in head; ventral $1 \frac{3}{5}$.

Back pale olive, sides and below pale, with silvery white tints. Hind edge of median caudal rays tinged dusky, fins otherwise dull brownish and lower ones paler. Iris whitish. Length 105 mm.

West Africa, Cape Verde to Ashantee. Described above from an example obtained by the U. S. "Eclipse" Expedition in Ashantee, now in the U. S. National Museum.

***Mugil falcipinnis* Valenciennes**

Figure 270

Mugil falcipinnis VALENCIENNES, 1836, 'Hist. Nat. Poiss.,' IX, p. 105. Senegal.—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 263 (Gorée).—GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' III, p. 453 (copied).—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LX (1), p. 955 (St. Louis).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalambie,' Poiss., p. 97 (Senegal, Gorée).—BUETTIKOFER, 1890, 'Reis. Liberia,' II, p. 479.—PERUGIA, 1891, Ann. Mus. Civ. Storia Nat., Genova, (2) X, p. 964 (Congo).—STEINDACHNER, 1895, Notes Leyden Mus., XVI, p. 35 (Messurado River mouth and Fisherman Lake, mouth Cape Mount River, Liberia).—BOULENGER, 1903 (1905), Mem. Soc. Españ. Hist. Nat., Madrid, I, p. 187 (Rio Benito, Spanish Guinea).—PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 155 (Banana, Congo).—REGAN, 1915, Ann. Mag. Nat. Hist., London, (8) XV, p. 127 (Lagos).—BOULENGER, 1916, 'Cat. Fresh-water Fishes Africa, IV, p. 88, Fig. 5 (Senegal, Gambia, Liberia, Lagos, Niger, Old Calabar, Benito River, Gaboon, Angola, Banana).

Liza falcipinnis FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 251 (Elmina, Ashantee).

Head $3 \frac{2}{5}$ to $3 \frac{7}{8}$; depth $3 \frac{2}{5}$ to $3 \frac{3}{4}$; dorsal IV-I, 9; anal III, 11; scales 35 to 39 in median lateral series to caudal base and 4 to 5 larger out over latter; 12 or 13 scales transversely; 29 to 31 predorsal scales; snout $3 \frac{3}{4}$ to 4 in head; eye $3 \frac{7}{8}$ to $5 \frac{1}{6}$; maxillary $3 \frac{3}{8}$ to 4; interorbital $2 \frac{1}{5}$ to 3.

Body elongate, well compressed, deepest at anal origin. Caudal peduncle well compressed, as long as deep, least depth $2 \frac{1}{10}$ to $2 \frac{1}{3}$ in head. Head width $1 \frac{3}{4}$ to $1 \frac{4}{5}$ in its length. Snout broad, length half its width. Eye advanced, hind edge slightly before center in head length. Mouth broad. Teeth extremely minute, rudimentary, few, in a single row and only in upper jaw. Maxillary concealed, not quite to eye. Upper lip width nearly half of pupil. Nostrils close, front one about midway in snout. Interorbital broadly convex. Preorbital denticulate. Gill rakers about $40 + 51$, finely lanceolate, about half of gill filaments, which latter equal eye. Scales with 7 to 9 basal radiating striae, reduced to 3 with age. Cheek with 3 rows of scales. Pectoral without axillary scaly flap and 4 scales behind depressed spinous dorsal tip and soft dorsal origin. Spinous dorsal inserted midway between eye center and caudal base, or midway between front eye edge

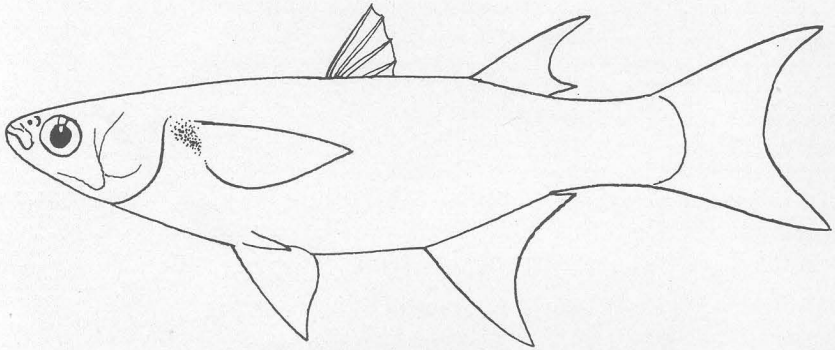


Fig. 270. *Mugil falcipinnis*, from Bou'enger.

and caudal base in smaller examples; second spine $1 \frac{7}{8}$ to $2 \frac{1}{8}$ in head. Soft dorsal inserted much nearer spinous dorsal origin than caudal base; first branched ray $1 \frac{1}{2}$ to $1 \frac{3}{4}$ in head. Anal inserted about midway between ventral origin and caudal base; third spine $2 \frac{1}{4}$ to $2 \frac{1}{3}$ in head; first branched anal ray $1 \frac{1}{4}$ to $1 \frac{3}{5}$. Caudal large, greater than head, 3 in combined head and trunk. Pectoral $1 \frac{1}{8}$ to $1 \frac{1}{4}$ in head; ventral $1 \frac{1}{2}$ to $1 \frac{3}{5}$.

Olive brown above, sides and below paler, with silvery white tints. Iris white. Fins pale brownish, with an obsolete brownish blotch at pectoral base. Length 321 mm.

West Africa, from Senegambia to Angola. Described above from eleven examples from the mouth of the Congo, obtained by Messrs. Lang and Chapin, and a series of examples from the U. S. "Eclipse" Expedition from Ashantee.

Adult in the U. S. National Museum from Lake Ngovi, French Congo, received from C. R. Aschemeier.

Mugil grandisquamis Valenciennes

Thiarrh, Segnall (Senegambia)

Mugil grandisquamis VALENCIENNES, 1836, 'Hist. Nat. Poiss.,' XI, p. 103. Gambia.—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 263 (Senegal).—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LX (1), p. 957 (St. Louis).—PETERS, 1876 (1877), Monatsb. Akad. Wiss. Berlin, p. 248 (Cameroon River).—ROCHEBRUNE, 1883–1885, 'Faune Sénégalie,' Poiss., p. 95 (Senegal).—PELLEGRIN, 1907, Act. Soc. Linn. Bordeaux, LXII, p. 88 (Senegal); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 32 (Senegal).—BOULENGER, 1916, 'Cat. Fresh-water Fishes Africa,' IV, p. 96, Fig. 58 (St. Louis; type of *Mugil hypslopterus* Günther).

Liza grandisquamis FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 253 (Elmina, Ashantee).

Mugil hypslopterus GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' III, p. 450, Fig. (head below). River Niger.—ROCHEBRUNE, 1883–1885, 'Faune Sénégalie,' Poiss., p. 96 (St. Louis, Senegal, Gambia, Falémé).—BOULENGER, 1903 (1905), Mem. Soc. Españ. Hist. Nat., Madrid, I, p. 187 (Rio Benito, Spanish Guinea).

Mugil schlegeli BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, XVIII, No. 2, p. 92, Pl. XIX, fig. 1. Ashantee.—ROCHEBRUNE, *loc. cit.* (Casamance, Senegal).—GUIMARÃES, 1884, Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, p. 22 (Bissau, West Africa).—OSORIO, 1894 (February), Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, (2) III, *op. cit.*, p. 183 (Bissau); 1898, *loc. cit.*, (2) V, p. 198 (Bissau).—PELLEGRIN, 1913, Bull. Soc. Zool. France, XXXVIII, p. 153 (Lagune de Grand-Bassam, Ivory Coast); 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 32 (Lagune de Grand-Bassam).

Mugil productus FISCHER, 1885, Jahrb. Hamburg, II, p. 69. Eloby, West Africa.

Head $3 \frac{2}{5}$ to $3 \frac{3}{4}$; depth $3 \frac{3}{4}$ to $3 \frac{4}{5}$; dorsal IV–I, 8; anal III, 9; scales 28 or 29 in median lateral series to caudal base and 5 or 6 larger out over latter; 10 scales transversely; 20 to 23 predorsal scales; snout $3 \frac{7}{8}$ to $4 \frac{1}{2}$ in head; eye 4 to $4 \frac{3}{5}$; maxillary $3 \frac{7}{8}$ to 4; interorbital $2 \frac{1}{2}$ to $2 \frac{7}{8}$.

Body elongate, well compressed, deepest at anal origin. Caudal peduncle well compressed, least depth 1 to $1 \frac{1}{8}$ in its length or $2 \frac{1}{5}$ in head. Head width $1 \frac{3}{5}$ to $1 \frac{2}{3}$ its length. Snout broad, length about half its width. Eye advanced, before center in head length. Mouth broad. Teeth extremely minute, rudimentary, few above laterally, slightly more developed in smaller example. Maxillary end little exposed, reaches eye. Nostrils close, front one about midway in snout length. Interorbital broadly convex. Preorbital conspicuously denticulate. Gill rakers 34 + 42, finely lanceolate, about $\frac{2}{3}$ of gill filaments and latter $1 \frac{1}{6}$ in eye. Scales with 8 to 10 basal radiating striae. Cheeks with 4 rows of scales. Ventral without axillary scaly flap and 2 scales between depressed spinous dorsal tip and soft dorsal origin. Small scales over base of front anal lobe and along front edge of soft dorsal. Spinous dorsal inserted about midway between front pupil edge and caudal base, midway between hind pupil edge and caudal base in smaller example; first spine $1 \frac{2}{3}$ in head. Soft dorsal inserted midway between spinous dorsal origin and caudal base; first branched ray $1 \frac{1}{3}$ in head, reaching caudal base in smaller example. Anal inserted about midway between ventral origin and caudal base, nearer latter in smaller example; $1 \frac{1}{4}$ to $1 \frac{2}{5}$ in head. Caudal

large, eye diameter longer than head, deeply forked, with lower lobe much longer in larger example. Pectoral $1\frac{1}{4}$ to $1\frac{1}{2}$ in head; ventral $1\frac{2}{5}$.

Dull olive brown above, paler to whitish below. Fins all pale brown. Length 146 mm.

West Africa, from Senegal to Cameroon. Described above from two examples in the U. S. National Museum, obtained by the U. S. "Eclipse" Expedition in Ashantee.

One 305 mm. long in the Museum of Comparative Zoölogy from Bathhurst, Gambia, received through Government d'Arcy in 1867.

Mugil productus Fischer is described with ten soft anal rays, doubtless a variant. Otherwise it does not appear to differ, according to the description, from the present species.

***Mugil provensalis* Risso**

Liza, Lisa (Canaries), Pounayh (Senegambia)

Mugil provensalis RISSO, 1810, 'Ichth. Nice,' p. 346. Nice, France.

Mugil bispinosus BOWDICH, 1825, 'Excurs. Madeira,' p. 236, Fig. 38. Bona Vista.

Mugil chelo VALENCIENNES, 1836-1844, 'Hist. Nat. Canaries,' II (2), p. 59 (Canaries).—LOWE, 1843, Proc. Zool. Soc. London, XI, p. 86 (Madeira).—GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' p. 454 (head) (Lanzarote).—STEINDACHNER, 1865, Sitzs. Akad. Wiss. Wien, LI (1), p. 402 (Santa Cruz, Teneriffe).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 97 (Cape Blanco, Portendik, Maringouins).—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 323 (Grand Canary).—OSORIO, 1898, Jorn. Sci. Math. Phys. Nat., Acad., Lisboa, (2) V, p. 198 (St. Thomas Island).—LAMPE, 1914, 'Deutsche Südpolar Exped.,' XV (2), p. 220 (Punta Delgada, Azores).—BOULENGER, 1916, 'Cat. Fresh-water Fishes Africa,' IV, p. 89, Fig. 52 (Egypt, Madeira, Canaries).—ROULE, 1919, Rés. Camp. Sci. Monaco, LII, p. 41 (southwest of Santa Lucia, Cape Verde, in 16 m.).

Mugil corrugatus LOWE, 1837 (1841), Trans. Zool. Soc. London, II, p. 184. Madeira; 1680, 'Fishes of Madeira,' p. 155, Pl. xxii (Madeira).

Mugil nigro-strigatus GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' III, p. 457, Fig. (of head). "Borneo," St. Vincent's.—TROSCHER, 1866, Archiv Naturg., p. 219 (Cape Verde Islands).

Head $3\frac{2}{5}$ to $4\frac{1}{8}$; depth $3\frac{3}{4}$ to 4; dorsal IV-I, 7; anal III, 9; scales 42 or 43 in median lateral series to caudal base and 5 more larger on latter; 11 or 12 scales transversely; 28 or 29 predorsal scales; snout $3\frac{3}{5}$ to 4 in head; eye $3\frac{1}{2}$ to $4\frac{3}{4}$; maxillary $3\frac{7}{8}$ to $4\frac{1}{4}$; interorbital $2\frac{1}{2}$.

Body moderately long, well compressed, deepest about spinous dorsal origin. Caudal peduncle well compressed, least depth $1\frac{3}{5}$ to $1\frac{2}{3}$ its length or $2\frac{1}{6}$ to $2\frac{1}{3}$ in head. Head width $1\frac{3}{5}$ to $1\frac{2}{3}$ its length. Snout wide, length $\frac{2}{3}$ to $\frac{3}{4}$ its width. Eye with center at first third in head; front pupil edge at first third in young; no adipose lids; diameter 1 to $1\frac{1}{3}$ in snout, $1\frac{2}{5}$ to 2 in interorbital. Mouth wide, lower jaw included within upper and would form an obtuse angle. Maxillary well exposed, not reaching eye. Row of fine close-set minute teeth in upper jaw, none in lower; patch of fine teeth on vomer. Nostrils together; front

one is a small pore at last fourth in snout; hind one 3 times as large, oval and little nearer front one than eye. Interorbital broadly convex. Preorbital denticulate. Gill rakers about 50 + 75, finely lanceolate, about half of gill filaments, which 4 1/2 in head. Scales in even longitudinal series; 6 to 11 basal radiating striae; 88 to 130 series of short low apical denticles; circuli fine. Few small scales at front of soft dorsal and anal basally. Ventral with axillary scale 2/5 of fin; no pectoral axillary scale. Spinous dorsal inserted midway between snout tip and caudal base, a little nearer latter in young; first spine 1 2/5 to 1 3/5 in head. Soft dorsal inserted a little nearer spinous dorsal origin than caudal base, about midway in young; first branched ray 1 4/5 to 2 in head. Anal origin slightly before that of soft dorsal; first branched ray 1 2/3 to 2 in head. Caudal well forked, nearly equals head, or little longer. Pectoral 1 1/3 to 1 2/5 in head. Ventral inserted about last third in depressed pectoral; midway in pectoral in young; 1 3/5 to 1 2/3 in head.

Brown above, sides and below silvery white. Each row of scales on trunk with longitudinal dark streak. Fins brownish, paired ones paler. Length 263 mm.

Eastern Atlantic, from Scandinavia to the Azores, Canaries, and Senegambia. Said to reach 550 mm. Described above from Italian examples.

Adult in the U. S. National Museum from the Canaries, obtained through the Vienna Museum.

In the Museum of Comparative Zoölogy two small examples from Fayal, Azores. Also two young from Porto Grande, Cape Verde Islands, obtained by the 'Talisman.'

Mugil bispinosus Bowdich, though described briefly and with a poor figure, is doubtless intended for the present species. This figure shows the large upper lip and dark stripes of most specimens. The description is as follows:

The lower part of the upper lip is set with small teeth, en velours; the first dorsal fin is composed of 4 strong spines, the second has 2 spines and 7 rays, the caudal 14 rays, the pectoral 13, the ventral 6, and the anal 10; the fish is silvery with 8 black stripes; the lateral line is not visible.

It seems that *Mugil nigro-strigatus* Günther is not distinct from *Mugil provensalis* Risso. Very likely the locality given as St. Vincent's pertains to the Cape Verde Islands, rather than the West Indies. Borneo is surely erroneous.

***Mugil curema* Valenciennes**

Figure 271

Mugil curema VALENCIENNES, 1836, 'Hist. Nat. Poiss.,' XI, p. (87) LXIV. Brazil, Martinique, Cuba, Bahia.—FOWLER, 1919, Proc. U. S. Nat. Mus., LVI, p. 278 (Loando, Angola).

Head 3 to 3 4/5; depth 3 1/5 to 3 1/2; dorsal IV-I, 8; anal III, 9, young II, 9; scales 34 to 40 in median lateral series to caudal base and 5 to 8 more larger on latter; 12 or 13 scales transversely at soft dorsal origin; 19 to 30 predorsal scales;

snout $3 \frac{2}{3}$ to $4 \frac{1}{2}$ in head; eye $3 \frac{1}{5}$ to 4; maxillary $2 \frac{3}{4}$ to 4; interorbital $2 \frac{1}{8}$ to 3.

Body elongate, compressed. Least depth of caudal peduncle $1 \frac{1}{10}$ to $1 \frac{1}{4}$ in its length or $2 \frac{1}{4}$ to $2 \frac{2}{5}$ in head. Head large, compressed, larger in young; width $1 \frac{3}{5}$ its length. Snout wide, convex, length about half its width; larger in young. Eye rounded, near first third in head; adipose eyelids greatly developed; eye larger in young and without adipose lids. Mouth wide, jaws about equal. Teeth minute, obsolete in young. Nostrils well separated. Interorbital broadly convex. Preorbital serrated. Gill rakers 30 to 36 + 40 to 60, slender, $\frac{2}{5}$ of eye; fewer in young. Scales with 10 radiating basal striae; mostly uniform, larger on top of head. Soft dorsal, anal, and caudal base densely scaled. Spinous dorsal inserted midway between snout tip and caudal base; more forward in young; first spine $1 \frac{3}{4}$ to $1 \frac{7}{8}$ in head. Soft dorsal inserted little nearer spinous dorsal origin than caudal base, highest in front. Anal inserted before soft dorsal origin, similar.

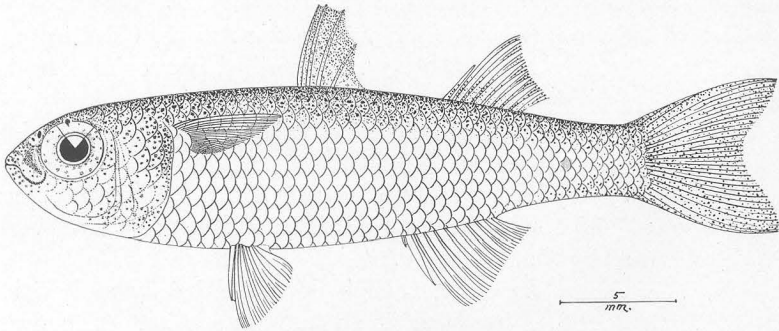


Fig. 271. *Mugil curema*.

Caudal large, broadly emarginate, tip of each lobe pointed, nearly equals head. Pectoral small, wide, inserted level with eye, not quite reaching first dorsal; $1 \frac{1}{4}$ to $1 \frac{1}{3}$ in head. Ventral inserted a little nearer pectoral origin than anal origin, reaches halfway to anal, a little longer in young; $1 \frac{3}{5}$ to $1 \frac{2}{3}$ in head.

Olivaceous above, sides and below silvery white. Scales on back with obscure longitudinal streaks, 1 along course of each row. Side of head grayish, with yellowish tints. Iris whitish. Dorsals grayish. Caudal yellowish at base, hind edge slightly dusky. Anal pale or whitish. Pectoral base slaty black. Ventral pale yellowish. Young brilliant shining silvery white, back dusky olive. Iris silvery white. Length 305 mm.

Tropical Atlantic. Described here from American (Middle States) examples and two from Angola in the U. S. National Museum.

***Mugil labeo* Cuvier**

Levranché, Lisa (Canaries)

Figure 272

Mugil labeo CUVIER, 1829, 'Régne Animal,' 2d Ed., II, p. 233. Mediterranean.
—VINCIGUERRA, 1892, Atti Soc. Ital. Sci. Nat., XXXIV, p. 323 (Grand Canary).

Head 4 to $4 \frac{3}{5}$; depth $3 \frac{4}{5}$ to 4; dorsal IV-I, 8; anal III, 11; scales 45 or 46 in median lateral series to caudal base and 5 more on latter; 11 or 12 scales transversely; 28 to 31 predorsal scales; snout $3 \frac{4}{5}$ to 4 in head; eye 3 to $3 \frac{4}{5}$; maxillary 3; mouth width $2 \frac{3}{5}$ to $3 \frac{1}{5}$; interorbital $2 \frac{1}{6}$ to $2 \frac{2}{5}$.

Body elongately fusiform, deepest at spinous dorsal origin. Caudal peduncle well compressed, least depth $1 \frac{3}{4}$ to $1 \frac{4}{5}$ its length or 2 to $2 \frac{1}{3}$ in head. Head width $1 \frac{2}{5}$ to $1 \frac{2}{3}$ in its length. Snout obtusely truncate, length in profile about half its width. Eye center at first third in head; front pupil rim at first third in head in young; without adipose lids; diameter greater than snout in profile, $1 \frac{1}{3}$ to $1 \frac{4}{5}$ in interorbital. Mouth very wide, when closed lower jaw is included in upper, only in young is the angle broadly obtuse, until front edge of jaw is straight with age. Upper lip very broad, fleshy, its width equals diameter of pupil. Maxillary well inclined, end exposed, not quite reaching to a point opposite the front of eye. Fringe of minute flexible teeth, close set along edge of each lip, none on palate. Front nostril small, a simple tube at last third in snout; hind one much larger, as a

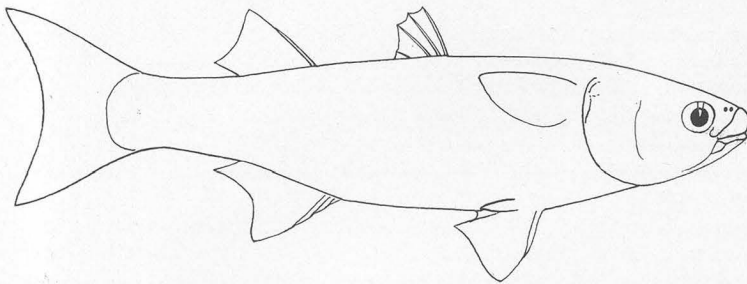


Fig. 272. *Mugil labeo*, from Bonaparte.

vertical slit close behind front one. Interorbital broadly convex. Preorbital with only lower edge finely denticulated. Gill rakers $25 + 37$, finely lanceolate, $1 \frac{4}{5}$ in gill filaments, which equal eye. Scales in even longitudinal series; with 10 to 13 radiating marginal striae; 34 to 50 rows of short apical points, basally as many as 8 close-set series; circuli fine. Few small scales at front of soft dorsal and anal basally. Caudal covered with small scales basally. Ventral axillary scale $\frac{2}{5}$ of fin; none at pectoral. Spinous dorsal inserted slightly nearer caudal base than snout tip, nearly midway in young; first spine $1 \frac{2}{3}$ to $2 \frac{1}{4}$ in head. Soft dorsal origin slightly nearer that of spinous dorsal than caudal base, more advanced in young; first branched ray $1 \frac{4}{5}$ to $1 \frac{7}{8}$. Anal begins little before dorsal origin; first branched ray $1 \frac{1}{2}$. Caudal deeply emarginate, a little longer than head at all ages. Pectoral 1 to $1 \frac{1}{5}$ in head. Ventral inserted opposite last third in pectoral, $1 \frac{1}{2}$ to $1 \frac{3}{5}$ in head.

Brownish olive above, sides and below silvery white. Traces of dark longitudinal streaks, one on each row of scales, less evident below. Fins pale brownish. Length 191 mm.

Mediterranean and eastern Atlantic to the Canaries. Readily

distinguished by the very wide thick upper lip, the snout truncate. Described above from Italian examples.

Two examples, larger 165 mm., from Fayal, Azores, in the Museum of Comparative Zoölogy.

MYXUS Günther

Myxus GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' III, p. 466. Type: *Myxus elongatus* GÜNTHER. (Designated by Jordan, Stanford Publications, 1919, 'Genera of Fishes,' part 3, p. 307.)

Mouth cleft extending on to sides of snout, but not to orbit. Upper lip not particularly thick. Front edge of mandible sharp. Small uniserial teeth above, and sometimes on palate and on mandible.

Species few.

Myxus curvidens (Valenciennes)

Mugil curvidens VALENCIENNES, 1836, 'Hist. Nat. Poiss.,' XI, p. 149, Pl. cccxiii. Ascension Island.

Myxus curvidens GÜNTHER, 1861, 'Cat. Fish. Brit. Mus.,' III, p. 467 (copied).—STEINDACHNER, 1882, Denkschr. Akad. Wiss. Wien, XLIV (1), p. 42 (Rufisque).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalaise,' Poiss., p. 97 (copied).

Mugil pulchellus TROSCHER, 1866, Archiv Naturg., p. 222, Pl. v, fig. 10 (teeth). Cape Verde Islands.

Myxus capurrii PERUGIA, 1892, Ann. Mus. Civ. Storia Nat., Genova, (2) XII, p. 1007. Senegal.

Head $2\frac{1}{2}$; depth $3\frac{2}{3}$; dorsal IV-I, 8; anal III, 9; scales 39 in median lateral series to caudal base; 11 scales between soft dorsal and anal origins; 20 predorsal scales; snout 5 in head; eye $3\frac{1}{2}$; interorbital 3; no adipose eyelid. Lower jaw oblique, with a thin edge and row of ciliate teeth; upper jaw strong, with little stronger teeth. Interorbital slightly convex. Preorbital denticulate. Lower cheek, between eye and lower edge of preopercle with 2 rows of scales. Lower front half of second dorsal and anal thickly scaled. Caudal strongly scaled. Spinous dorsal origin a little nearer caudal base than end of snout; first spine highest, $1\frac{3}{5}$ to $1\frac{4}{5}$ in head. First dorsal ray little longer than first spine. Third anal spine longest, little less than first ray, which $\frac{2}{3}$ of head. Caudal deeply emarginate. Pectoral not quite so long as head, reaches eleventh or twelfth scale from axil. Ventral somewhat shorter than pectoral, with axillary scale. Bluish, rest of body silvery white. Pectoral base blue-black. Edge of soft dorsal grayish black. (Steindachner.)

Ascension Island, Cape Verde, Senegal.

Both *Mugil pulchellus* Troschel and *Myxus capurrii* Perugia appear to be synonyms.

SUBORDER RHEGNOPTERI

Thread Fins

Maxillary excluded from border of upper jaw. Dentition feeble. Air vessel very large, when present. Body covered with ctenoid scales.

Two distinct dorsal fins, anterior of few spines. Pectorals low down, with detached lower rays. Pelvic bones suspended from postclavicles. Ventral more or less approximated to pectoral.

One family.

Polynemidae

Thread Fins

Body oblong, compressed. Head rather large. Snout more or less conic, projects over mouth. Eye rather large, forward, lateral. Adipose eyelid usually well developed. Mouth large, inferior, with lateral cleft. Premaxillaries protractile. Maxillary without supplemental bone, extends much beyond eye. Villiform teeth in jaws, on palatines, sometimes on vomer. Gill membranes separate, free from isthmus. Gills 4, slit behind fourth. Pseudobranchiae concealed. Branchiostegals 7. Vertebrae 24, of which 14 caudal. Air vessel various, sometimes absent. Stomach caecal, with few pyloric appendages. Scales rather large, loose, ctenoid. Lateral line complete, extends on tail, usually forked, with a branch on each lobe. Head entirely scaly. Second dorsal, anal, and caudal covered with small scales. Two separate dorsals, somewhat distant, spines 8 in first fin, rather high though feeble with first and last very short and third longest. Second dorsal equally high, with longer base, with spine and 9 to 13 rays. Anal like second dorsal, spines 3, rays 13 to 30. Pectoral moderate, low, in 2 parts, lower and anterior division of several thread-like rays, free from each other, sometimes greatly extended, function as organs of touch. Ventral abdominal, not free from pectoral, of 1 spine and 5 rays.

Mostly valued food fishes of the sandy shores of tropical countries, some entering rivers. Others valued for the isinglass yielded by the air vessel. The free pectoral filaments greatly variable, are tactile organs and can be moved independently of the fins. Some of the species reach a large size.

KEY TO THE GENERA

a.—Maxillary little expanded terminally; pectoral filaments short, 9 or 10.

GALEOIDES.

aa.—Maxillary well expanded terminally; pectoral filaments 4 or 5.

b.—Preopercle edge denticulated; anal as long as soft dorsal; pectoral filaments short.....POLYDACTYLUS.

bb.—Preopercle edge entire; anal greatly longer than soft dorsal; pectoral filaments longer than body.....POLYNEMUS.

GALEOIDES Günther

Galeoides GÜNTHER, 1860, 'Cat. Fish. Brit. Mus.,' II, p. 332. Type: *Polynemus polydactylus* Vahl. Monotypic.

Maxillary not much widened behind. Bands of villiform teeth in both jaws and on palatines, none on vomer or pterygoids. Preopercle edge serrate. Air vessel simple, large. Scales moderate. Two separate dorsals, first with 8 feeble spines. Soft dorsal and anal nearly equal.

West coast of Africa and China.

Galeoides polydactylus (Vahl)

Siket N'Bow (Senegambia), pescado de bacalao, Arbou (Senegal)

Figure 273

Polynemus polydactylus VAHL, 1798, *Skriv. Naturh. Selsk.*, IV (2), p. 164. In mari Tingidem.—PETERS, 1876 (1877), *Monatsb. Akad. Wiss. Berlin*, p. 246 (Victoria, Cameroon).

Galeoides polydactylus GÜNTHER, 1860, 'Cat. Fish. Brit. Mus.,' II, p. 332 (Africa, Niger River).—STEINDACHNER, 1870, *Sitzs. Akad. Wiss. Wien*, LX (1), p. 701, Pl. XI (St. Louis).—GÜNTHER, 1880, 'Rept. Voy. "Challenger,"' I, p. 3 (St. Jago).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalie,' Poiss., p. 70 (St. Louis, Guet N'Dar, Gorée).—OSORIO, 1890 (September), *Jorn. Sci. Math. Phys. Nat., Acad., Lisboa*, (2) II, p. 131 (Benguella, Angola).—BUETTIKOFER, 1890, 'Reis. Liberia,' II, p. 479.—STEINDACHNER, 1895, 'Notes Leyden Mus.,' XVI, p. 16 (Cape Mount and Robertsport, Liberia).—OSORIO, 1898, *loc. cit.* (2) V, p. 197 (St. Thomas Island; Angola).—LAMPE, 1914, 'Deutsche Südpolar Exped.,' XV (7), p. 229 (St. Vincent, Cape Verde Islands).

Polynemus decadactylus BLOCH, 1795, 'Naturg. Ausl. Fische,' IX, p. 26, Pl. cccci. Guinea.—SCHNEIDER, 1801, 'Syst. Ichth. Bloch,' p. 19 (Guinea).—LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, pp. 411, 413 (Guinea).—CUVIER, 1829, 'Hist. Nat. Poiss.,' III, p. 290 (copied).—DUMÉRIL, 1858, *Arch. Mus. Hist. Nat. Paris*, X, p. 262 (Guinea).

Galeoides decadactylus BOULENGER, 1903 (1905), *Mem. Soc. Españ. Hist. Nat., Madrid*, I, p. 544 (Rio Benito, Spanish Guinea).—PELLEGRIN, 1905, *Act. Soc. Linn. Bordeaux*, LX, p. 43 (Guet N'Dar); 1905, *Bull. Soc. Zool. France*, XXX, p. 138 (Cape Blanco, Cape Verde); 1907, *Act. Soc. Linn. Bordeaux*, LXII, p. 95 (Dakar); 1913, *Bull. Soc. Zool. France*, XXXVIII, p. 117 (Baie du Lévrier); *op. cit.*, p. 152 (Konakry, Guinea), p. 153 (Lagune Grand-Bassam, Ivory Coast), p. 155 (Banana).—EHRENBAUM, 1913, *Fischerbote*, V, p. 312 (Cameroon).—PELLEGRIN, 1914, *Ann. Inst. Océanogr. Monaco*, VI (4), p. 33 (Baie du Lévrier, Guet N'Dar).—REGAN, 1915, *Ann. Mag. Nat. Hist., London*, (8) XV, p. 188 (Lagos).—FOWLER, 1919, *Proc. U. S. Nat. Mus.*, LVI, p. 231 (Freetown, Sierra Leone), p. 241 (Cape Palmas, Liberia), p. 258 (Elmina, Ashantee).—METZELAAR, 1919, 'Rapp. Kolonie Curaçao,' II, p. 225 (Senegal).—CHABANAUD AND MONOD, 1926, *Bull. Étud.-Hist. Sci. Af.-Occ. française*, p. 260 (Baie du Lévrier).

Polynemus enneadactylus (Vahl) CUVIER, 1829, 'Règne Animal,' 2d Ed., II, p. 155 (*nomen nudum*); 1829, 'Hist. Nat. Poiss.,' III, p. 289. Tangeri.—DUMÉRIL, 1858, *Arch. Mus. Hist. Nat. Paris*, X, p. 262 (Gorée).

Galeoides enneadactylus TROSCHEL, 1866, *Archiv Naturg.*, p. 204 (Cape Verde Islands).

Head $2\frac{7}{8}$ to 3; depth $2\frac{7}{8}$ to $3\frac{1}{5}$; dorsal VIII or IX-I, 13, or 14, 1; anal II, 11, 1 or 12, 1; scales 45 or 46 in lateral line to caudal base and 3 to 6 more on latter; 6 scales above lateral line, 9 below; 23 to 26 predorsal scales; snout 5 to $5\frac{1}{5}$ in head; eye $3\frac{2}{5}$ to $4\frac{7}{8}$; maxillary $2\frac{3}{4}$ to $2\frac{7}{8}$; interorbital 4 to $4\frac{1}{8}$.

Body strongly compressed, elongately ovoid, edges convex. Caudal peduncle well compressed, least depth $1\frac{1}{2}$ to $1\frac{2}{3}$ in its length or $2\frac{1}{4}$ to $2\frac{4}{5}$ in head. Head width $2\frac{1}{10}$ to $2\frac{1}{2}$ in its length, upper profile convex. Snout obtusely conic, length $\frac{3}{5}$ to $\frac{4}{5}$ its width. Eye well advanced in head; diameter greater than snout, but little less than interorbital; covered entirely by broad adipose tissue. Mouth nearly horizontal, lower jaw much shorter than upper. Maxillary extends well beyond eye; expansion $2\frac{2}{5}$ to 3 in pupil. Bands of minute teeth in jaws, on vomer, and palatines. Tongue free, smooth. Nostrils rounded, together, close before eye, hind one slightly larger. Interorbital broadly convex. Hind preopercle edge finely serrate.

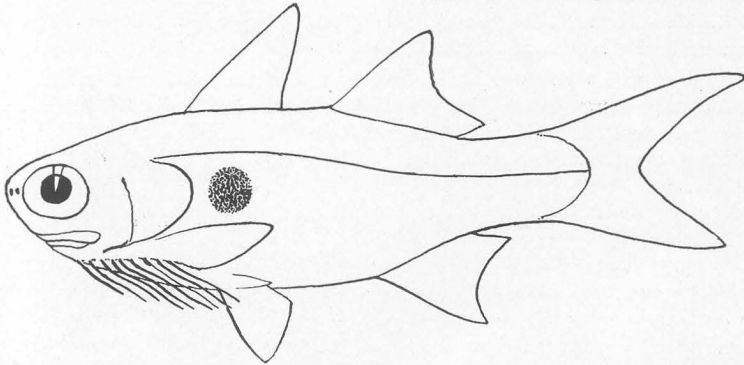


Fig. 273. *Galeoides polydactylus*, from Steindachner.

Gill rakers $10 + 15$, 1, lanceolate, slightly longer than gill filaments or $1\frac{3}{5}$ in eye. Scales with 3 or 4 basal radiating striae; apical denticles 116 to 117, basal elements in 12 series; circuli fine. Scales adherent, rather large on head; small on spinous dorsal and ventral, also soft dorsal, anal and caudal densely scaly. Lateral line complete, concurrent with dorsal profile; tubes simple and well exposed. Second dorsal spine $1\frac{2}{5}$ in head; first branched dorsal ray $1\frac{1}{2}$ to $1\frac{3}{4}$; second anal spine $3\frac{2}{5}$ to 5; first branched anal ray $1\frac{3}{4}$ to $1\frac{7}{8}$; pectoral $1\frac{2}{5}$ to $1\frac{1}{2}$, filaments 9 in number; ventral $1\frac{2}{3}$ to $1\frac{3}{4}$; caudal $2\frac{1}{2}$ to $2\frac{3}{5}$ in combined head and trunk.

Brownish, a little paler below. Ends of fins all more or less dusky. Pectoral yellowish basally; fins pale in young. Large round dusky spot about the size of the eye below lateral line and below front of spinous dorsal. Length 112 to 330 mm.

West Africa, from the Senegal to Angola. Chabanaud and Monod also report it from Mazagan, eastern Morocco. Described above from six examples obtained by the Congo Expedition at the mouth of the Congo.

The U. S. National Museum has an adult from the Canaries through M. Bellotti and a half-grown example from West Africa received through the British Museum. The Wilkes Expedition obtained two examples at the Cape Verde Islands.

One from the Canaries, 203 mm. long, in poor preservation, in the Museum of Comparative Zoölogy.

POLYDACTYLUS Lacépède

Barbudos

Polydactylus LACÉPÈDE, 1803, 'Hist. Nat. Poiss.,' V, p. 419. Type: *Polydactylus plumierii* Lacépède. Monotypic.

Trichidion KLEIN, 1776, 'Gesell. Schauplatz,' III, p. 592. Type: *Polynemus virginicus* Linné. Monotypic. (Inadmissible.)

Maxillary well widened behind. Bands of villiform teeth in jaws, on vomer, palatines, and ectopterygoids. Preopercle edge denticulate and scaly flap at angle. Scales rather small, finely ctenoid. Dorsal spines 7 or 8, rather long, first and last short. Soft dorsal and anal subequal. Pectoral filaments 3 to 9, mostly shorter than body.

Species rather numerous in the tropical Atlantic and Indo-Pacific.

Polydactylus quadrifilis (Cuvier)

Dyané, Capitaîne (Senegambia)

Figure 274

Polynemus quadrifilis CUVIER, 1829, 'Hist. Nat. Poiss.,' III, p. 288. Senegal.—DUMÉRIL, 1858, Arch. Mus. Hist. Nat. Paris, X, p. 262 (Senegal, Gorée).—STEINDACHNER, 1870, Sitzs. Akad. Wiss. Wien, LX (1), p. 698, Pl. x (St. Louis).—PETERS, 1876 (1877), Monatsb. Akad. Wiss. Berlin, p. 246 (Victoria, Cameroon).—ROCHEBRUNE, 1883-1885, 'Faune Sénégalaise,' Poiss., p. 69 (Senegal, Gambia, Casamence, St. Louis).—BOULENGER, 1903 (1905), Mem. Soc. Españ. Hist. Nat., Madrid, I, p. 554 (Rio Benito, Spanish Guinea).—PELLEGRIN, 1907, Act. Soc. Linn. Bordeaux, LXII, p. 94, Fig. 11 (M'Bow et Nianing).—EHRENBAUM, 1913, Fischerbote, V, p. 309 (Cameroon).—PELLEGRIN, 1914, Ann. Inst. Océanogr. Monaco, VI (4), p. 32 (between M'Bow and Nianing).—CHABANAUD AND MONOD, 1926, Bull. Étud.-Hist. Sci. Af.-Occ. française, p. 260 (Baie du Lévrier).

Trichidion quadrifilis BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, XVIII, No. 2, p. 88 (Elmina, Guinea).

Head 3 to 3 1/2; depth 4 to 4 1/2; snout 4 4/5 in head; eye 5 1/8; maxillary 2 2/5.

Head moderate. Snout more or less pointed, projects strongly beyond mouth, as long as or a little shorter than eye. Eye large, partly hidden under adipose tissue. Mouth large. Maxillary extends beyond vertical of posterior border of

eye. Gill rakers 13 to 15 on lower part of first arch, a little longer than gill filaments. Scales finely denticulate, 70 to 72 in lateral line, 5 or 6 above, 18 below; rather large on head. Dorsal VIII, I, 13, first spine extremely short, third longest and 2/3 to 3/4 of head; second dorsal pointed, emarginate, covered with small scales. Anal III, 11 or 12, like second dorsal. Pectoral 2/3 to 3/4 of head; 4 filaments, longest long as or little longer than head. Caudal very large, crescentic,

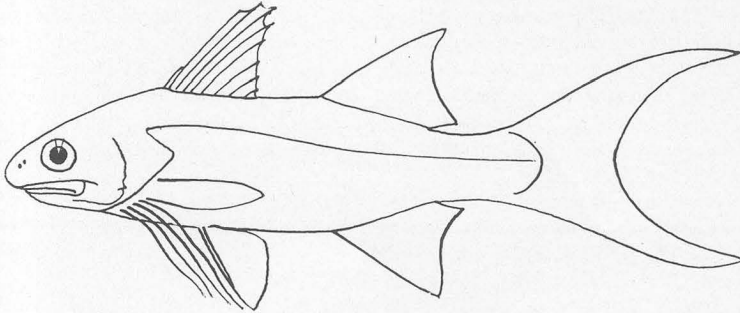


Fig. 274. *Polydactylus quadrifilis*, from Steindachner.

covered with small scales. Gray or purplish gray above, white below. Dark spot on gill cover. Fins yellow or gray. Length 500 mm. (Boulenger.)

Senegal to the Congo.

POLYNEMUS Linné

Thread Fins

Polynemus (Gronow) LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 317. Type: *Polynemus quinquarius* Linné. (Designated by Gill, 1861, Proc. Acad. Nat. Sci. Philadelphia, p. 272.)

Pentanemus (Artedi) GÜNTHER, 1860, 'Cat. Fish. Brit. Mus.,' II, p. 331. Type: *Polynemus quinquarius* Linné. Monotypic.

Maxillary well widened behind. Bands of villiform teeth in jaws, on vomer, palatines, and ectopterygoids. Preopercle edge entire. Air vessel present. Scales moderate, ciliated. Vertical fins partly naked. Dorsal spines 8, feeble. Anal much longer than soft dorsal. Pectoral filaments 5, much longer than body.

Tropical Atlantic.

Polynemus quinquarius Linné

Elobajh (Senegambia), Gerdi (Senegal)

Figure 275

Polynemus quinquarius LINNÉ, 1758, 'Syst. Nat.,' 10th Ed., p. 317. America.

Pentanemus quinquarius GÜNTHER, 1860, 'Cat. Fish. Brit. Mus.,' II, p. 331 (Niger River, Ashantee, Africa).—BLEEKER, 1863, Nat. Verh. Holl. Maatsch. Wetensch., Haarlem, XVIII, No. 2, p. 86 (Enkufankusta, Elmina, Ashantee, Guinea).

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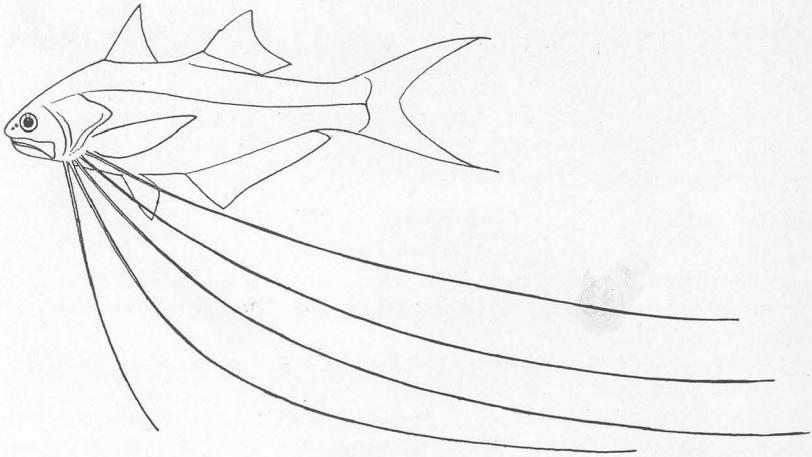


Fig. 275. *Polynemus quinquarius*, modified from Boulenger.

Head $3 \frac{2}{5}$ to $3 \frac{3}{4}$, young $3 \frac{1}{3}$; depth 3 to $3 \frac{1}{4}$, young 4 ; dorsal VIII–I, 13, 1 to 17, 1; anal II, 28, 1 to 30, 1; tubular scales 68 to 71 in lateral line to caudal base and 5 or 6 more on latter; 9 scales above lateral line, 15 to 19 below; 38 to 45 predorsal scales; snout 5 to $5 \frac{4}{5}$, 6 in young, in head; eye $4 \frac{4}{5}$ to $6 \frac{1}{3}$, 3 in young; maxillary 2 to $2 \frac{1}{8}$, $1 \frac{7}{8}$ in young; interorbital 4 to $4 \frac{1}{5}$.

Body strongly compressed, elongately ovoid, edges convex. Caudal peduncle well compressed, least depth $1 \frac{1}{2}$ to 2 in its length or $2 \frac{2}{5}$ to $2 \frac{1}{2}$, $3 \frac{1}{4}$ in young, in head. Head width $2 \frac{1}{3}$ to $2 \frac{1}{4}$, $3 \frac{1}{4}$ in young, in its length; upper profile concave over eyes. Snout obtusely conic, length $\frac{3}{5}$ its width. Eye with hind

edge at about first third in head; diameter greater than snout, a little less than interorbital; adipose tissue well developed, covers eye completely. Mouth a little inclined from horizontal; mandible slightly shorter than snout. Maxillary extends beyond eye; expansion $1 \frac{2}{5}$ to $1 \frac{1}{2}$, $1 \frac{2}{3}$ in young, in eye. Bands of minute teeth in jaws, on vomer, and palatines. Tongue free, smooth. Nostrils rounded, together, posterior little larger, close before eye. Interorbital widely convex.

Gill rakers $22 + 28$ to 30 , lanceolate, much longer than gill filaments or nearly as long as eye. Scales with 7 to 9 basal radiating striae; apical denticles 65 to 80 ; circuli fine. Scales adherent, small and extend over most of head; small ones at front of dorsals basally, and on almost all of anal and caudal basally. Lateral line largely follows profile of back; tubes simple and well exposed. Second dorsal spine $1 \frac{2}{5}$ to 2 in head; first branched dorsal ray $1 \frac{2}{5}$ to $1 \frac{2}{3}$; second anal spine $3 \frac{1}{2}$ to $4 \frac{3}{4}$; first branched anal ray $1 \frac{3}{5}$ to $2 \frac{1}{4}$; ventral $1 \frac{3}{4}$ to $2 \frac{1}{5}$; pectoral 3 to $3 \frac{1}{8}$ in combined head and trunk, $1 \frac{1}{4}$ in head in young; caudal $2 \frac{1}{3}$ to $2 \frac{4}{5}$. Pectoral filaments 5 , greatly longer than body; but little shorter than body in young.

More or less uniform brownish, a little paler below. Pectoral slaty, filaments pale brown. Adults 253 to 330 mm., young 58 to 72 mm.

Tropical Atlantic and Caribbean Sea, sometimes entering rivers. Described above from a series of seven examples from the mouth of the Congo, obtained by the Congo Expedition.